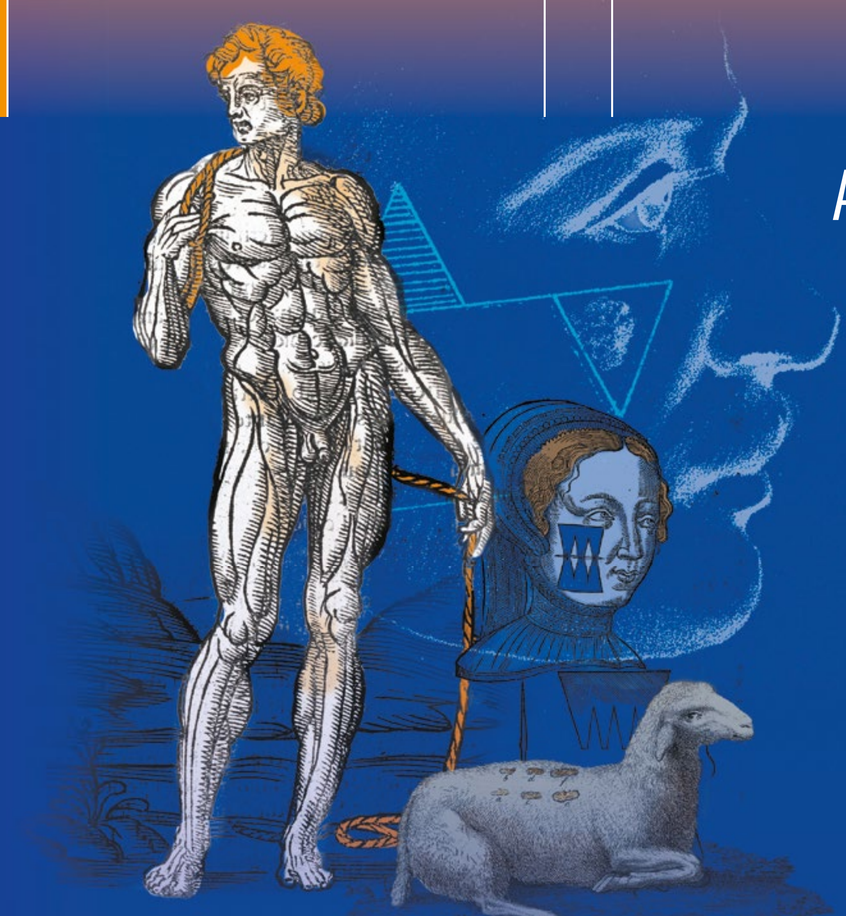
Riccardo F. Mazzola
Catherine B. Foss

Plastic Surgery



An Illustrated History

Springer

Plastic Surgery

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This book is dedicated to the memory of my late uncle,
Prof. Gustavo Sanvenero Rosselli (1897–1974),
founder of plastic surgery in Italy and initiator of the library,
and to my daughter Isabella, plastic surgeon.
May this book provide her a useful guide
to discover the fascinating work of our forefathers.

Foreword

It is indeed my honor and great pleasure to write the foreword to this one-of-a-kind, beautifully illustrated book on the pictorial history of plastic surgery. The journey begins with the first plastic surgical operation, reported in the Bible (Genesis 2:22), when the Lord God harvests Adam's rib to create woman. From Genesis and ancient times to the current day, advances have transformed plastic surgery. Dr. Riccardo Mazzola and Catherine Foss have compiled the most comprehensively illustrated text of the history of plastic surgery from ancient times to medieval times to recent history.

The history of plastic surgery is in parallel with the history of the modern world from times of famine, times of devastating diseases, times of war, and times of incredible growth in knowledge and development, especially that of anatomy. The enhancement of techniques and technology and the advent of anesthesia safety and antiseptic concepts have transformed both surgery and plastic surgery.

Plastic surgery advances catapulted during times of great conflict globally and the remedies were being incorporated into plastic surgery. The wars and conflicts around the world have propelled plastic surgery to the forefront by enabling restoration and the enhancement of the human form as so elegantly and pictorially depicted by Mazzola and Foss.

Plastic surgery has not been in the forefront, but it really is the basis of progress of both medicine and surgery to enhance patient outcomes and restoration from traumatic war wounds and congenital deformities which allowed for improved long-term outcomes. The authors have shown how reconstructive and cosmetic surgery can truly enhance the quality of life for humans as it manifests when restoring or improving one's appearance.

Thus, looking better and feeling better about oneself, but also restoring function through the global advances in plastic surgery, has been pivotal to the success of plastic surgery over time. Plastic surgery comes from the Greek "to mold and to make." Truly, the reconstructive aspects of plastic surgery have transformed the specialty as illustrated by the authors. Its incredible advances from trauma care, cancer care, and the management of congenital deformities have been a stepping stone to the progress made in ancient times. When one reflects upon innovations today, a look back reveals so much is truly not new, but buried in the ancient rich history of plastic surgery, such as how to manage the cleft lip or a forehead flap for nasal reconstruction. However, innovative minds of plastic surgeons throughout the ages have been augmented by the advances in patient safety as it relates to anesthesia, pain control, and an enhanced understanding of the antiseptic techniques of today. We all seek avenues of techniques and technology to make them function and look better and that epitomizes modern plastic surgery. There is no book like this amazing pictorial description that depicts these incredible advances.

I applaud Dr. Mazzola and Catherine Foss for this amazing book and filling in the missing link of history and hence providing an incredible charter to all in surgery by blending the history of human civilization with the birth and advances of plastic surgery today.

This is a must-read book for all of us, not only as plastic surgeons, but to all in medicine and surgery so as to fully understand the incredible impact our specialty has had not only on advances in medicine, but for the betterment of humankind!

Rod J. Rohrich
Baylor College of Medicine, Houston, TX, USA
UT Southwestern Medical Center, Dallas, TX, USA
Dallas Plastic Surgery Institute, Dallas, TX, USA

Preface

A comprehensive book on the history of plastic surgery would not only be complicated to write for the vast amount of material available, but also almost impossible to read. It would have to relate all of surgery, wound care, reconstructive procedures, and anatomy over the centuries.

Thus, our project is far less ambitious. In preparing the history of our discipline, we have maintained it within reasonable limits. Of course the end result will be a work which may appear somehow incomplete. This was done on purpose, simply for the sake of brevity. The reader wishing to obtain detailed information regarding techniques, surgeons or anatomists over the centuries, should refer to more extensive works on the history of medicine.

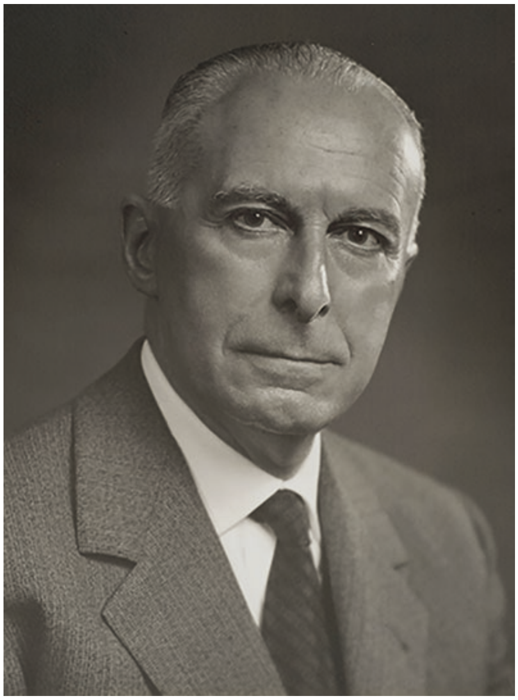
Although embellished with masterpiece illustrations to be found in numerous kinds of publications from all epochs, this book is not intended as a mere history of plastic surgery. On the contrary, it traces the progress—and the recording—of reconstructive work developed by surgeons from ancient times until World War II. It shows the evolution of wound healing through the ages, the close relationship between anatomy and surgery, and the impact of anatomy on the advancement of surgery.

Our fascinating journey begins with the first plastic surgical operation, reported in the Bible (*Genesis* 2:22), when the Lord God harvests Adam's rib to create woman. It continues through Mesopotamia, the cradle of human civilization with the clay tablets; then through Egypt with the Edwin Smith Papyrus; India with nasal reconstruction; Greece with Hippocrates and Aristotle; Rome with Celsus and Galen; then the Middle Ages with the founding of Universities, the beginning of cadaveric dissection, and the invention of printing; then the Renaissance with Gaspare Tagliacozzi, regarded as the founder of plastic surgery; then the nineteenth century with the discovery that transfer of skin from one part of the body to another (*skin graft*) was possible, the knowledge of the importance of anesthesia and antisepsis; and finally the twentieth century with the identification of different types of skin flaps for wound closure, the reconstruction of complex facial injuries after WWI, the birth of aesthetic surgery, and the official recognition of plastic surgery as an independent surgical specialty. Our long journey ends with WWII. New developments in reconstructive and aesthetic surgery from the postwar period onward are not included in the present book. They will require a separate work.

I found this journey particularly exciting, yet often frustrating, as we realized that most of the so-called "new" operations have been previously described by our forefathers, demonstrating that nothing is new under the sun.

Plastic Surgery: An Illustrated History includes hundreds of photographs taken and adapted from books housed in my personal library, unless otherwise stated. For this, I wish to thank the photographer, Pietro Scapin, for his professional cooperation. My appreciation also to Doris Schubert for working with the images to create an attractive cover design which incorporates some of the fundamentals of plastic surgery, anatomical dissection, skin grafting, skin flap, and facial wound closure. When the text had no illustration, we selected the frontispiece, which in many cases well summarizes the contents. An essential biography of each author, highlighting his or her role and contribution to the development of plastic surgery, is always reported. No book is mentioned unless I personally examined the original. Regarding the references, I tried to quote the first edition as much as possible. To assist the reader, the Latin, German, Italian, and French texts, titles, or references have been translated into English.

How was this project possible? The answer is simple. I enjoy the advantage of owning one of the most important rare book collections, specifically oriented to plastic surgery, which was bequeathed to me by my late uncle Prof. Gustavo Sanvenero Rosselli (1897–1974), the founder of plastic surgery in Italy and the initiator of the library. Over the years, I tried to fill in missing works with a meticulous search around the world and nowadays the library has nearly doubled in size.



Sanvenero Rosselli began acquiring rare books about plastic surgery in the early 1930s, when the supply was large and demand limited to a few collectors.

A true bibliophile, he used to compete with his friend Jerome P. Webster (1888–1974), who had a similar interest.

Old books have never been cheap. When Sanvenero bought his first *Tagliacozzi* (the famous book on nasal reconstruction) he didn't dare tell his family about the purchase—as it was the price of an apartment. Nowadays, prices have dropped considerably.

With these premises, writing a book on the history of plastic surgery was mandatory. However, it was not easy to find the appropriate person to share the difficulties of such demanding work.

My association with Catherine Foss has been a great stimulus. For 22 years, she served as Executive Director of the International Society of Aesthetic Plastic Surgery (ISAPS) and was also the Managing Editor of *ISAPS News,* a publication with which I cooperated for more than a decade as Historian. She edited the manuscript carefully, with painstaking competence, revising the text, incorporating proper corrections, and reviewing dates, facts, and nomenclature. She thanks Dr. Nina Naidu for planting the seed that flowered into this book.

Prof. Denys Montandon from Geneva aided me in amending the manuscript and making appropriate suggestions. His great interest in the history of our discipline has been a source of inspiration.

Plastic Surgery: An Illustrated History is divided into ten chapters.

1. The Ancient World
2. The Middle Ages
3. The Renaissance
4. The Seventeenth and Eighteenth Centuries (or the decline of plastic surgery)
5. The Nineteenth Century (or the *Golden Age*)
6. The Twentieth Century (or the development of *modern* plastic surgery)
7. The Birth of Aesthetic Surgery
8. The Impact of Anatomy on the Evolution of Surgery
9. Cleft Lip and Palate
10. Conclusions

The book is directed to plastic surgeons, both reconstructive and aesthetic, maxillo-facial surgeons, otolaryngologists, general surgeons, anatomists, and historians.

Milano, Italy Riccardo F. Mazzola

Introduction

Gaspare Tagliacozzi (1545–1599) (Fig. 1) defined plastic surgery, the new surgical branch he created, as the art that:

> … restores what Nature has given and chances have taken away. We reconstruct parts of the body, we repair and re-establish their integrity not to please the eye, but rather to benefit the soul of the patient. (…) The main purpose of this procedure is not the replacement of the original beauty of the face, but rather the rehabilitation of the part in question.
> *(Latin: Ea quae Natura dederat, Fortuna abstularat, membra reducimus, resarcimus integritatiti restituimus, non ut oculos delectent, sed ut animae operanti emolumento sint. (…) Quamuis enim pristinum faciei decus restituatur non tamen hic finis est (…), sed ut membra illa actiones suas ex naturae decreto obeant (…))* [1].

The term "plastic" comes either from the Greek πλάσσειν (plassein) to create or from the Greek πλάστικός (plasticòs), moldable.

Fig. 1 Wooden statue of Gaspare Tagliacozzi (1545–1599) holding a nose in his left hand. Bologna, Archiginnasio. (Courtesy of the Fondazione G. Sanvenero Rosselli)

Reference

1. Tagliacozzi G. De curtorum Chirurgia per Insitionem [On the surgery of injures by grafting]. Bologna: Bindoni; 1597. Book 1, Chapter 11.

Contents

About the Authors

Riccardo F. Mazzola, MD After obtaining his medical degree at the University of Pavia in 1967, Riccardo Mazzola completed residencies in ENT in 1970 at the University of Ferrara and plastic surgery at the University of Milan in 1974 under Prof. G. Sanvenero Rosselli. Past Professor of Plastic Surgery at the Postgraduate School of Plastic Surgery, ENT and Maxillo-Facial Surgery of Milan University.

In 1975, Prof. Mazzola established the *Fondazione G. Sanvenero Rosselli for Plastic Surgery,* as a tribute to his late uncle Gustavo Sanvenero Rosselli, the founder of plastic surgery in Italy. This internationally renowned institution promotes various forms of teaching, including a continuous postgraduate training program in the field of plastic surgery. Directed by a Board of Trustees, the Fondazione has coordinated more than 150 meetings and seminars and organized 53 courses with live surgery over the years. The Fondazione, of which Prof. Mazzola is currently President, houses one of the most important rare book collections on plastic surgery, with more than 3000 volumes, dating from 1490.

Prof. Mazzola was a founding member and has served as Secretary General and President of EURAPS (European Association of Plastic Surgeons). He has been Secretary and President of the Italian Society of Plastic Surgery (SICPRE) and is a member of more than 15 national and international societies, among them the prestigious American Association of Plastic Surgeons (AAPS). He has presented over 450 lectures and courses at national or international meetings and organized 55 congresses. He was honored to be chosen as the Maliniac lecturer at the 2006 ASPRS Congress in San Francisco and is coauthor of three textbooks, 12 book chapters, and 115 publications, 40 of them in peer-reviewed scientific journals. His primary interests include cleft lip and palate, head and neck reconstruction, nasal reconstruction, rhinoplasty, and the history of plastic surgery.

Catherine B. Foss Ms. Foss has served as Executive Director of the Northeastern Society of Plastic Surgeons (NESPS); the Plastic Surgery Research Council (PSRC); the Rhinoplasty Society; the International Federation for Adipose Therapeutics and Science (IFATS); the International Confederation for Plastic, Reconstructive and Aesthetic Surgery (IPRAS); and the International Society of Aesthetic Plastic Surgery (ISAPS), in addition to several non-medical societies.

She is a board-certified Medical Technologist with a BS degree from the University of Vermont. Before establishing the Office of Continuing Medical Education at the Dartmouth-Hitchcock Medical Center in Hanover, New Hampshire, in 1976, she worked as a Medical Microbiologist and then as a Cardiac Catheterization Lab Technician at the Columbia-Presbyterian Medical Center in New York City.

In 1982, she founded a meeting planning company that evolved into an association management firm that she continued to run for 38 years until her retirement. While providing administrative support for the International Society of Aesthetic Plastic Surgery, she also served as the Managing Editor of *ISAPS News*, the organization's quarterly newsletter. She collected and edited all articles submitted by members and others on both clinical and non-clinical topics—including, since 2009, a regular column on the history of plastic surgery.

Her interests have included competing internationally in downhill skiing, 3-day eventing, an equestrian sport that combines dressage, cross-country and show jumping, and singing with the Handel Society Chorus at Dartmouth College, of which she was also President for a time.

1 The Ancient World

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The Ancient World: Salient Events in Surgery and Plastic Surgery

- The **remote origins** of plastic surgery are found in the **Bible** (*Genesis* 2:22), when the Lord God causes man to fall into a deep sleep, before harvesting a rib to create woman.
- In **Mesopotamia**, one of the most impressive libraries of the ancient world (established ca. 668–627 BC) is discovered in the mid-nineteenth century. Of the 30,000 clay tablets composing the library, written in cuneiform script, almost 800 are of a medical nature, and some of them are relevant to plastic surgery. They deal with the healing of wounds and congenital malformations.
- In **Ancient Egypt**, we are well informed about Egyptian surgery, thanks to the Edwin Smith Papyrus, the most ancient medical text devoted to surgical cases known to man, a handbook on wound management dating to about 1650 BC. Forty-eight case reports concerning closure of skin defects and treatment of fractures, dislocations, ulcers, and tumors are described. Some of them are of plastic surgery interest.
- In **India**, nasal reconstruction is performed, probably since 600 BC, initially with local flaps and later with forehead flaps.
- In **Greece**, **Hippocrates** (ca. 460–375 BC), the greatest physician of his time and regarded as the founder of medicine, establishes the first School of Medicine on the island of Kos called the Asclepeion, a healing temple sacred to Asklepios, the Greek god of medicine. Hippocrates' teaching was extremely influential for centuries.
- The **Medical School of Alexandria** in Egypt develops about 311 BC. Anatomy is studied. **Herophilus** of Chalcedon (ca.335–280 BC) and **Erasistratus** of Chios (ca. 304–259 BC) are the leading physicians of the period.
- In **Rome**, **Aulus Cornelius Celsus** (25 BC–AD 50) writes *De Medicina* (On Medicine) in eight volumes, about AD 30. Volume 6 is devoted to surgery. He holds a key role in plastic surgery as he describes defect closure by advancement flap for the first time. **Claudius Galenus (Galen)** (ca. AD 129–201), the most important physician of the Roman period, writes on anatomy and wound treatment.
- With the downfall of the western Roman Empire in 476 AD, medicine and surgery suffer a period of considerable decay. On the other hand, the eastern Empire tries to maintain culture and tradition. Byzantium (now Istanbul), the capital of the Byzantine (Eastern) Empire, becomes a teaching center. Medicine and surgery are mainly concentrated in the hands of a few physicians, important from a plastic surgery standpoint, such as **Oribasius** (ca. 325–403 AD), **Aëtius of Amida** (about fifth century AD), and **Paulus of Aegina** (ca. 625–690 AD). Paulus writes on surgery, in particular on tracheostomy, gynecomastia, and earlobe colobomata (defects).

The origin of the term plastic is an object of discussion. Either it comes from the Greek πλάσσειν (plassein) to create or from the Greek, πλάστικός (plasticòs), moldable. In the history of the evolution of plastic surgery, the following periods can be identified:

1. The ancient world.
2. The downfall of the Roman Empire.
3. The Middle Ages.
4. The Renaissance. Gaspare Tagliacozzi, the founder of plastic surgery.
5. The seventeenth and eighteenth centuries (or the decline of plastic surgery).
6. The nineteenth century (or the *Golden Age*).
7. The twentieth century (or the development of *modern* plastic surgery).
8. The birth of aesthetic surgery.

1.1 The Remote Origins of Plastic Surgery

Plastic surgery is as old as human beings. Its origin is found in the Bible (*Genesis* 2:22): *So, the Lord God caused the man to fall into a deep sleep* (anesthesia) (Fig. 1.1, *top*), *and while he slept, He took one of the man's ribs and closed up the area with flesh* (the rib's harvesting and wound closure) (Fig. 1.1, *center*), *and from the rib that Lord God had taken from the man, He made a woman and brought her to him* (the creation of the woman) (Fig. 1.1, *bottom*).

Apart from this biblical episode, the beginning of plastic surgery can only be speculated. The remote origin is essentially the story of wound management [1]. The wound represented a real problem for primitive man [2]. One day, coming out of the cave where he was sheltered, he felt an acute pain in his foot. Each time he put the heel down for walking, the pain increased. At this point the primitive man sat down, examined the sole of his foot, and noticed a drop of blood. A big thorn had entered deep into his flesh. Using his long, strong nails, he was able to remove the thorn (Fig. 1.2). On that memorable day, the first surgical procedure took place.

Wound management in ancient times can only be imagined; regrettably, it is not possible to document it. Wound healing was probably left entirely to nature. Information concerning the stitching of wounds is not available. If this occurred, primitive man tried to sew the margins with simple means like fibers, or an animal's tendon, using a thorn as a needle, or the jaws of ants to approximate the edges, thus transforming an open wound, with a long healing process, into a linear section that heals faster. The second problem was hemorrhage. Primitive man understood that control of bleeding was accomplished by compression or bandaging. He probably filled the wound with various types of dressings and balms. The beginning of the use of cautery is uncertain, most likely, sometime around 3000 BC [2]. The third problem was infection. Bone disease, caused by infection, is very old. Evidence of osteomyelitis in man and animals has been documented in numerous fossils [2]. However, primitive man was probably more resistant to bacterial aggression. Hence, wound management in prehistoric life was rather an emergency procedure and surgery mainly reparative.

But when did primitive man start the peaceful use of surgery and for what type of indication? Apparently for two main purposes: one was castration of animals to domesticate them and the second was trepanation of the skull, a practice which apparently goes back to 10,000 BC. The skull was either perforated with a trepan or scraped. The rationale for this operation was the sequelae of head wounds, or to keep evil spirits away [2].

Fig. 1.1 The Book of the Genesis. The first operation of plastic surgery. *Top:* The Lord God causes the man to fall asleep. *Center*: the rib harvesting. *Bottom:* the creation of woman from man. Scenes of the Old Testament. Fourteenth-century bas reliefs by Lorenzo Maitani (ca. 1275–1330). Cathedral of Orvieto (central Italy)

Fig. 1.2 First example of wound management: thorn removal (Lo Spinario). Roman bronze statue. First century BC. Rome, Musei Capitolini. (Courtesy, © Sovrintendenza Capitolina – Foto in Comune)

1.2 Mesopotamia

Mesopotamia, also known as the Fertile Crescent, is the region between the Tigris and the Euphrates rivers, now in Iraq. In this green land, agriculture flourished, irrigation systems originated, and some of the most important inventions of mankind came into being: the wheel and writing. It was one of the cradles of human civilization that included the Sumerians, considered the inventors of writing; the Accadians; the Babylonians, the promulgators of one of the oldest known codes of law known as the Code of Hammurabi (about 1700 BC); and the Assyrians.

1.2.1 The Clay Tablets

During the mid-nineteenth century, excavations of the Nineveh Palace, near what is today Mosul, one of the most impressive libraries of the ancient world, were discovered. Established by Ashurbanipal (668–627 BC), the last great king of the Assyrian Empire, it contained more than 30,000 **clay tablets** written in cuneiform script with all kinds of texts. They were written about 600 BC, although some of the text dates back to about 2000 BC. The majority, about 6000, concerns legislation, correspondence, engagements, and financial matters. The rest include divinations, omens, and religious poems, and still others deal with medicine, astronomy, and literature. The clay tablets were transported to England and are now housed in the British Museum.

About 800 of these tablets are of a medical nature (Fig. 1.3). We have to understand that medicine was well developed in the Assyrian culture, although strongly influenced by astrology and magic. Some of these clay tablets are relevant for plastic surgery. They deal with the healing of wounds and congenital malformations. *If a man is sick with a blow on the cheek, pound together turpentine, tamarisk, daisy, flour of Inninu* (…) *mix in milk and beer in a small copper pan; spread on skin and he shall recover.* Another tablet suggests the use of dressings with oil for the management of an open wound. Monsters (or those born with congenital malformations) were considered a key omen, a sign of the Gods for predicting future events. *When a woman gives birth to an infant whose nose is absent, the country will be in affliction and the house of the man ruined; who has no tongue, the house of the man ruined; who has no lips, affliction will strike the country and the house of the man destroyed.* Curiously, surgery is not mentioned in the clay tablets, although we are aware that surgery was practiced at the time.

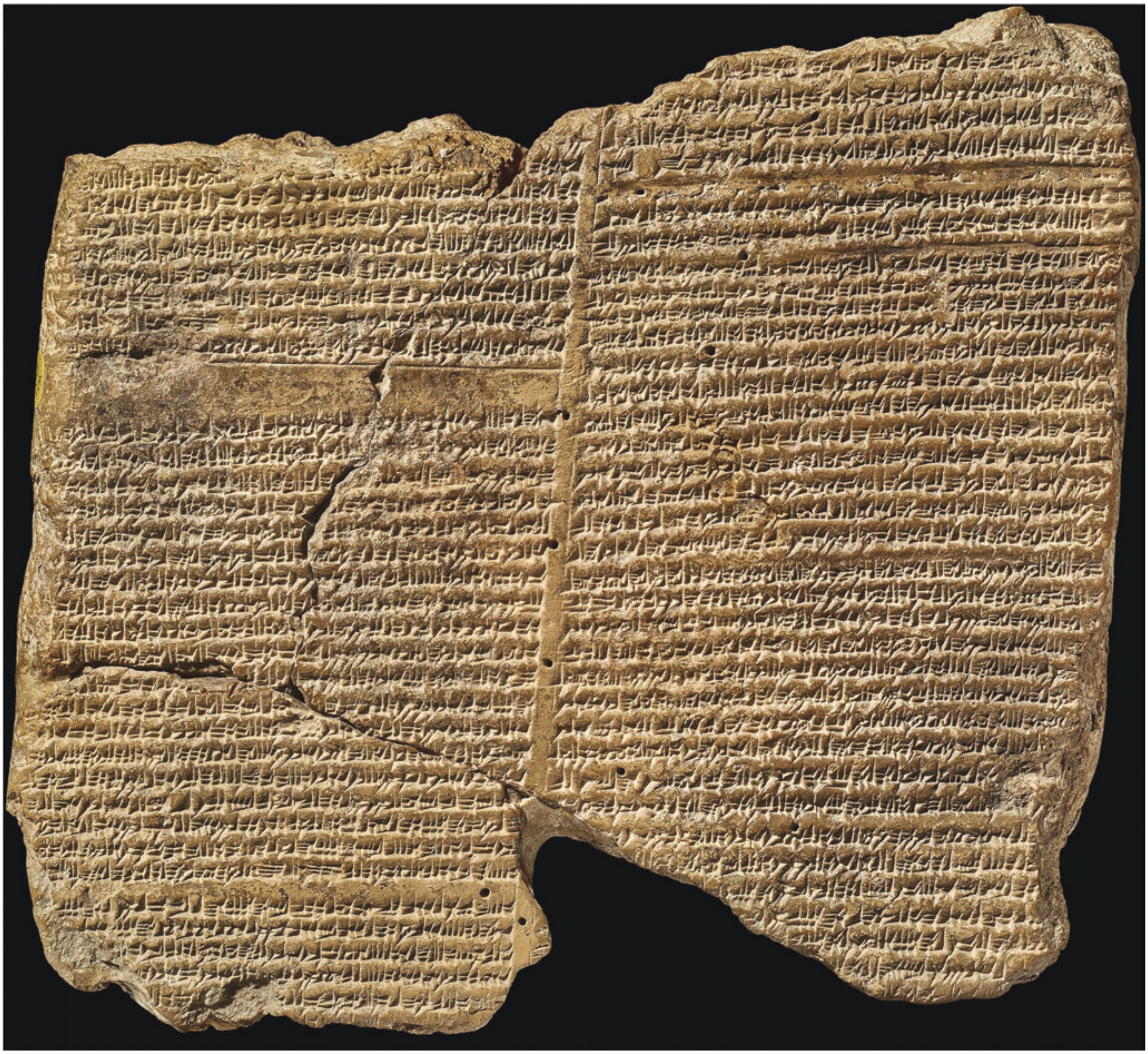


Fig. 1.3 Mesopotamian clay tablet of medical interest. London. (Courtesy, © The Trustees of the British Museum)

1.2.2 The Code of Hammurabi

On the contrary, in the **Code of Hammurabi** (ca.1755–1750 BC), surgical malpractice was identified and punished by mutilation, typical of the Assyrian code. The statements in the Code of Hammurabi, although very severe, have great historical value because they represent the first written identification of penal and civil medico-legal responsibility of the physician. *If a physician carried out a major operation with a bronze surgical knife and has caused the seignior's death or he opened the eye socket of a seignior and has destroyed the seignior's eye, his hand shall be cut off. If a physician carried out a major operation on a commoner's slave with a bronze surgical knife and has caused (his) death, he shall replace the slave with another slave. If he shall open an abscess with a bronze surgical knife and destroy the eye, he shall pay half of the value of the slave.*

1.3 Ancient Egypt

1.3.1 The Smith Papyrus

We are well informed about Egyptian surgery, thanks to the Edwin Smith Papyrus, the most ancient medical text devoted to surgical cases known to man, a handbook on wound management. The copy that arrived to us is a transcription dated about 1650 BC of an original manuscript from the Old Kingdom, dating between 3000 and 2500 BC [3, 4] (Fig. 1.4). It is a fragment about 4.7 m long, which includes 48 case reports concerning closure of skin defects and treatment of fractures, dislocations, ulcers, and tumors, grouped according to the following criteria. The first 27 deal with head and facial injuries; from 28 to 33 with injuries of the neck and cervical vertebrae; 34 and 35 with fractures of the clavicle; from 36 to 38 with humeral fractures; from 39 to 46 with thoracic injuries; 47 with axillary sores; and finally 48 with a dorsal vertebral lesion.

The unknown wise author made the following recommendations regarding treatment: (1) *an ailment which I will treat* (considered curable); (2) *an ailment which I will contend* (with doubts about curability); and (3) *an ailment not to be treated* (recognized beyond the chances of success). The text was translated into English by Prof. James H. Breasted and published by the University of Chicago in 1930 [3]. It is currently preserved at the New York Academy of Medicine.

Each case is presented in the same sequence. The patient's examination comes first, followed by the diagnosis of the type of injury, whether superficial, involving the soft tissues only, or deeper, reaching the bone or the internal organs. The suggested treatment modalities conclude the case report and include surgical, medicinal, postural, and dietary recommendations. For dressing, the Egyptian surgeon made use of absorbent lint, whereas for nasal injuries, swabs or linen tampons were introduced into the nostrils. Wound closure was by edge approximation by means of special bandages or adhesive plasters. Fresh meat was applied over the repaired wound the first day and grease and a honey-based ointment with lint the second day. Stitching was used for facial and other types of lesions for the first time in the history of surgery.

Of the 48 reported cases, we shall quote only those related to plastic surgery, namely, nasal fractures and management of fresh wounds.

- *Case 2*. Wound in the scalp. *Treatment*. Approximation with adhesive plaster. Fresh meat bound on, first day; then honey ointment on lint bound on, second day.
- *Case 11*. A broken nose. *Examination*. If thou examinest a man having a break in the column of his nose, his nose being disfigured and a (depression) being in it, while the swelling that is on it, protrudes, and he has discharged blood from his nose. *Treatment*. Thou shouldst cleanse (it) for him (with) two plugs of linen saturated with grease in the inside of his two nostrils. Thou shouldst put (him) at his mooring stakes until the swelling is reduced. Thou shouldst apply for him stiff rolls of linen by which his nose is held fast. Thou shouldst treat him afterward (with) grease, honey (and) lint, every day until he recovers.
- *Case 12*. A break in the nasal bone. Instructions concerning a break in the chamber of his nose (nasal bone): *Diagnosis*: If thou examinest a man having a break in the chamber of his nose and thou findest his nose bent, while his face is disfigured, and the swelling which is over it is protruding. Thou shouldst say concerning him: one having a break in the chamber of his nose. An ailment which I will treat. *Treatmen*t: Though shouldst force it to fall in, so that it is lying in its place, (and) clean out for him the interior of both his nostrils with two swabs of linen until every worm of blood which coagulates in the inside of the two nostrils comes forth. Now afterward thou shouldst place two plugs of linen saturated with grease and put (them) into the two nostrils. Thou shouldst place for him two stiff rolls of linen bound on. Thou shouldst treat him afterward with grease, honey, (and) lint until he recovers. As for: A break in the chamber of his nose, it means the middle of his nose as far as the back, extending to the region between his two eyebrows.
- *Case 13*. Compound comminuted fracture in the side of the nose. Instructions concerning a smash in his nostril. If thou examinest a man having a smash in his nostril, thou shouldst place thy hand upon his nose at the point of his smash. Should it crepitate under thy fingers, while at the same time he discharges blood from his nostril and from his ear, in the side of him having that smash, it is painful when he opens his mouth, because of it; (and) he is speechless. Thou shouldst say concerning him: One having a smash in his nostril. An ailment not to be treated. (The injury is so serious that it is regarded as fatal and no treatment is indicated. Probably a fracture of the skull's base).
- *Case 16*. Flesh wound in one side of the nose. *Treatment*: draw together with stitching; cleanse with two swabs of linen. Fresh meat bound on, first day. Honey ointment on lint, bound on, second day.
- *Case 26*. Flesh wound in upper lip. *Treatment*: drawn together with stitching; fresh meat bound on, first day. Honey ointment on lint, bound on, second day.

Curiously, in the Smith Papyrus the surgical knife is never mentioned. In the cases presented, the wounds were caused by flint weapons, not iron-related. In a bas relief visible in a tomb at Saqqara (about 2250 BC), a scene of circumcision is provided. Apparently, the surgeon uses a sharp stone instead of a metal blade. Bronze and iron arrived relatively late in Egypt from the East. It is difficult to establish a possible date, certainly after the Smith Papyrus was written (1650 BC) [2].

Egyptian surgeons were often requested to solve problems of malpractice and to repair defects caused by unfavorable surgical procedures.

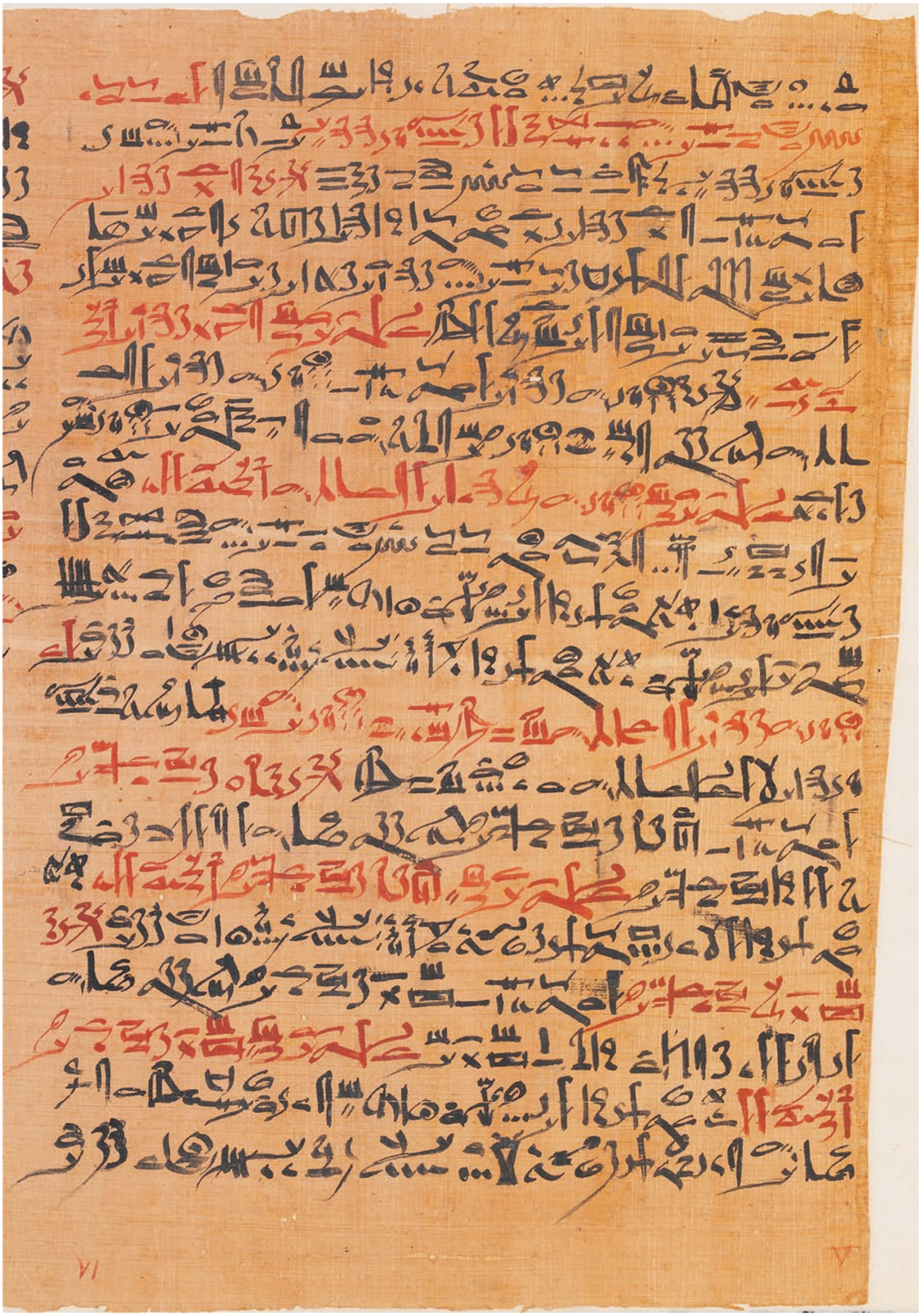


Fig. 1.4 Edwin Smith Papyrus—The oldest text of surgical case reports known to man. Academy of Medicine, New York. (Courtesy of the New York Academy of Medicine Library)

1.4 India

In India, the birth of reparative surgery was strictly related to the art of nasal reconstruction. This apparently curious origin has a logical explanation if one considers the rather common tradition of cutting off the nose of adulterers, thieves, and prisoners of war as a sign of humiliation. The same type of treatment has been observed in the great majority of marble Roman statues when invaders entered Rome destroying or pillaging what they could at the fall of the western Roman Empire [5].

1.4.1 The Shamita

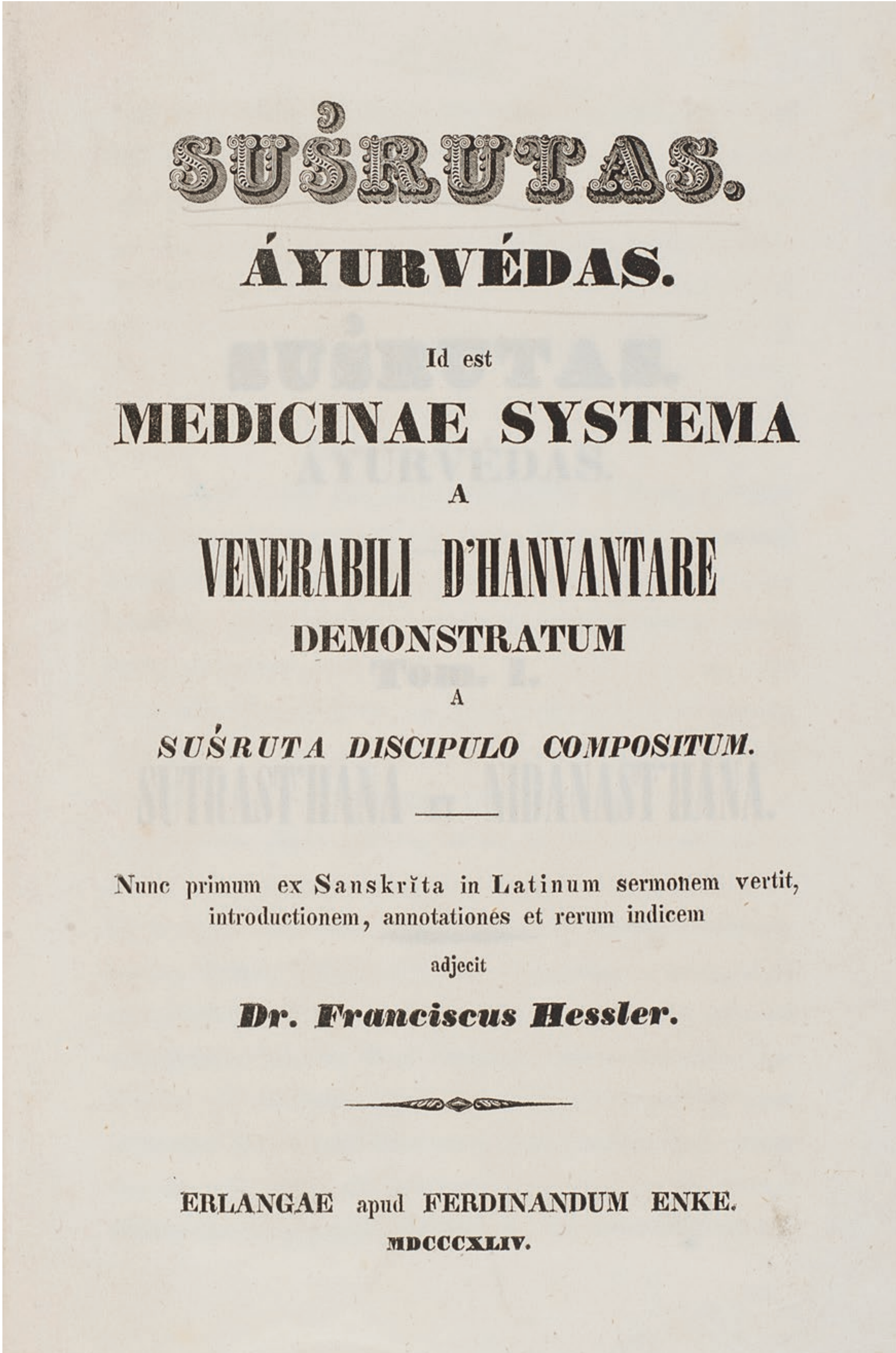
In India, in an attempt to improve this terrible disfigurement, repair was practiced by the Koomas, a low caste of priests, or according to some, a guild of potters. Details of the nasal reconstructive procedure were reported in the Samhita, one of the two foundation works of ancient Indian surgery and midwifery, the other being the Charaka Samhita, devoted to medicine. The work we are referring to is the first translation of the Sanskrit Samhita (*Compendium*) into Latin, made by **Franz Hessler** (1799–1890) in 1844 [6] (Fig. 1.5).

Now I shall report the technique for affixing an artificial nose. The careful surgeon takes a leaf of a creeper, long and broad enough to cover the size of the nose, cuts from the cheek the shape of skin outlined (of the piece of leaf), so that it is still attached by one part, and quickly sets it in position, after he has freshened the margins, securing it with appropriate bandages, in which are carefully fixed two small tubes into the nostril to facilitate respiration, lifts it up and dusts it with red Sandal, licorice root and antimony. He covers it with a soft cloth and sprinkles it with sesame oil. The patient should be given clarified butter to drink and when this has been digested, he should be anointed with oil, and treated with purgative in the usual way. When the implanted nose is united, the remaining pedicle is divided. If the nose is too small, attempts should be made to enlarge it; if it has too much flesh it should be thinned to its natural size. The mode of restoring the upper lip, is the same as for the nose, but without using the tubes. (Book One, Chapter 16, page 40).

In other words, the part of the missing nose should be carefully measured in advance using a leaf, which acts as a template, for outlining an equal amount of skin on the cheek. The cheek skin flap has to be transposed to the nose, maintaining the vascular pedicle. Its sectioning occurs a few days later. In the text, an earlobe reconstruction with skin flaps outlined in the cheek has also been reported.

In Book One, Chaps. 7 and 8, an accurate description of *yantra* (blunt) (Fig. 1.6a) and *sastra* (sharp) (Fig. 1.6b) instruments necessary to perform surgical operations is supplied [6]. **Suśhruta** says: *A wise surgeon should get instruments made of pure iron and with sharp edges by an expert blacksmith who is skilful and experienced in his craft* [7].

Suśhruta is regarded as the legendary founder of Hindu medicine. Tradition says that he was instructed by the holy Dhanwantari, the physician to the gods. Apparently, he lived between the sixth and fifth centuries BC, although historians believe that Suśhruta was not one man, but the result of various Indian authors who contributed to establish the Áyurvédas (or "knowledge of life"), the Hindu system of medicine, over the centuries [7, 8]. No one has yet succeeded in dating precisely the Indian medical classics.



SUŚRUTAS.

ÁYURVÉDAS.

Id est

MEDICINAE SYSTEMA

A

VENERABILI D'HANVANTARE

DEMONSTRATUM

A

SUŚRUTA DISCIPULO COMPOSITUM.

Nunc primum ex Sanskrĭta in Latinum sermonem vertit,
introductionem, annotationes et rerum indicem

adjecit

Dr. Franciscus Hessler.

ERLANGAE apud FERDINANDUM ENKE.

MDCCCXLIV.

Fig. 1.5 Title page of the first translation of the Suśhruta Samhita from the Sanskrit into Latin by Hessler (1799–1890) in 1844

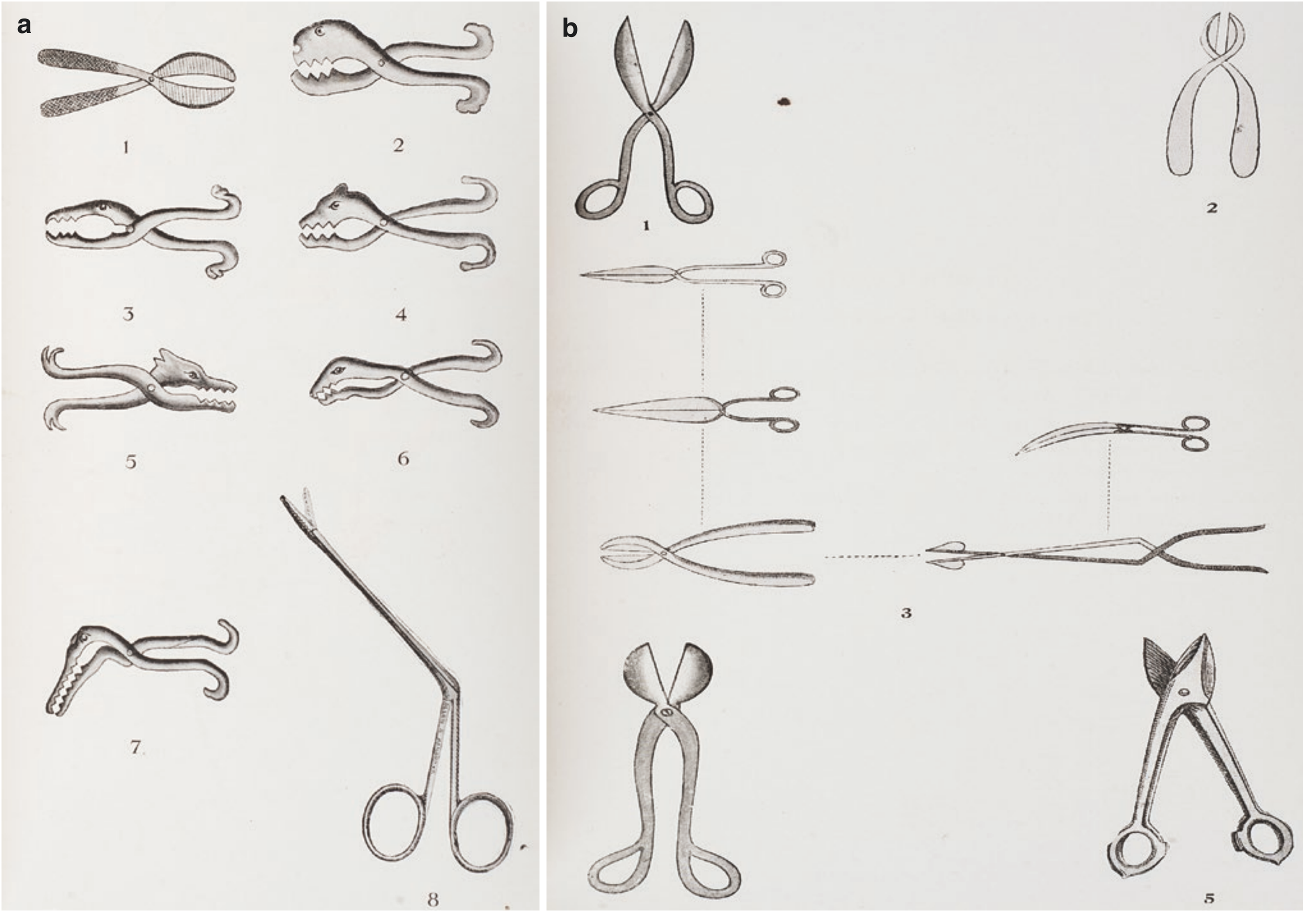


Fig. 1.6 The surgical instruments of the Indus: (**a**) *yantra* (blunt); (**b**) *sastra* (sharp) necessary to perform surgical operations. (From: Mukhopadhyaya G. *The Surgical Instruments of the Indus.* Calcutta, Calcutta University, 1913–14)

1.4.2 The Forehead Flap for Nasal Reconstruction

When was the forehead skin first used? Probably in the sixteenth century, although there is no documentation about it. In the second half of the seventeenth century, the Venetian adventurer **Nicolao Manucci** (1639–1717) (Fig. 1.7) wrote *Storia do Mogor* (History of the Moghuls), a long, detailed manuscript about the Moghul dynasties, their complicated battles, and their barbaric custom of cutting the nose off their prisoners of war instead of killing them [9]. Regrettably, Manucci's text remained in manuscript form in the Marciana Library in Venice. It was only in 1907 that the text was translated into English and published in London [10], thanks to William Irvine (1840–1911) (Fig. 1.8). But let's see what Manucci writes about the Moghul King Aurangzeb and his campaigns against Bijapur, when he directly witnessed the dramatic scene of cutting off the noses of Moghul prisoners and the immediate repair of the ensuing mutilation: *At the commencement of the war (ca. 1670–1686), when the men of Bijapur caught any unhappy persons belonging to the Moghuls, who had gone to cut grass or collect straw or do some other service, they did not kill them, but cut off their noses. Thus, they came back into the camp all bleeding. The surgeons belonging to the country cut the skin of the forehead above the eyebrows, and made it fall down over the wounds on the nose. Then, giving it a twist so that the live flesh might meet the other live surface, by healing applications they fashioned for them other imperfect noses. There is left above, between the eyebrows, a small hole caused by the twist given to the skin to bring the two live surfaces together. In a short time, the wound heals up, some obstacle being placed beneath to allow respiration. I saw many persons with such noses and they were not so disfigured as they would have been without any nose at all, but for the bore between their eyebrows – the mark of the incision* (Manucci, 1907, Volume 2, page 301) (Fig. 1.9)

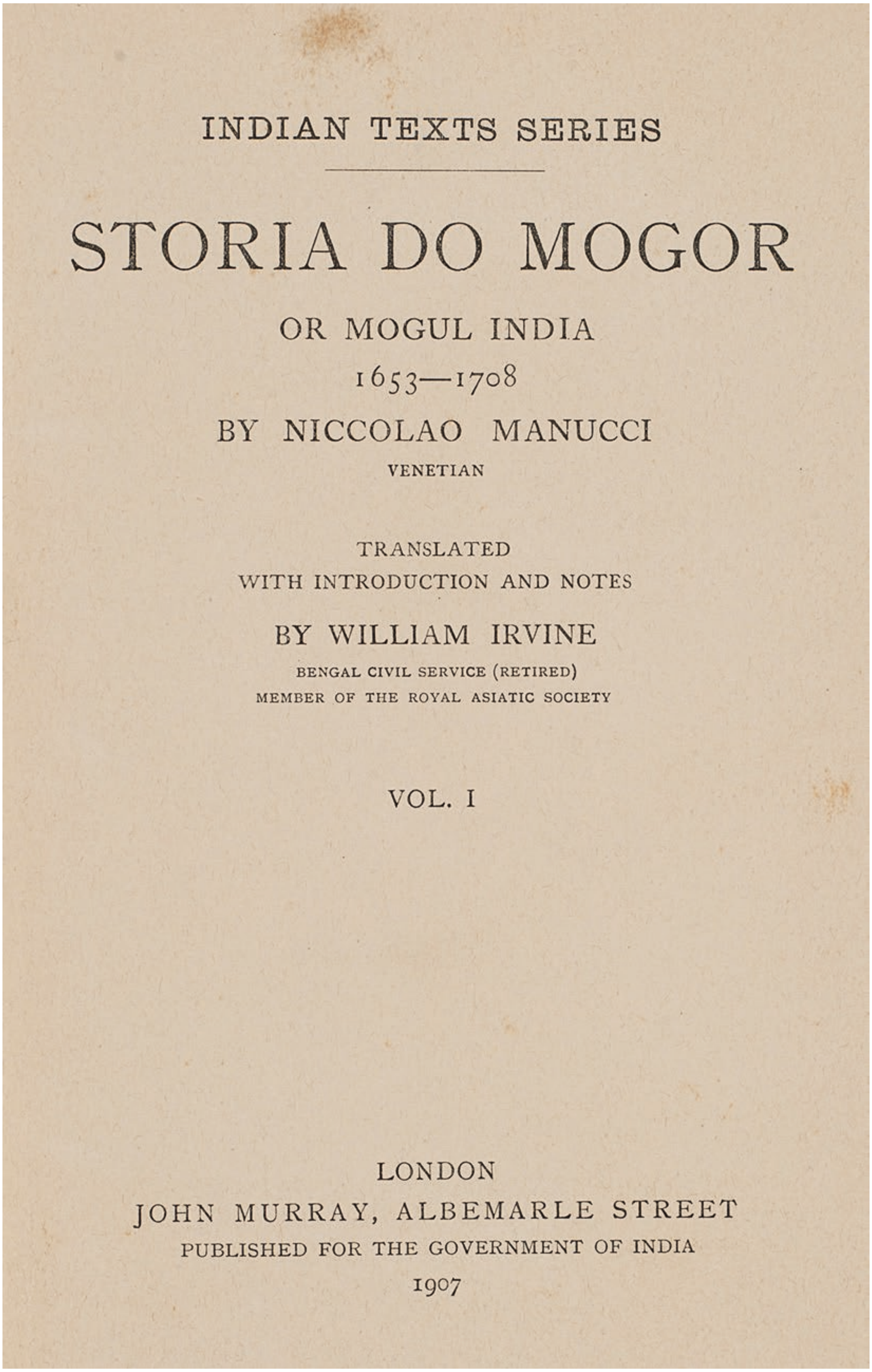
Historically, Manucci's description is particularly relevant because it demonstrates that forehead rhinoplasty was already practiced in India in 1670. However, his report did not influence the western world because it remained unknown in manuscript form and was only translated in 1907. Indeed, at that time the western world had been aware of Indian forehead rhinoplasty since the end of the eighteenth century. A letter, signed B.L. and recently identified as the English engraver

Barak Longmate (1768–1836), addressed to the Editor-in-Chief of the popular London monthly *The Gentleman's Magazine*, was published in the October issue in 1794 [11]

There followed the detailed description of the two-step type of repair, carried out on Cowasjee, a bullock driver for the British army, who fell into disfavor of Tippoo Sultan and had his nose amputated. The letter had a profound impact on a widespread interest in nasal reconstruction and plastic surgery in general. As we shall see (Chap. 5), it stimulated the English surgeon **Joseph C. Carpue** (1764–1846) to practice this operation on two injured soldiers, to reconstruct the missing nose, and to publish the successful outcome in an account dated 1816.

Forehead rhinoplasty continued its long tradition in subsequent years. In the second half of the nineteenth century, the Irish physician **Denis F. Keegan** (1840–1920) established himself in India and performed numerous nasal reconstructions. Upon returning to Dublin, he issued *Rhinoplastic Operations, with a description of recent improvements of the Indian method* [12], summarizing his almost 30 years of experience in replacing the missing nose while achieving amazing results, thanks to his technical improvements (Fig. 1.10)

Fig. 1.7 Portrait of Nicolao Manucci (1639–1717). (From: Manucci N. *Storia do Mogor*. (History of the Moghuls) London, John Murray, 1907–08)



INDIAN TEXTS SERIES

STORIA DO MOGOR

OR MOGUL INDIA

1653—1708

BY NICCOLAO MANUCCI

VENETIAN

TRANSLATED

WITH INTRODUCTION AND NOTES

BY WILLIAM IRVINE

BENGAL CIVIL SERVICE (RETIRED)

MEMBER OF THE ROYAL ASIATIC SOCIETY

VOL. I

LONDON

JOHN MURRAY, ALBEMARLE STREET

PUBLISHED FOR THE GOVERNMENT OF INDIA

1907

Fig. 1.8 Title page of the first translation into English, dated 1907, of *Storia do Mogor* (History of the Moghuls), the report of the Venetian adventurer Nicolao Manucci who described the first forehead rhinoplasty in 1686

Fig. 1.9 First description of forehead flap for nasal reconstruction performed by Indian surgeons in 1670. (From: Manucci N. *Storia do Mogor (History of the Moghuls)*. Vol. 2 London, John Murray, 1907–1908, p. 301)

The campaigns against Bījāpur began from one thousand six hundred and seventy, and [238] lasted until this year (? 1686). At the commencement of the war, when the men of Bījāpur caught any unhappy persons belonging to the Moguls who had gone out to cut grass or collect straw or do some other service, they did not kill them but cut off their noses. Thus they came back into the camp all bleeding. The surgeons belonging to the country cut the skin of the forehead above the eyebrows, and made it fall down over the wounds on the nose. Then, giving it a twist so that the live flesh might meet the other live surface, by healing applications they fashioned for them other imperfect noses. There is left above, between the eyebrows, a small hole, caused by the twist given to the skin to bring the two live surfaces together. In a short time the wounds heal up, some obstacle being placed beneath to allow of respiration. I saw many persons with such noses, and they were not so disfigured as they would have been without any nose at all, but they bore between their eyebrows the mark of the incision.

Fig. 1.10 Pre- and postoperative photographs of a forehead rhinoplasty. (From: Keegan DF *Rhinoplastic Operations*. London, Baillière, Tindall and Cox, 1900)

1.5 Greece

1.5.1 Hippocrates

Greek medicine was influenced by **Hippocrates** (ca. 460–375 BC), the greatest physician of his time and regarded as the founder of medicine (Fig. 1.11). Historians believe that Hippocrates was born on the island of Kos (Greece) around 460 BC. He learned medicine from his father Heraclides and probably trained at the Asclepeion of Kos. In ancient Greece and Rome, an Asclepeion (Greek: *Asklepeion*; Latin *Aesculapium*) was a healing temple sacred to Asklepios, the Greek god of medicine. Hippocrates rejected the views of his time that considered illness to be something caused by supernatural, astral influence, possession of evil spirits, or disfavor of the gods. On the contrary, he based his diagnostic process on direct observation of the disease and on analysis of the human body, introducing scientific method into medicine for the first time. He believed that illness had a logical and physical explanation, and its etiology had to be accurately investigated. He established the Great School of Medicine on the island of Kos. He taught and practiced medicine throughout his life, traveling in various Greek regions. He probably died in Larissa (Greece) at the age of between 83 and 90 [1].

Hippocrates' teaching was extremely influential for centuries and his medical and surgical knowledge vast. He used cauterization for the management of raw surfaces, reduced malunited fractures, and practiced cranial trephination for evacuating hematomas.

1.5.2 The Corpus Hippocraticum

The *Corpus Hippocraticum* (Hippocratic Corpus) is a collection of about 70 medical tracts, attributed to Hippocrates in antiquity and assembled during the Alexandrian era (third century BC). Whether Hippocrates himself was the author of the *Corpus*, in other words whether these works are genuine, is still a matter of great dispute and controversy. Very possibly, they were written by his students and disciples over the years. The *Corpus* contains manuals, research, essays, and philosophical thoughts on different medical topics, arranged without any logical order and even with striking contradictions among them. They certainly offer a complete overview of Greek medicine at the time.

Among the treatises included in the *Corpus*, mention should be made of *The Oath*, the first written Code of Ethics, to which the physician should adhere. The Oath, formulated about 430 BC, currently modified and updated, is still taken by doctors at the beginning of their medical practice.

It also includes *The Book of Prognostics*; *On Regimen in Acute Diseases; On Airs, Water and Places*; *Instruments of Reduction*; *On Injuries of the Head*; and *Aphorisms*. An aphorism is a statement of subjective truth or observation skillfully and concisely written. One of the most famous aphorisms is: *Life is short, art long, opportunity fleeting, experience misleading, judgement difficult* (Fig. 1.12). Hippocrates' works were true best-sellers. A rough calculation estimates more than 4000 different editions of the entire work. Some of them, like Aphorisms and the Oath, have appeared numerous times over the centuries. The first printed edition of the *Opera Omnia* (Complete Works) was issued in Latin in 1525 [13] and dedicated to Pope Clement VII, a member of the Medici family, in luxury and magnificence, typical of the publications executed by the Pope's order (Fig. 1.13).

Fig. 1.11 Supposed portrait of Hippocrates. (From: Hippocrates. *Opera Omnia*, edited by Anutio Foesio. Geneva, Samuel Chouët, 1657)

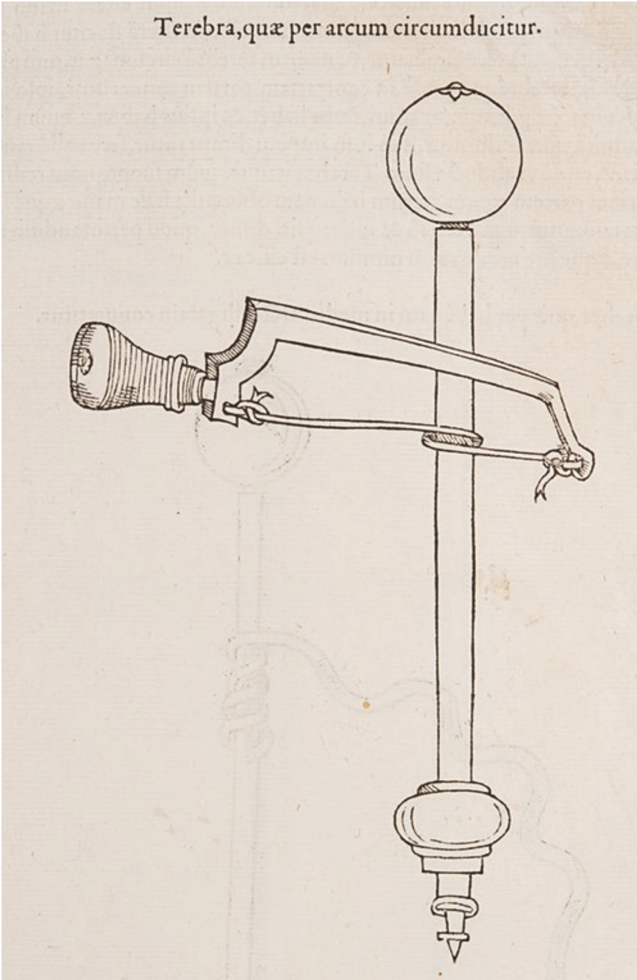


Fig. 1.12 Trephine for the management of head injuries. (From: Hippocrates. *De Vulneribus Capitis* (On Injuries of the Head). In: G. Guidi. *Chirurgia è Graeco in Latinum conversa* (Surgery, translated from Greek into Latin). Paris, Pierre Gaultier, 1544)

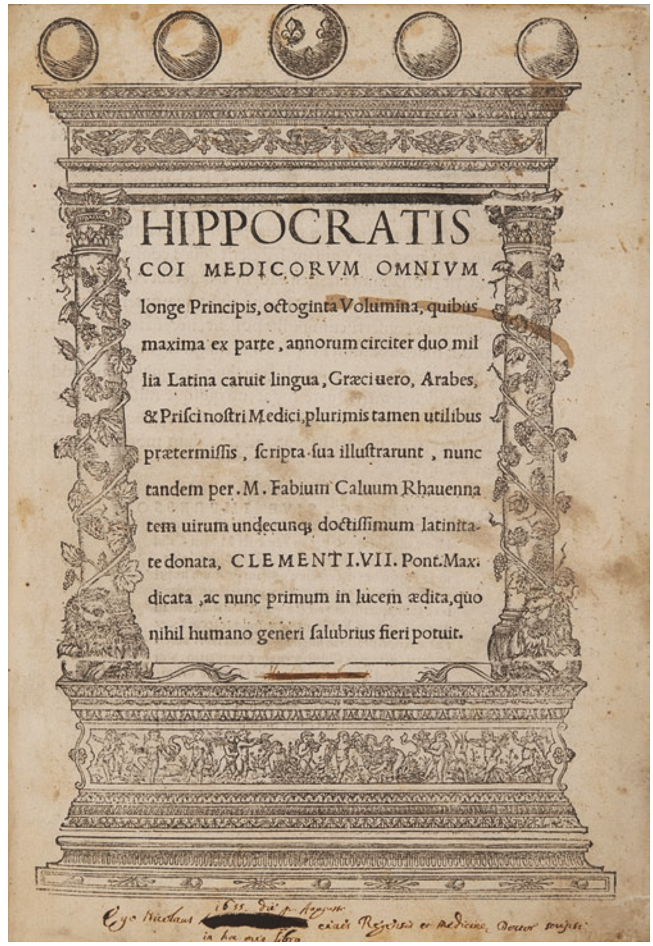

HIPPOCRATIS
COI MEDICORVM OMNIVM
longe Principis, octoginta Volumina, quibus maxima ex parte, annorum circiter duo millia Latina caruit lingua, Græci uero, Arabes, & Prisci nostri Medici, plurimis tamen utilibus prætermissis, scripta sua illustrarunt, nunc tandem per. M. Fabium Caluum Rhauennatem uirum undecunq; doctissimum latinitate donata, CLEMENTI.VII. Pont.Max. dicata, ac nunc primum in lucem ædita, quo nihil humano generi salubrius fieri potuit.

Fig. 1.13 Title page of the first edition of Hippocrates *Opera Omnia*. (From: Hippocrates. *Octaginta volumina* (Eighty treatises), edited by M. Fabio Calvo. Roma, Francesco Minitio Calvo, 1525)

1.6 The Medical School of Alexandria

In 331 BC, **Alexander the Great** (356–323 BC) founded the city of Alexandria in Egypt. It would become the cultural center of his empire, housing one of the most important libraries of the period. A School of Medicine was established about 311 BC, where anatomy was studied, and according to the Roman physician Claudius Galenus, dissections of human and animal bodies were practiced, although there is no evidence to support this statement. Surgery and pharmacology flourished. **Herophilus** of Chalcedon (ca.335–280 BC) and **Erasistratus** of Chios (ca.304–259 BC) were the leading physicians of the period (see Sect. 8.2.2).

1.7 Rome

In Rome surgery was well developed. The rather sophisticated bronze surgical instruments found in Pompei demonstrate the high level of technology achieved. Many of these instruments were stored in pocket-size traveling kits to be used for emergencies or on the battlefields. A first-century fresco, discovered in Pompei and now preserved in the Museo Archeologico Nazionale of Naples, illustrates the removal of an arrow from the thigh of Enea in standing position. The surgeon tries to extract the weapon, grasping it with a pair of bronze forceps. Close to him, a putto (cherub) is crying while he assists in this dramatic scene (Fig. 1.14).

The two most representative figures of ancient Roman medicine were Celsus and Galen.

Fig. 1.14 The surgeon removes an arrow from Enea's thigh using bronze forceps. Pompeian fresco about first century AD. Naples, with permission of the Ministero della Cultura. Museo Archeologico Nazionale di Napoli. Photo: Luigi Spina

1.7.1 Celsus

Aulus Cornelius Celsus (25 BC–AD 50) was probably not a physician, but a writer from a noble family and the author of *De Medicina* (On Medicine) in eight volumes, written about AD 30 [14] (Fig. 1.15). In Book Seven, Chapter 9, vessel ligature, lithotomy, and lip closure (cleft lip or lip tumor) by means of flaps are reported. Celsus explains how defects of the ears, lips, and nose can be cured (*curta in auribus, labrisque ac naribus, quomodo sarciri et curare possint*), followed by a description of wound closure by two advancement flaps: *The defect should be converted into a square (in quadratum redigere). Then, from the inner angles, transverse incisions are made (lineas transversas incidere), so that the part on one side is fully divided from that on the opposite side. After that, the tissues which have been undermined, are drawn together (in unum adducere). If this is not possible, two additional semilunar incisions are made at some distance from the original (ultra lineas, quas ante fecimus, alias duas lunatas et ad piagam conversas immittere), but sectioning the outer skin only. (…) These latter incisions enable the parts to be easily brought together without using any traction* (Fig. 1.16).

In Chapter 7 of Book Seven, Celsus described the correction of entropion with the folding of the lid margin, sometimes complicated by eyelashes contacting the corneal surface and the excess of upper eyelid skin, nowadays called blepharochalasis. Details regarding this operation performed by Celsus are in the section on aesthetic surgery of the eyelids (see Sect. 7.1.1.1).

Celsus holds a key role in the history of plastic surgery as he is considered the earliest author who described defect closure by flap advancement, the so-called Celsian method. To maintain the wound's margins approximated, if stitching was complicated, he recommended the use of *fibulae* (pins), a method already used among primitive people (Fig. 1.17). He also identified the four cardinal signs of acute inflammation: redness and swelling with heat and pain (*rubor et tumor,* cum *calore et dolore*). A copy of Celsus's manuscript was discovered in Milan in 1443 and printed for the first time in 1478 in Florence. *De Medicina* was a very successful textbook. It went through more than 50 editions over the years.

Fig. 1.15 The device (logo) of Benedetto Fontana, the Venetian printing house of the 1497 edition of *De Medicina* (On Medicine) by A. C. Celso (25 BC–AD 50)

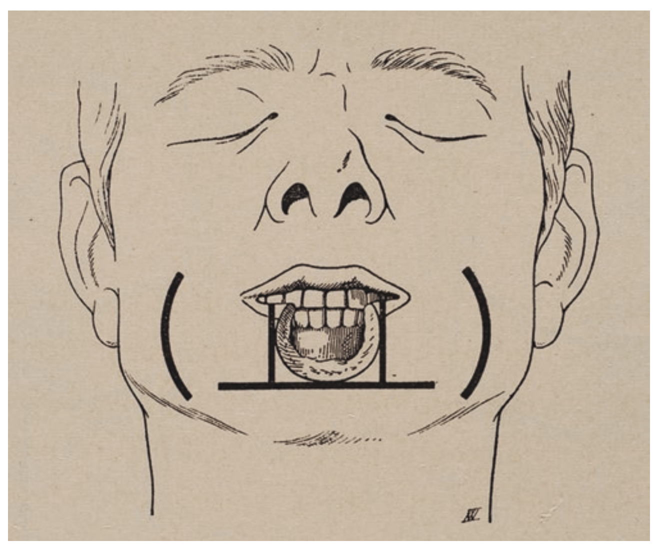


Fig. 1.16 Lower lip closure by double advancement flap. Interpretation of the Celsian method for closing a skin defect. (From: Nélaton C, Ombrédanne L. *Les Autoplasties*. Paris, Steinheil, 1907)

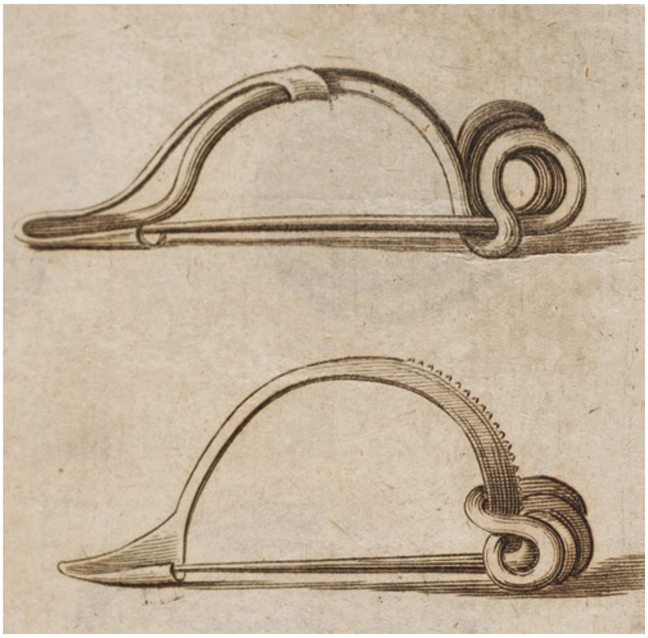


Fig. 1.17 A Roman *fibula* for maintaining the wound margins drawn together. (From: J. Rode. *De Acia Dissertatio* (An Essay on Threads). Padova, Paolo Frambotto, 1639)

1.7.2 Galen

Claudius Galenus (Galen) (*c.* AD 129–201) was born in Pergamon (coast of Asia Minor, now Turkey), studied medicine at the Asklepieion in Greece, and moved to Rome, where he remained for 24 years, becoming the court physician of Marcus Aurelius. He wrote about anatomy, head traumas, techniques of trephination for evacuating hematomas, and various types of bandaging (*De Fasciis*) [15] (Fig. 1.18). An excellent anatomist, he mainly based his anatomical knowledge on the dissection of animals such as pigs and apes, studying their bony and muscular structure. He described more than 300 muscles and the seven pairs of cranial nerves, demonstrating that nerves arise from the brain or spinal cord. He observed that section of the recurrent laryngeal nerve, now eponymously called Galen's nerve, resulted in dysphonia (Fig. 1.19). For management of wounds, he used sutures and cautery. He strongly believed that suppuration was an essential part of the healing process, an error which affected generations of surgeons for centuries, when eventually in the thirteenth century Hugh of Lucca (ca.1160–1257) recognized the effectiveness of the dry method for wound management (see Sect. 2.4.1.1). Numerous works of Galen were lost, but 82 survived. Originally written in Greek, many were translated into Arabic during the Arabic domination over the Mediterranean and Spain (seventh to tenth centuries) and retranslated from the Arabic into Latin.

Galen's *Opera* was first printed in Latin in Venice in 1490 and in Greek in Venice in 1525 by the Aldine Press.

Fig. 1.18 Bandage for nasal fracture. (From: C. Galenus. *De Fasciis*. In: G. Guidi. *Chirurgia è Graeco in Latinum Conversa* (Surgery, translated from Greek into Latin). Paris, Pierre Gaultier, 1544)

Fig. 1.19 Vivisection of a pig. Probably Galenus (to the right in the foreground) tries to demonstrate his famous “nerve of the voice.” (From: C. Galenus. *Opera. Prima-Septima classis*. Venezia, Giunta, 1586–1625)

1.8 Plastic Surgery After the Downfall of the Roman Empire: The Byzantine Period

Relaxation of morals, less respect for central authority, and reduced control over borders’ defenses by soldiers were regarded as the co-factors responsible for the downfall of the western Roman Empire that occurred in 476 AD. The barbarian populations coming from the north invaded the Roman provinces without any particular difficulty. Medicine, the prey of quacks, magicians, and charlatans, suffered a period of considerable decay.

The eastern Empire made a substantial effort to preserve culture and heritage from the past. Byzantium (Constantinople, now Istanbul), the capital of the Byzantine Empire, was a teaching center. In medicine, the Greek texts and the long-lasting medical tradition survived, thanks to the Byzantine doctors, also prominent physicians. Although Byzantine power spanned over a millennium, from the fourth to the fifteenth centuries, medicine and surgery were mainly concentrated in the hands of a few physicians, excellent compilers, and at the same time capable surgeons.

1.8.1 Oribasius

Oribasius was born in Pergamon about AD 325 and died about AD 403. He studied in Alexandria and was a friend and court physician of Julian the Apostate. An eminent encyclopedist, he wrote a vast medical anthology of 70 books, the

Synagogae Medicae, of which only a third survived. Oribasius quoted his predecessors, including Hippocrates and Galen, who might otherwise have been lost, with great accuracy, often verbatim. In this sense, the work is particularly relevant from a historical point of view. Chapters 25 and 26 in particular are of specific interest for plastic surgery, dealing with reconstruction following facial defects. He suggested creating a square defect around the original tissue loss. He then created a sort of "H," undermined the skin, and advanced the two lateral flaps toward the midline [16]—something overlapping what was described by Celsus, in *De Medicina* [14]. For nasal defects the reported procedure was very similar. Two works by Oribasius have often been published over the years in different editions with fine illustrations: *De laqueis* (on laces) and *De machinamentis* (on machines) [17]. This last work deals with the description of complicated apparatuses for the reduction of luxations (Fig. 1.20) or stabilization of mandibular fracture (Fig. 1.21).

Fig. 1.20 Reduction of dislocated shoulder. (From: Oribasius. *De Machinamentis* (On Machines). In: G. Guidi. *Chirurgia è Graeco in Latinum Conversa* (Surgery, translated from Greek into Latin). Paris, Pierre Gaultier, 1544)

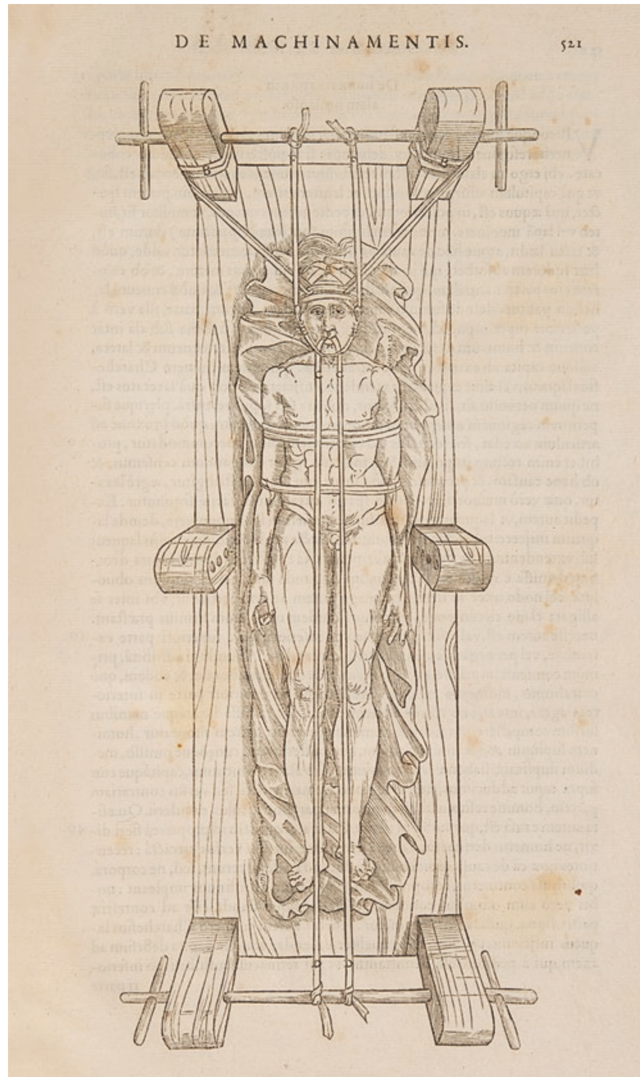


Fig. 1.21 Stabilization of a fracture of the jaw. (From: Oribasius. *De Machinamentis* (On Machines). In: G. Guidi. *Chirurgia è Graeco in Latinum Conversa* (Surgery, translated from Greek into Latin). Paris, Pierre Gaultier, 1544)

1.8.2 Aëtius

Aëtius of Amida was born in Amida (Mesopotamia, now Turkey) in the fifth century and is probably among the earliest recorded Greek Christian physicians. He was the court physician of Byzantium and royal physician to the Emperor Justinian I, from AD 527 to 565. He wrote an extensive compilation, *Tetrabyblos*, so named because the text was divided into four (τέτρα = *tetra* = four) books (βίβλως = *biblos* = books), where management of ankyloglossia by frenulum excision and tonsillotomy was described [18] (Fig. 1.22).

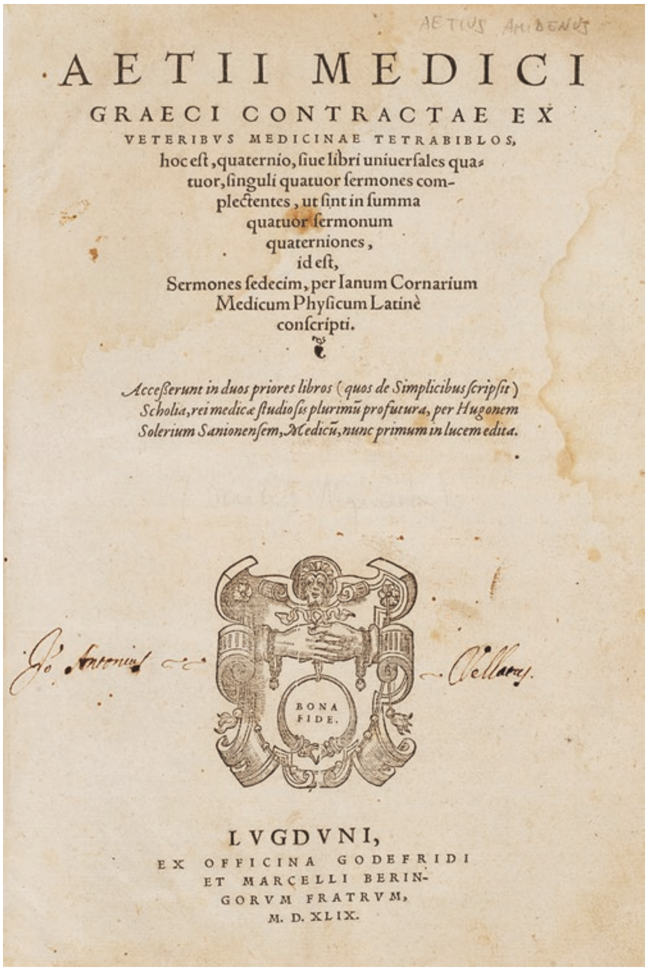


Fig. 1.22 Title page of *Contractae ex Veteribus Medicinae Tetrabiblos* (Four Books on Medicine, derived from earlier works) by Aëtius of Amida. Lyon, Godefroy and Marcellin Beringen, 1549

1.8.3 Paulus

Paulus of Aegina was born on the island of Aegina (Greece) about AD 625 and died about AD 690, but little is known of his life, other than that he studied and practiced medicine in Alexandria about AD 640. He is considered the last representative of Byzantine medicine, before the Muslim supremacy. He summarized the medical knowledge of his time in a seven-book encyclopedia entitled *Epitome*, or *De Materia Medica* (On Medicine) [19–21] (Fig. 1.23).

The sixth book is devoted to surgery [21], where he described tracheotomy, cranial trephination, tonsillotomy, ectropion, entropion, gynecomastia, upper eyelid retraction, and lip repair. Defects of the lips and ears (Greek: *colobomata*) were treated in the following way. First the skin was freed on the underside. Then the edges of the wound were brought together and the callosity removed. Finally, stitches for holding the margins in position were applied. This technique closely resembles that of Celsus. *Epitome* greatly influenced Muslim medicine and the Salernitan School.

In preparing his *Kitāb al-Manṣūrī* (Book to al-Manṣūr), the Persian master physician **al-Rāzī** (Rhazes) drew extensively from *Epitome*. The same applies to **Abu-al-Qasim** (Albucasis), one of the most renowned of Islam's surgeons. In writing his text, he borrowed largely from the *Epitome*'s sixth book on surgery.

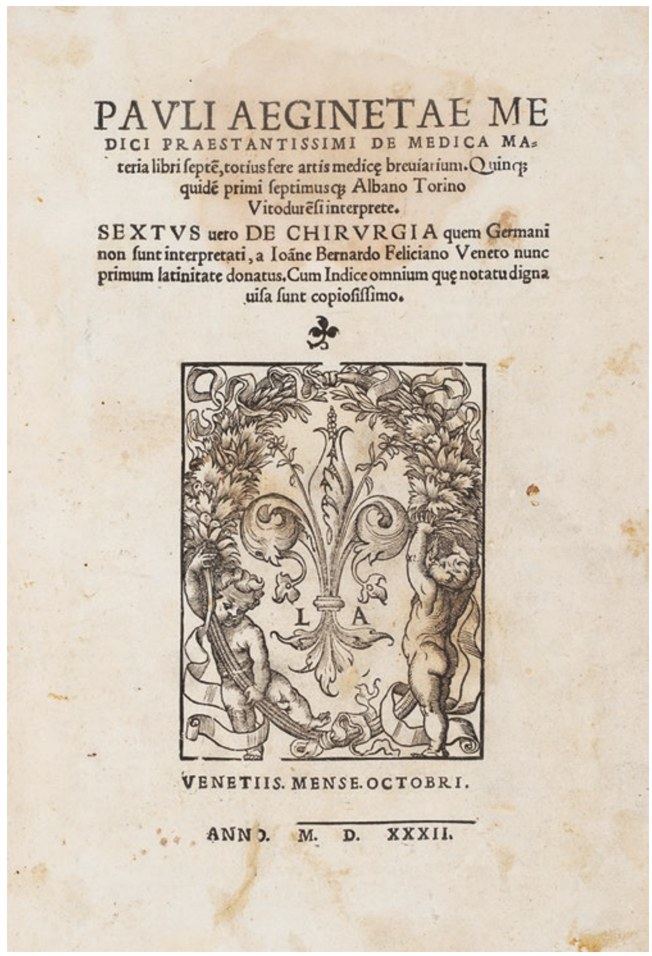


Fig. 1.23 Title page of *De Medica Materia, Libri Septem*. (On Medicine in Seven Books) by Paulus of Aegina. Venezia, Lucantonio Giunta, 1532

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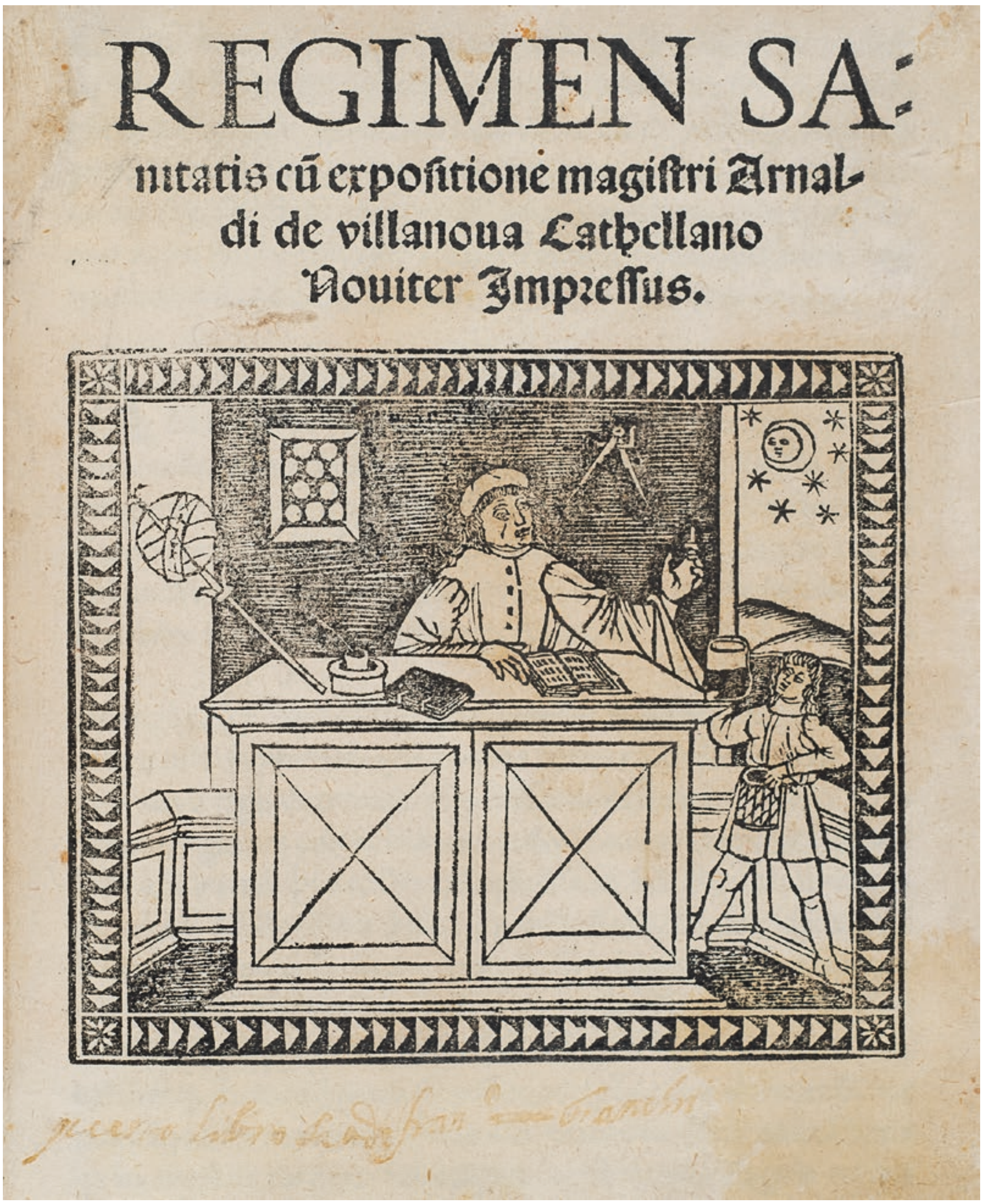
2 The Middle Ages



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The Middle Ages: Salient Events in Medicine, Surgery, and Plastic Surgery

- **The Middle Ages** is the period from the downfall of the Roman Empire until the discovery of America in 1492 and is also called the Dark Ages due to intellectual and cultural decadence.
- **Arabian Medicine** flourishes in the sixth century when Arabs achieve military and political control of the Mediterranean and surrounding countries—particularly Spain. Arabian medicine maintains some of the classic texts that might otherwise have been lost. Translated into Syriac, then into Arabic, and often retranslated into Latin, they contribute to the resurrection of European medicine. Arabs are bibliophiles and establish libraries in various cities.
- **Arabian Surgery** is best represented by **Abu-l-Qa-sim** (**Albucasis**) (ca. AD 936–1013), the most important Arabian surgeon of the period, practicing in Cordoba (Spain). He writes *Al Tasrif* (On Surgery), which remains the standard text on surgery for centuries. Surgical instruments are illustrated. Arabs favor cautery over the surgical knife.
- The **School of Salerno** is established around the ninth century, the first high school in the west for doctors, where it is possible to be instructed in Greek, Latin, Arabic, or Hebrew—a sort of modern university campus. It plays a key role in the development of medicine and surgery. Teaching is by lectures and direct observation of sick persons at the bedside. The most famous publication of the Salernitan School is *Regimen Sanitatis*, a textbook on hygiene, containing rules for daily life and well-being, written in about 1260 in double hexameter form. The School of Salerno begins to decline when Frederick II establishes the University of Naples in 1224.
- The **Founding of Universities** is the most important event for the development of modern culture and the greatest legacy that the Middle Ages have bequeathed to us. The oldest university, at least in Europe, is in Bologna, established in 1088.
- **Mondino de' Luzzi** (1270–1326) begins anatomical dissections in Bologna in about 1295.
- In France, important surgeons of the period are **Lanfranchi** (or Lanfranco) of Milan (?–1315), **Henri de Mondeville** (ca. 1260–1320), and **Guy de Chauliac** (ca. 1298–1368) whose *Cyrurgia* (Great Surgery), published in 1478, is one of the most influential texts from the fourteenth to the sixteenth centuries and remains the standard surgical text in all the universities of western Europe for two centuries.
- In Italy, **Petrus de Argellata** (?–1423) writes *Chirurgia* in about the second decade of the fifteenth century. It is first published in 1480 in Venice.
- In Germany, **Heinrich von Pfolfprundt** (ca. 1415–1465) writes *Buch der Bündth-Ertznei* in 1460, an extremely important document in the history of nasal reconstruction, but it is not published until 1868. **Hyeronimus Brunschwig** (ca. 1450–1512) and **Hans von Gersdorff** (ca. 1455–1529), both from Strasbourg, write fully illustrated textbooks on surgery.
- In 1436, **Johannes Gutenberg** (ca. 1398–1468), a goldsmith from Mainz (Germany), invents movable type. The first book, the *Bible*, is printed in 1455. From Germany, where it begins, printing spreads rapidly and develops in Venice in particular. The invention favors the rise of a humanistic culture, the spread of education, and the development of science.

The true beginning of the Middle Ages is in dispute [1]. Some historians choose the year AD 395 when the Roman Empire was divided into two parts, the East and the West. Others place it in AD 476 with the downfall of the western Roman Empire and the barbarian invasions. Still others cite the year AD 800 when Charlemagne was crowned Roman Emperor.

When did the Middle Ages end? Historians are also divided. Some consider the discovery of America, 1492, a moment of great impact for world civilization, but with little influence on medicine and the arts. Others refer to the invention of printing, about 1435, or the fall of Constantinople, 1453, the end of the Byzantine Empire, gradually replaced by the *Quattrocento*, with the blossoming of fine arts, and the *Cinquecento*, better known as the Renaissance.

The Middle Ages were also called the Dark Ages due to intellectual and cultural decadence. However, it is not correct to blame that period globally. On the contrary, the Middle Ages had a tremendous impact upon the progress of European civilization with the founding of universities, the discovery of printing, and the evolution of medicine and surgery, as we shall see.

2.1 Arabian Surgery

With the downfall of the Roman Empire, Arabs achieved military and political control of the Mediterranean and surrounding countries—expanding particularly into Spain. They could have achieved hegemony over the whole of Europe by invading Gaul (France) if Charles Martel had not defeated the Islamic troops, led by Abdul Rahman al Ghafigi, Governor of al-Andalus, at the Battle of Tours, also known as the Battle of Poitier, in western France. That battle changed the course of human history completely in AD 732. Historians agree that the Battle of Tours was unquestionably decisive: *there was no more important battle in the history of the world.*

In medicine, Muslim supremacy was without rival. The period was named *Arabic*, considering the Arabic language in which works were written, the common denominator, despite the fact that most of the medical writers were of different nationalities: Persian, Syrian, Jews of Spain, and those from other parts of the Islamic empire. The world should be greatly indebted to Arabian medicine, as it maintained some of the classic texts that might otherwise have been lost, contributing to the resurrection of European medicine. Greek and Latin manuscripts were translated into Syriac and then into Arabic and often retranslated into Latin, maybe in an altered state, but preserved nonetheless (see Sect. 8.2.6). By tradition, Arabs were bibliophiles and established libraries in various cities.

2.1.1 Albucasis

Of the numerous medical books written in Arabic, by a wide variety of master physicians, including Rhazes, Mesue the Elder, Mesue the Younger, Avicenna, Avenzoar, Averroes, Serapion, and others, only one deals with surgery, *Al Tasrif* (On Surgery), by **Abu-l-Qa-sim**, (**Albucasis**) (936–1013), witness of a period of stagnation for surgery [2]. Albucasis was born near Cordoba in southern Spain and practiced in Cordoba.

Let's see what Albucasis writes in the introduction to his book: *Surgery is no longer in honor in our country. In its actual decline it has disappeared, almost completely, without leaving any trace. There remain some vestiges in the writings of the Ancients, but the transcriptions have changed them, error and confusion have overrun them, in a manner to render them unintelligible and useless.* (…) *The reason one does not find skillful surgeons today is this: medicine requires time. Those wishing to practice it, should first study anatomy, as Galen has written.* (…) *Hippocrates said 'There are many physicians in name, but few particularly in the field of surgery.' If one disregards the knowledge of anatomy of which we have spoken, he necessarily falls into error and kills the patients* (…).

Al Tasrif was translated into Latin by Gerard of Cremona and first published in 1500. It remained the standard text on surgery for centuries. It included more than 200 illustrations of surgical instruments, such as a tongue depressor, a tooth extractor, hooks, and cauteries, most invented by Albucasis himself, with an explanation of their use (Fig. 2.1). He was the first to use a syringe with a piston for injecting liquids into the bladder [3] (Fig. 2.2). Like most Arabian surgeons, Albucasis was a proponent of cautery for different clinical applications, management of wounds, and also treatment of cleft lip. *Al Tasrif*, largely inspired by Paulus of Aegina, deals with fractures, dislocations, lithotomy, ophthalmology, and dental surgery.

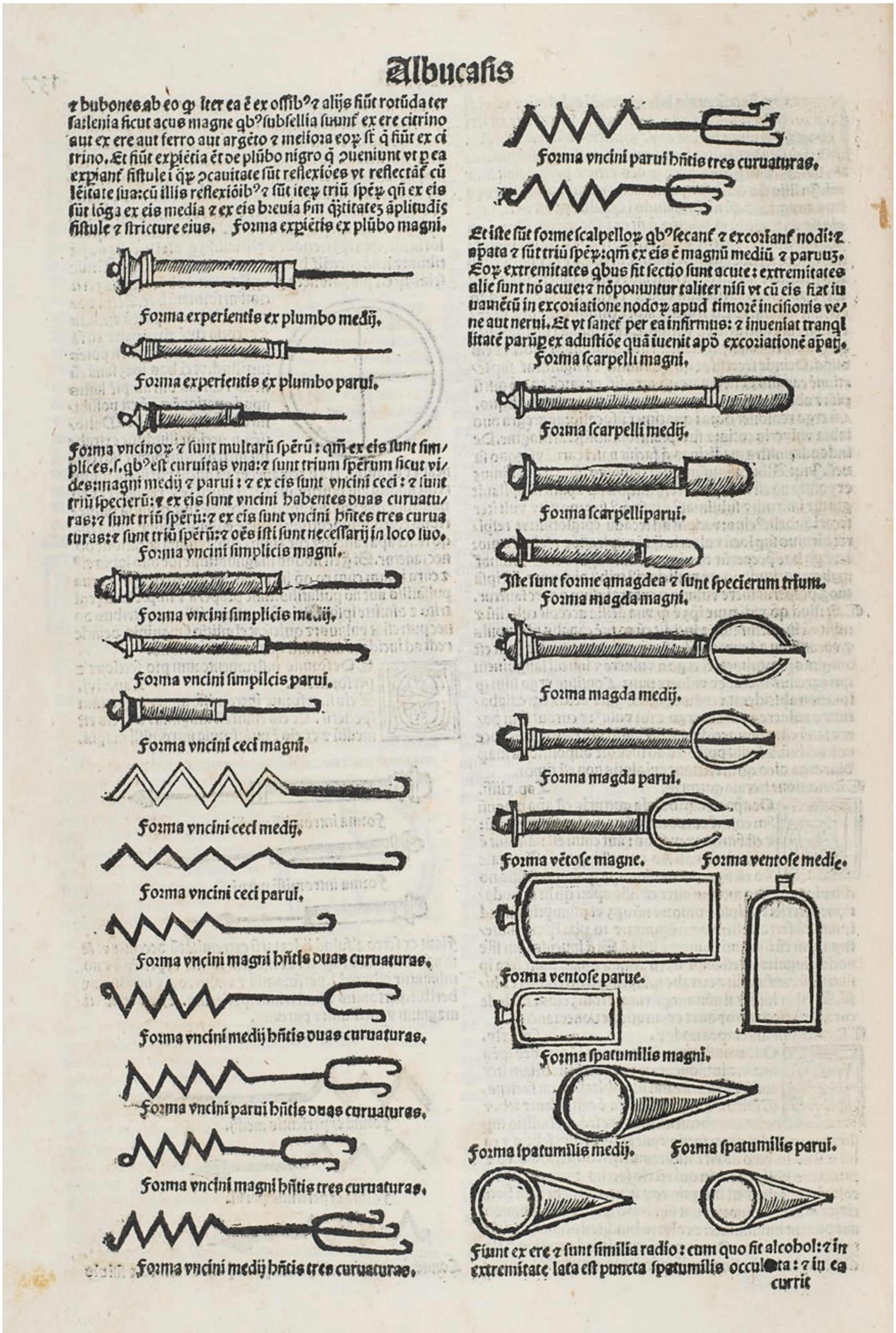


Fig. 2.1 Albucasis' surgical instruments. (From: *Cirurgia Argelatae cum Albucasi*. Venezia, Lucantonio Giunta, 1531)

Fig. 2.2 Syringe with a piston for injecting liquids in the bladder. Albucasis is regarded as the inventor of the syringe. (From: *Cirurgia Argelatae cum Albucasi.* Venezia, Lucantonio Giunta, 1531)

2.2 The School of Salerno

Located on the beautiful Gulf of Paestum (southern Italy), close to Naples, the medical school of Salerno was established around the ninth century probably by the monks of the neighboring Benedictine Abbey of Monte Cassino. It was a multilingual medical training center, a sort of *civitas hippocratica* (City of Hippocrates), a modern university campus, the first high school in the west for doctors, where it was possible to be instructed in Greek, Latin, Arab, or Hebrew. It played a key role in the development of medicine. Teaching was by lectures and by direct observation of sick persons at the bedside. The school received a great thrust when the Normans established themselves in Sicily and southern Italy about 1075. Roger II of Sicily (1095–1154) and Frederick II, King of Sicily and Holy Roman Emperor (1194–1250), issued decrees that obliged students to a preliminary 3 years of work in humanities prior to entering the school and 5 years of specialization, with a final examination, before graduation [4]. One of the most outstanding personalities as a teacher in the field of medicine was **Constantinus Africanus** (1020–1087). However, the school also employed instructors in anatomy and surgery.

2.2.1 Trotula

Apparently, the School of Salerno was the only medical training center in Europe that opened its doors to women. It seems that an independent team of women physicians, teachers, and medical scholars played a role in surgical and scientific achievements [5]. The most famous female physician was named **Trotula de Ruggiero** (possibly Trotta, Trocta, and Dame Trot). Debates about Trotula's existence and if she was a Magistra of Medicine at the School of Salerno still exist [1, 6, 7] (see Sect. 7.1.3.1).

2.2.2 Roger

Roger of Salerno, also known as Roger of Parma and Ruggero Frugardi (1140–1195), wrote *Practica Chirurgiae* (Practice of Surgery) about 1170, apparently the first tract on surgery in the western world. It became the standard text of the Salernitan school, in which he described the techniques of suturing or ligating vessels in hemorrhage, management of hernia, and skull trephination. Roger was a strong supporter of maintaining clean wounds that he dressed with lint and egg albumen, whereas for extensive wounds, he used silk sutures.

2.2.3 Roland

Roland of Parma, also known as Rolando Capelluti (ca. 1198–1280), one of Roger's most distinguished students, wrote a commentary, with additions, on *Practica Chirurgiae*, known as *Rolandina*. He practiced in Bologna.

2.2.4 *Regimen Sanitatis*

The most famous publication of the Salernitan School was *Regimen Sanitatis* (Health Regimen), a very successful textbook on hygiene, containing 362 rules for daily life and well-being, written about 1260 in double hexameter form (Fig. 2.3).

The School of Salerno began its decline when Frederick II founded the University of Naples in 1224.

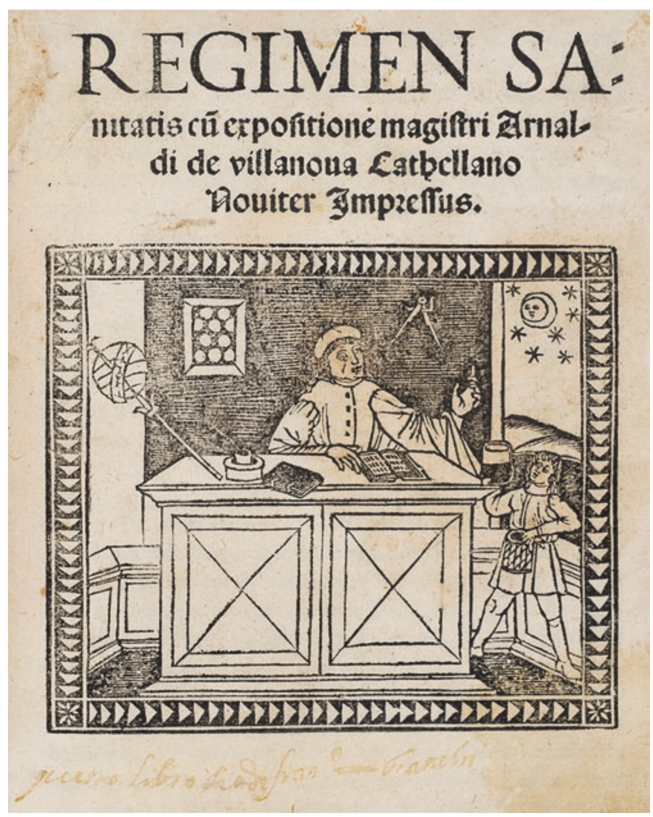


Fig. 2.3 *Regimen Sanitatis.* The woodcut illustration represents Arnaldus de Villanova, physician and alchemist, in the chair examining a urine flask and consulting stars in search of a correct diagnosis. A compass is hanging on the wall, and an astrolabe, ink container, and medical books lie on his desk. (From: *Regimen Sanitatis cum Expositione Magistri Arnaldi de Villanova*. Venezia, Bernardino de' Vitali, 1500)

2.3 The Founding of Universities

The founding of universities was without any doubt one of the most important factors, if not the most important, for the development of modern culture [1]. It was the greatest legacy that the Middle Ages have bequeathed to us. Originally, the term *Universitas* (University) denoted an aggregation of persons or students, who attended a place, *Studium Generale*, where law, theology, and philosophy were taught. The term was restricted to *Studium* when only medical studies were carried out [1]. In the beginning, there were neither schools nor classrooms, but only scholars and masters (*Magister*). Teaching did not occur in a public place, but in the home of the *Magister*. Students sat upon straw on the floor, whereas masters sat in a chair or stood behind a podium to dominate the audience (Fig. 2.4). The oldest university, at least in Europe, was in Bologna, established in 1088, followed by Paris (1200), Oxford (1206), Naples (1224), Padua (1228), Cambridge (1229), and Montpellier (1289).

In Bologna, where medicine was officially taught from 1295, cadaveric dissection was allowed, significantly contributing to the development of anatomy [8]. **Mondino de' Luzzi** (1270–1326) was the first anatomist to lecture directly in front of the cadaver, often in outdoor space to avoid unpleasant smells (Fig. 2.5). Mondino's *Anothomia* was one of the first anatomical textbooks (1316), reissued numerous times (see Sect. 8.3.1).

Fig. 2.4 A lecture in the fifteenth century. The master is behind the podium. The students sit on the ground listening to his explanations. (From: *Autoritates Aristotilis et aliorum philosophorum*. Köln, H. Quentel, 1498)

Fig. 2.5 Mondino de' Luzzi (also known as Mundinus) (1270–1326), supervising an open-air cadaveric dissection. Mondino in the chair, wearing a long robe and a hat. He holds an open book in his left hand, while with his right hand, he indicates how to section the corpse. (From: *Anathomia Mundini Emendata per Doctorem Mellerstadt*. Leipzig, Martin Landsberg, 1493)

2.4 Surgery in the Middle Ages

Surgery in the Middle Ages was mainly devoted to solving problems related to the management of injuries, hernias, fractures, dislocations, tumors, swellings, amputations, and vessel ligation for controlling hemorrhage. In general, wounds were approximated by bandaging, rarely by sutures. However, use of needles and sutures for certain wounds of the face, lips, ears, and nose was recommended. Under the influence of the Arabs, cautery was largely employed whereas the knife as little as possible. As we have seen, surgery passed a period of stagnation. It was not until **Guglielmo da Saliceto** (about the end of the thirteenth century) resurrected the use of the knife in western surgery [1].

2.4.1 The Twelfth and Thirteenth Centuries: The Founding of the Studium of Bologna

The fame of the Salernitan School spread rapidly to the north of Italy. Bologna with its great *Studium* just established assumed a primary position with respect to Salerno.

2.4.1.1 Hugh of Lucca and Theodoric Borgognoni

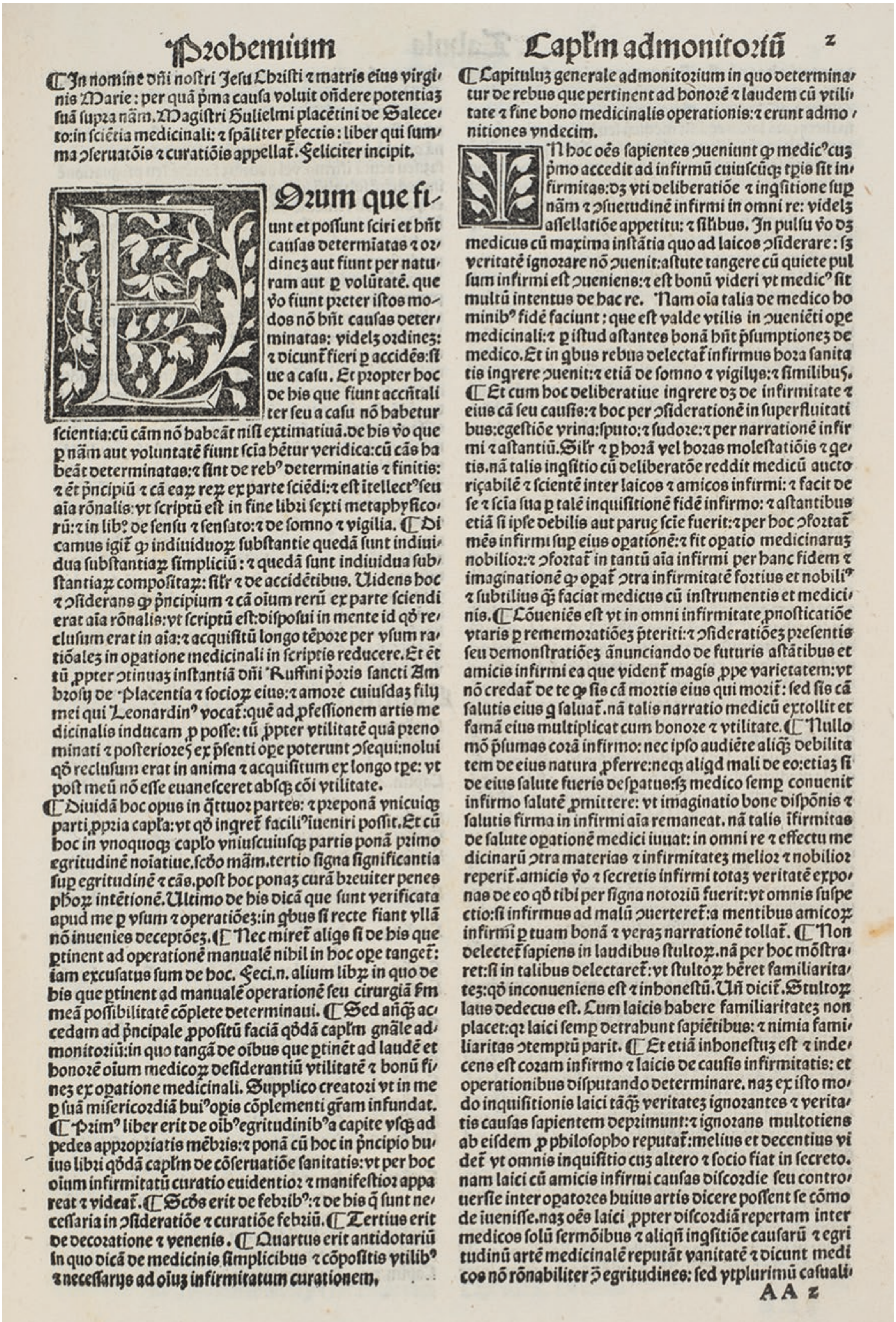
Hugh of Lucca (ca. 1160–1257), considered the founder of the *Studium* of Bologna, and his student **Theodoric Borgognoni** (ca. 1205–1296), a Dominican friar and Bishop of Cervia, practiced surgery in Bologna [6–8]. He was a proponent of the dry wound, in contrast to the general trend in vogue in that period that suppuration was necessary to achieve the healing of wounds. *Pus sanum et laudabilis* (laudable and healthy pus) it was currently said, and if suppuration failed to occur spontaneously, it was promoted—a great error that characterized generations of surgeons over the years. **Hugh**, **Theodoric**, and **Henri de Mondeville** were against this practice. Theodoric wrote in his *Chirurgia* that suppuration was not necessary. Hugh and Theodoric used the *soporific sponge*, a cloth soaked in a mixture of several narcotic drugs, among them mandragora and opium, and applied it to the patient's nose to induce sleep.

2.4.1.2 Guglielmo da Saliceto

In Italy, the most relevant figure of the thirteenth century was the cleric **Guglielmo da Saliceto** (ca. 1210–1277), a native of Saliceto in the surroundings of Piacenza (northern Italy). He studied medicine at Bologna about 1230 under **Hugh of Lucca**, obtaining the degree of *Magister in Physica* (Master in Physics), which allowed him permission to practice medicine. He was a cleric and worked in different cities, Piacenza, Cremona, and Milan, with great success. Back in Bologna in 1269, he was appointed Professor at that University until 1275. For political reasons, Guglielmo had to migrate to Verona, where he completed his major work *Chirugia* in 1275. He died at Piacenza about the end of 1276 or beginning of 1277. He is the author of *Summa conservationis et curationis* (On treatment and prevention of diseases) and *Chirurgia* [6, 8] (Fig. 2.6).

Chirurgia is divided into six books. It opens with the definition of surgery, *the science which treats soft tissues, nerves, and bones using the hand*. *Book One* deals with the different diseases best managed by surgery. Chapter 19 describes correction of cleft lip and nose, for which Guglielmo suggests the use of cautery. *Book Two* analyzes various types of wounds and injuries of the human body. Chapter 3 explains how to manage nasal injuries. The author advocates their suture, whenever possible, to achieve better healing. *Book Three* is on fractures and luxations. Chapter 1 is devoted to nasal fractures. Their reduction is managed by inserting a finger within the nostril to readjust the dislocated nasal bones to their original position. If the fracture is associated with an injury of the overlying skin, this should be sutured. *Book Four* is on anatomy and is particularly relevant in the history of medicine because it is considered the first work on topographical anatomy, based on Guglielmo's own dissections and on personal considerations. Special attention is given to the venesection sites. *Book Five* discusses cautery, whereas *Book Six* concentrates on drugs.

Chirurgia, considered one of the masterpieces of thirteenth-century medical literature, was very popular. First issued in Venice in 1474 in Italian and 2 years later in Latin, it was then translated into English, French, and Hebrew. It was probably the first textbook on surgery ever printed [9]. With this work, Guglielmo reintroduced use of the knife, up until this time often in favor of cautery, typical of the Arabic tradition.



Prohemium

¶ In nomine dñi nostri Jesu Christi ⁊ matris eius virginis Marie: per quã p̃ma causa voluit oñdere potentiã suã supra nãm. Magistri Gulielmi placẽtini de Saliceto: in sciẽtia medicinali: ⁊ spãliter pfectis: liber qui summa ɔseruatõis ⁊ curatiõis appellat. Feliciter incipit.

Orum que fiunt et possunt sciri et hñt causas determiatas ⁊ ordinez aut fiunt per naturam aut p volũtatẽ. que vo fiunt preter istos modos nõ hñt causas determinatas: videlz ordinez: ⁊ dicunt fieri p accidẽs: siue a casu. Et propter hoc de his que fiunt accñtaliter seu a casu nõ habetur scientia: cũ cãm nõ habeãt nisi extimatiuã. de his vo que p nãm aut voluntatẽ fiunt scia hẽtur veridica: cũ cãs habeãt determinatas: ⁊ sint de reb⁹ determinatis ⁊ finitis: ⁊ ẽt p̃ncipiũ ⁊ cã eaꝝ reꝝ ex parte sciẽdi: ⁊ est itellect⁹ seu aĩa rõnalis: vt scriptũ est in fine libri sexti metaphysicorũ: ⁊ in lib⁹ de sensu ⁊ sensato: ⁊ de somno ⁊ vigilia. ¶ Dicamus igit ꝙ indiuiduoꝝ substantie quedã sunt indiuidua substantiaꝝ simpliciũ: ⁊ quedã sunt indiuidua substantiaꝝ compositaꝝ: silr ⁊ de accidẽtibus. Uidens hoc ⁊ ɔsiderans ꝙ p̃ncipium ⁊ cã oium rerũ ex parte sciendi erat aĩa rõnalis: vt scriptũ est: disposui in mente id qd reclusum erat in aĩa: ⁊ acquisitũ longo tẽpore per vsum rationales in opatione medicinali in scriptis reducere. Et ẽt tũ ꝑpter ɔtinuaz instantiã dñi Ruffini põris sancti Ambrosij de Placentia ⁊ socioꝝ eius: ⁊ amore cuiusdaz filij mei qui Leonardin⁹ vocat: quẽ ad ꝓfessionem artis medicinalis inducam ꝓ posse: tũ ꝑpter vtilitatẽ quã prenominati ⁊ posteriores ex p̃senti ope poterunt ɔsequi: nolui qd reclusum erat in anima ⁊ acquisitum ex longo tpe: vt post meũ nõ esse euanesceret absq̃ cõi vtilitate.

¶ Diuidã hoc opus in q̃ttuor partes: ⁊ preponã vnicuiq̃ parti ꝓpria capl'a: vt qd ingret facili⁹ iueniri possit. Et cũ hoc in vnoquoq̃ caplo vniuscuiusq̃ partis ponã primo egritudinẽ noiatiue. scdo nãm. tertio signa significantia sup egritudinẽ ⁊ cãs. post hoc ponaz curã breuiter penes phoꝝ intẽtionẽ. Ultimo de his dicã que sunt verificata apud me p vsum ⁊ operatiões: in qbus si recte fiant vllã nõ inuenies deceptões. ¶ Nec miret aliqs si de his que ptinent ad operationẽ manualẽ nihil in hoc ope tanget: iam excusatus sum de hoc. Feci. n. alium libꝝ in quo de his que ptinent ad manualẽ operationẽ seu cirurgiã fm meã possibilitatẽ cõplete determinaui. ¶ Sed añq̃ accedam ad p̃ncipale ꝓpositũ faciã qdã caplm gnãle admonitoriũ: in quo tangã de oibus que ptinẽt ad laudẽ et honorẽ oium medicoꝝ desiderantiũ vtilitatẽ ⁊ honũ fines ex opatione medicinali. Supplico creatori vt in me p suã misericordiã hui⁹ opis cõplementi grãm infundat. ¶ Prim⁹ liber erit de oib⁹ egritudinib⁹ a capite vsq̃ ad pedes appropriatis mẽbris: ⁊ ponã cũ hoc in p̃ncipio huius libri qdã caplm de cõseruatiõe sanitatis: vt per hoc oium infirmitatũ curatio euidentior ⁊ manifestior appareat ⁊ videat. ¶ Scds erit de febrib⁹: ⁊ de his q̃ sunt necessaria in ɔsideratiõe ⁊ curatiõe febriũ. ¶ Tertius erit de decoratione ⁊ venenis. ¶ Quartus erit antidotariũ in quo dicã de medicinis simplicibus ⁊ cõpositis vtilib⁹ ⁊ necessarijs ad oiuz infirmitatum curationem.

Capl'm admonitoriũ 2

¶ Capitulũ generale admonitoriũ in quo determinatur de rebus que pertinent ad honorẽ ⁊ laudem cũ vtilitate ⁊ fine bono medicinalis operationis: ⁊ erunt admonitiones vndecim.

In hoc oẽs sapientes ɔueniunt ꝙ medic⁹ cuz p̃mo accedit ad infirmũ cuiuscũq̃ tpis sit infirmitas: dz vti deliberatiõe ⁊ inqsitione sup nãm ⁊ ɔsuetudinẽ infirmi in omni re: videlz assellatiõe appetitu: ⁊ filibus. In pulsu vo dz medicus cũ maxima instãtia quo ad laicos ɔsiderare: sz veritatẽ ignorare nõ ɔuenit: astute tangere cũ quiete pulsum infirmi est ɔueniens: ⁊ est bonũ videri vt medic⁹ sit multũ intentus de hac re. Nam oia talia de medico hominib⁹ fidẽ faciunt: que est valde vtilis in ɔueniẽti ope medicinali: ⁊ p istud astantes bonã hñt p̃sumptiones de medico. Et in qbus rebus delectat infirmus hora sanitatis ingrere ɔuenit: ⁊ etiã de somno ⁊ vigilijs: ⁊ similibus. ¶ Et cum hoc deliberatiue ingrere dz de infirmitate ⁊ eius cã seu causis: ⁊ hoc per ɔsiderationẽ in superfluitatibus: egestiõe vrina: sputo: ⁊ sudore: ⁊ per narrationẽ infirmi ⁊ astantiũ. Silr ⁊ p horã vel horas molestatiõis ⁊ gentis. nã talis inqsitio cũ deliberatõe reddit medicũ auctoriçabilẽ ⁊ scientẽ inter laicos ⁊ amicos infirmi: ⁊ facit de se ⁊ scia sua p talẽ inquisitionẽ fidẽ infirmo: ⁊ astantibus etiã si ipse debilis aut paruꝫ scie fuerit: ⁊ per hoc ɔfortat mẽs infirmi sup eius opatiõnẽ: ⁊ fit opatio medicinaruz nobilior: ⁊ ɔfortat in tantũ aĩa infirmi per hanc fidem ⁊ imaginationẽ ꝙ opat ɔtra infirmitatẽ fortius et nobili⁹ ⁊ subtilius q̃ faciat medicus cũ instrumentis et medicinis. ¶ Cõueniẽs est vt in omni infirmitate ꝓnosticatiõe vtaris p rememoratiões p̃teriti: ⁊ ɔsideratiões presentis seu demonstratiões ãnunciando de futuris astãtibus et amicis infirmi ea que videnẽ magis ꝓpe varietatem: vt nõ credat de te ꝙ sis cã mortis eius qui morit: sed sis cã salutis eius q saluat. nã talis narratio medicũ extollit et famã eius multiplicat cum honore ⁊ vtilitate. ¶ Nullo mõ p̃sumas corã infirmo: nec ipso audiẽte aliq̃ debilitatem de eius natura ꝓferre: neq̃ aliqd mali de eo: etiaz si de eius salute fueris desperatus: sz medico semp conuenit infirmo salutẽ ꝓmittere: vt imaginatio bone dispõnis ⁊ salutis firma in infirmi aĩa remaneat. nã talis ifirmitas de salute opationẽ medici iuuat: in omni re ⁊ effectu medicinarũ ɔtra materias ⁊ infirmitatez melior ⁊ nobilior reperit. amicis vo ⁊ secretis infirmi totaz veritatẽ exponas de eo qd tibi per signa notoriũ fuerit: vt omnis suspectio: si infirmus ad malũ ɔuerteret: a mentibus amicoꝝ infirmi p tuam bonã ⁊ veraz narrationẽ tollat. ¶ Non delectet sapiens in laudibus stultoꝝ. nã per hoc mõstraret: si in talibus delectaret: vt stultoꝝ hẽret familiaritatez: qd inconueniens est ⁊ inhonestũ. Uñ dicit. Stultoꝝ laus dedecus est. Cum laicis habere familiaritatez non placet: qz laici semp detrahunt sapiẽtibus: ⁊ nimia familiaritas ɔtemptũ parit. ¶ Et etiã inhonestuz est ⁊ indecens est coram infirmo ⁊ laicis de causis infirmitatis: et operationibus disputando determinare. naz ex isto modo inquisitionis laici tãq̃ veritatez ignorantes ⁊ veritatis causas sapientem deprimunt: ⁊ ignorans multotiens ab eisdem ꝓ philosopho reputat: melius et decentius videt vt omnis inquisitio cuz altero ⁊ socio fiat in secreto. nam laici cũ amicis infirmi causas discordie seu controuersie inter opatores huius artis dicere possent se cõmode iuenisse. naz oẽs laici ꝑpter discordiã repertam inter medicos solũ sermõibus ⁊ aliqñ inqsitiõe causarũ ⁊ egritudinũ artẽ medicinalẽ reputãt vanitatẽ ⁊ dicunt medicos nõ rõnabiliter ɔ egritudines: sed vtplurimũ casuali

AA 2

Fig. 2.6 Guglielmus from Saliceto. First page of his *Sũma Conservationis et Curationis.* Venezia, Ottaviano Scoto per Boneto Locatelli, 1502

2.4.1.3 Lanfranco

Lanfranchi (or Lanfranco) of Milan (?–1315) (Fig. 2.7) was a student of Guglielmo da Saliceto in the *Studium* of Bologna and practiced surgery in Milan. However, due to conflicts between the Guelphs and the Ghibellins, he had to leave his native Milan with his family and settled first in Lyon (France), where he resumed his practice and wrote *Cyrurgia Parva* (Little Surgery). In 1295, he moved to Paris; however, as a married man, he was not accepted by the strictly celibate clerical faculty. On the recommendation of **Jean Pitard** (ca. 1248–1327), surgeon to the Kings of France, Louis the Saint (1214–1270) and Philip the Fair (1268–1314), and founder of the brotherhood of St. Côme and St. Damien in 1260, Lanfranco became affiliated with that guild of surgery and lectured there. Among his disciples were **Henri de Mondeville** and **Jean Yperman**. In 1296, he completed his *Cyrurgia Magna* (Great Surgery) in five books dealing with anatomy; wounds; swelling; diseases of the nose, eyes, ears, and breast; hernias; luxations; and fractures. He dedicated it to the King of France, Philip the Fair [2, 6–8, 10]. He devoted great attention to suture techniques and described surgical knots and the four stitches or U-suture. Facial wounds had to be treated with particular care, because *it is a place that is much seen*, obtaining an almost unnoticeable scar. Therefore, he was a supporter of margin approximation by an adhesive plaster for achieving healing by primary intention—as he named this procedure. Regarding nasal injuries, he wrote: *many people lie about nasal wounds, for they say that someone brought along in his hand his nose, which had been cut off, and it was replaced. This is the greatest fake story. In injuries of the nose, whether transverse or longitudinal, if the nose is still hanging, adjust it and retain it in position by splints of wax* (*Book Two*, Chap. 2). His motto was: *Do all you can for the poor, and get all you can from the rich*. A printed edition of *Cyrurgia Parva* and *Cyrurgia Magna* was included in the *Collection Chirurgica* (Surgical Collection), an anthology of surgical works first issued in Venice in 1497 and reprinted in 1498 and 1513 [11]. He died in Paris about 1315.

Fig. 2.7 Supposed portrait of Lanfrancus from Milano included in a woodcut initial of *Cyrurgia Practica*. (From: Lanfrancus of Milano. *Cyrurgia Practica*. In: *Cyrurgia Guidonis de Cauliaco*. Venezia, Gregorio de' Gregorii, 1513)

2.4.1.4 Henri de Mondeville

A disciple of Lanfranchi, **Henri de Mondeville** (ca. 1260–1320), like the preceding Italian surgeons, was a cleric (Fig. 2.8). He was born in Normandy and studied medicine at the University of Montpellier and surgery in Bologna with Theodoric, from whom he learned the notion that wounds should be closed primarily to prevent the air from producing pus. Wounds were always cleansed of all foreign matter. *When your dressing had been carefully applied, do not interfere with it for some days; keep the air out, for a wound left in contact with air suppurates* (…) *Do not pull your dressing about (too often). Nature works better left alone.* He was one of the surgeons to the King Philip the Fair (1268–1314) and his successor Louis X (1289–1316) [7, 10].

His *Chirurgie* (Surgery), written between 1306 and 1320, was the first book on surgery by a Frenchman and gives an overview of the status of surgery and medicine in the fourteenth century. The work was never completed, due to Henri's poor health conditions. He died probably from chronic asthma and tuberculosis. *Chirurgie* includes five books on anatomy, wounds, surgical diseases, and remedies. The book on anatomy begins with the following well-known phrase, still very modern: *Every artisan has to know the material with which he works, otherwise he makes mistakes while operating. The surgeon is the artisan of health for the human body; thus, he must know the nature and composition of the body, hence its anatomy*. Regrettably, it remained in manuscript form until the late nineteenth century when it was rediscovered by the German, **Julius L. Pagel**, and published in 1892 [12]. The following year it was translated into French by **Édouard Nicaise** [13].

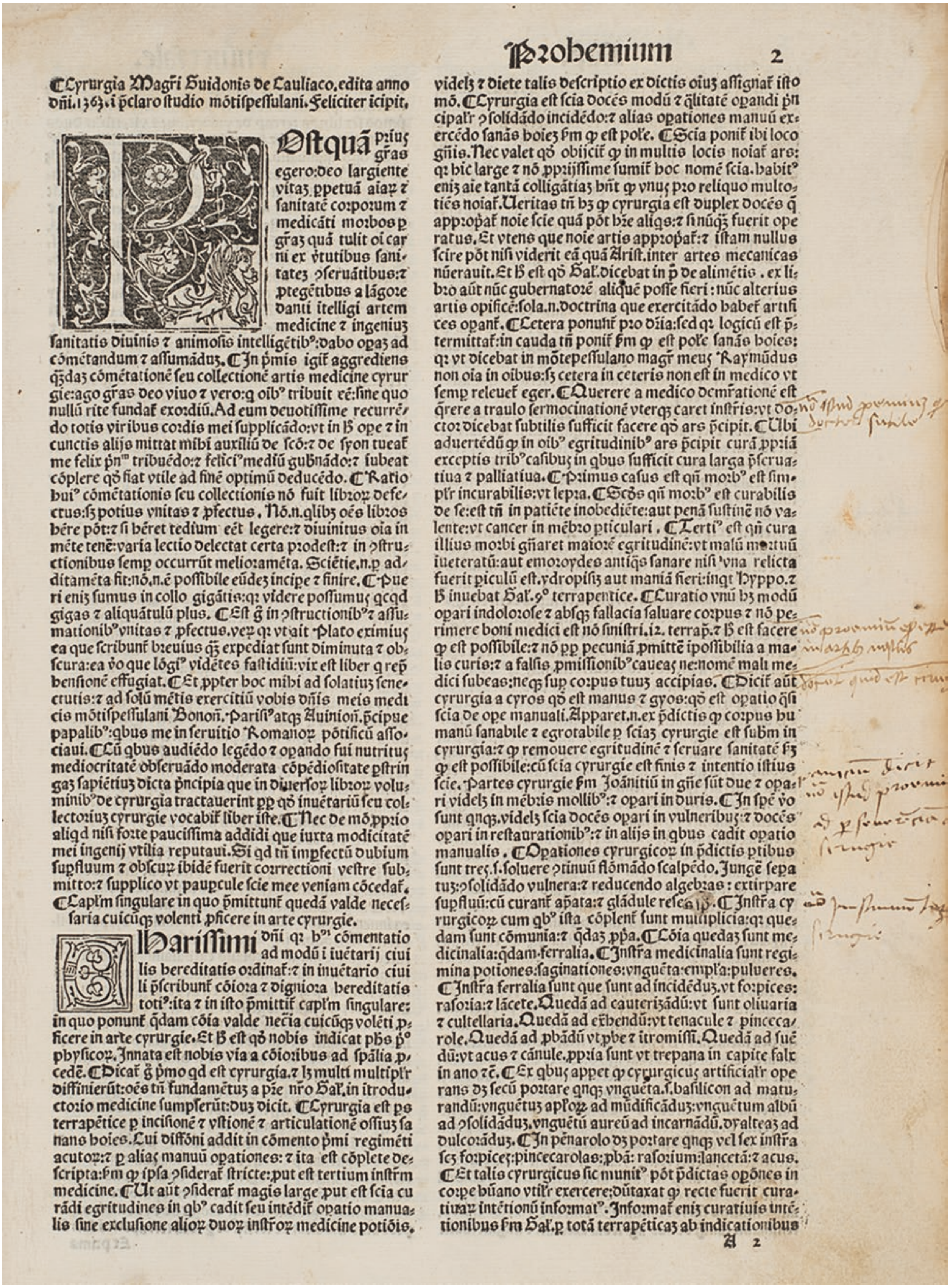
Fig. 2.8 Portrait of Henri de Mondeville. (From: Henri de Mondeville. *Chirurgie*, edited by É. Nicaise. Paris, Félix Alcan, 1893)

2.4.1.5 Guy de Chauliac

Guy de Chauliac (ca. 1298–1368), the second great French surgeon of the Middle Ages, was born in Chauliac, a village in the French department of Lozère. He studied medicine in Toulouse and then in Montpellier and went to the *Studium* of Bologna to learn anatomy under Mondino de' Luzzi and Nicolò Bertruccio. With this anatomical basis, he moved to Paris, where he remained from 1315 to 1325, completing his surgical studies and teaching and lecturing there (Fig. 2.4). Taking holy orders, he became a Canon of St. Just Cathedral in Lyon in 1344 and practiced medicine and surgery in that city. In 1353, he was elected Canon at Reims, and finally, he established himself at the Court in Avignon during the period of the plague, becoming physician to three popes, Clement VI (1342–1352), Innocent VI (1352–1362), and Urban V (1362–1370). He was affected by the plague, but he recovered. He died in Lyon in 1368 [1, 7, 10, 14].

Cyrurgia (Great Surgery) by Guy was one of the most influential works from the fourteenth to the sixteenth centuries and remained the standard text for surgery in all the universities of western Europe for two centuries, the so-called Guidon, until it was superseded by the publications of **Jean de Vigo** (1460–1525) and **Ambroise Paré** (1510–1590). The work is divided into seven parts. *Part One* dealing with anatomy, considered by Guy essential for performing the surgical art correctly. *A good surgeon should be familiar with medicine and above all with anatomy. Anatomy is taught in two ways, learning from books or pictures as many teachers are doing or by experiencing directly on cadavers of men, apes and other animals*. *Part Two* explains swellings and tumors. *Part Three* describes management of various types of wounds, removal of foreign bodies, and approximation and union of separated parts. Management of hemorrhage was by ligature of vessels, compression, and cauterization. *Part Four* considers the nature of ulcers and their treatment. *Part Five* examines fractures and dislocations. *Part Six* discusses local diseases of the eye, teeth, and ears from the surgical point of view. *Part Seven* deals with drugs and their administration and the use of antidotary.

The text, probably written in the vernacular, was finished in Avignon in 1363 and immediately became very successful and popular. It was first printed in Lyon in 1478 and went through numerous editions—according to Nicaise more than 60 [15] (Figs. 2.9 and 2.10). It was translated into various languages.



Prohemium 2

Cyrurgia Magri Guidonis de Cauliaco. edita anno dñi. 1363. i pclaro studio mõtispessulani. Feliciter icipit.

Fig. 2.9 The first page of Guy de Chauliac's *Chirurgia Magna* with floriated woodcut initial. Venezia, Gregorio de' Gregorii, 1513

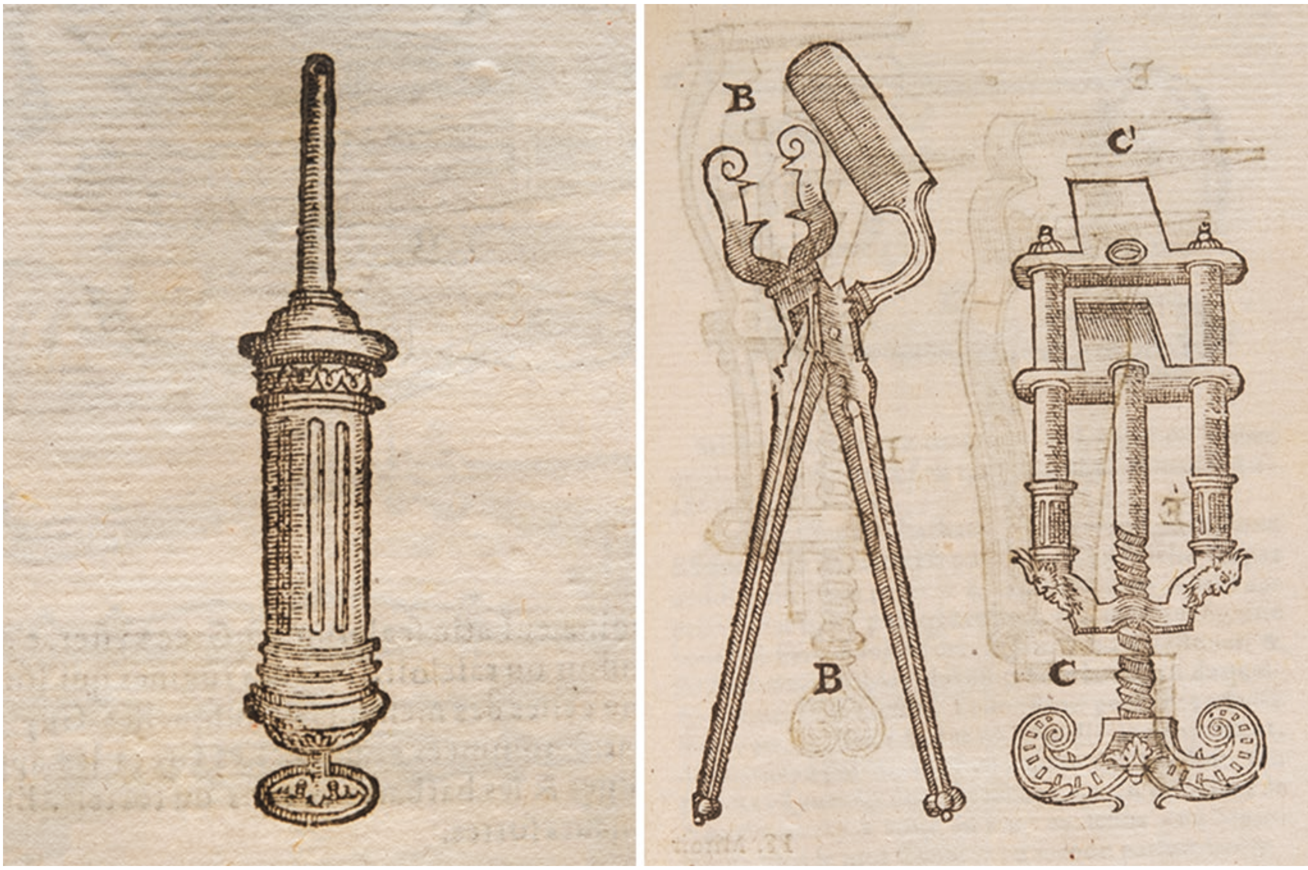


Fig. 2.10 Surgical instruments of Guy de Chauliac. *Left*: syringe. *Right*: two different types of mouth gags. (From: Guy de Chauliac *La Grande Chirurgie*, (…) *Annotations sur toute la Chirurgie de M. Guy de Chauliac*, edited by Laurent Joubert. Tournon, Claude Michel, 1598)

2.4.1.6 Jehan Yperman

The achievements in the fields of anatomy and surgery by the Italian masters of the second half of the thirteenth century at the *Studium* of Bologna reached France and adjacent countries, thanks to Lanfranco. **Jehan Yperman** (ca. 1260–1331), a native of the Flemish city of Ypres, studied medicine in Paris and surgery at the brotherhood of St. Côme, becoming a student of Lanfranco. Like his master, he devoted himself to surgery and wrote the tract *Cyrurgie* (Surgery) in the Flemish language, dealing mainly with facial injuries and malformations [7, 16]. From a plastic surgery point of view, he was among the first to describe the technique for uni- and bilateral cleft lip repair, using the knife for freshening the edges and suturing them together by a twisted wax thread.

2.4.1.7 John of Arderne

John of Arderne (ca. 1306–1380) was the first English surgeon of note. Little is known about his life. Born on the Arderne in Newark (Great Britain), his training took place possibly at the Medical Faculty of Montpellier. He started his career as an army surgeon in France, in campaigns where gunpowder was used in combat for the first time during the Hundred Year's War. For 20 years, he practiced in Newark; then in 1370 he moved to London where he was admitted as a member of the guild of surgeons as a Master Surgeon. He wrote on many subjects, but his most famous work was *De Arte Phisicale et de Cirurgia* (On the Art of Medicine and on Surgery) dealing with cures of several ailments and in particular with the treatment of anal fistula—the first proctologist [7, 10, 17]. The secret of his success was the ligature of the opening of the fistulous tract in the rectum and the postoperative care with simple cleansing, without the use of any irritating or suppurative medication. The dedicated armamentarium was devised by him.

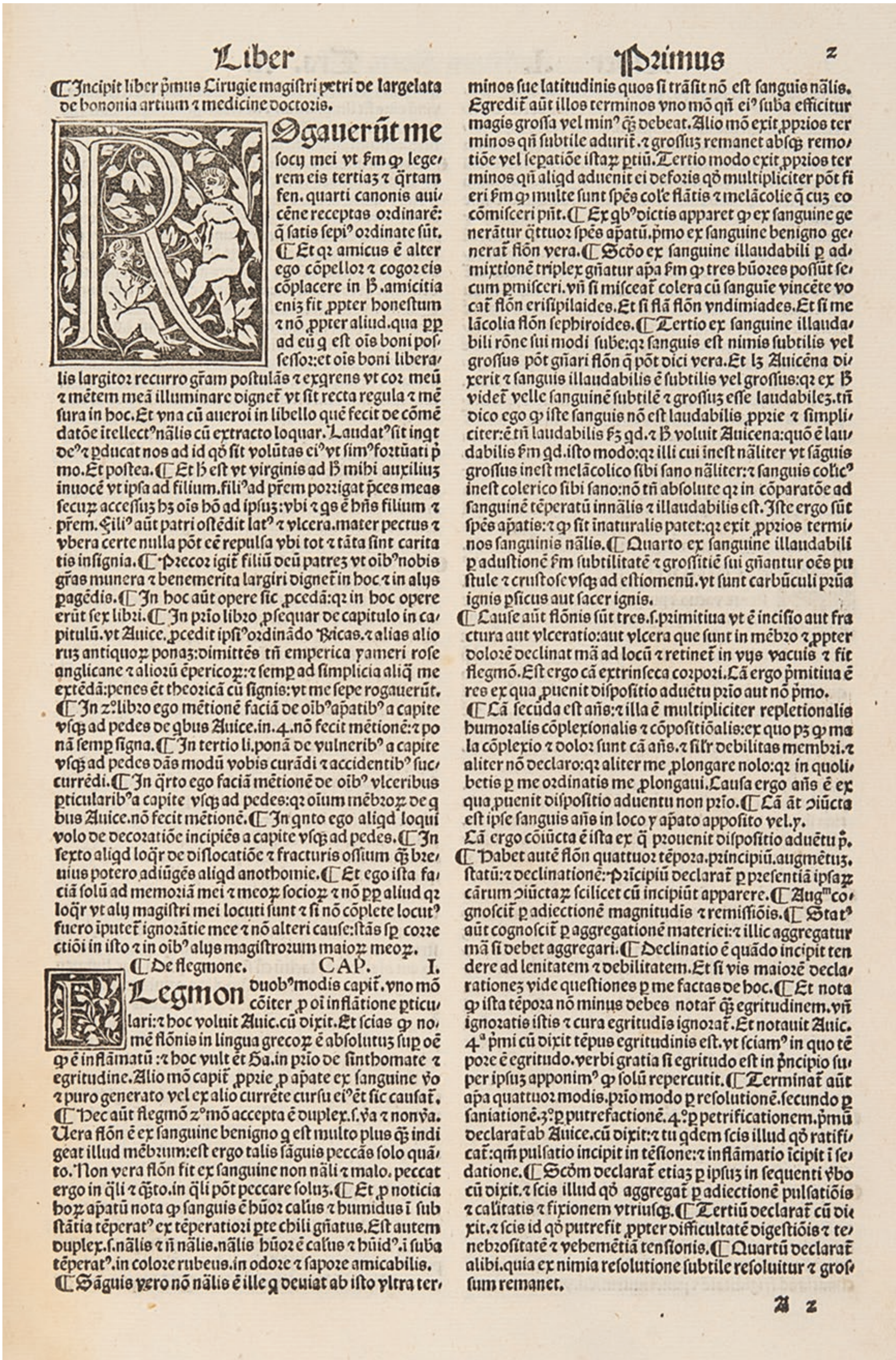
2.4.2 The Fifteenth Century and the First Half of the Sixteenth Century

2.4.2.1 Surgery in Bologna

In Bologna the tradition of surgery continued in the fifteenth century with Petrus de Argellata.

Petrus de Argellata

In Bologna, the most renowned surgeon of this period was **Petrus de Argellata** (?–1423). Born in Argellata in the territory of Bologna in the second half of the fourteenth century, Petrus studied medicine in Bologna, where he obtained his medical degree in 1391. He was a lecturer at the *Studium* of Bologna in logic, astrology, and medicine, and his lectures were highly appreciated. He taught surgery from 1410 to 1411 and then medicine again from 1411 to 1421. He was considered a talented surgeon primarily for his operations on hernia, lithotomy, and head traumas. He explained to his students not only surgical procedures but also failures, complications, and how to avoid them. He died in Bologna on the January 20, 1423 [8]. Three centuries later, a wood statue of him was placed in the Anatomical Theatre of the Bolognese Archiginnasio. *Cirurgia* was written in manuscript form in the second decade of the fifteenth century and first printed in Venice in 1480 and reissued later [18] (Fig. 2.11). Greatly inspired by Guy's *Chirurgia*, the work is divided into six books, each one including numerous tracts and chapters. All surgical procedures known at that time are scholarly considered and discussed, from hernias to wounds, plus fractures, sores, and skull trephination. An entire chapter is devoted to the interruption of nerve continuity, its consequences, and possible treatment (*Book One*, Tract 6). In *Book Three*, Petrus explains facial wounds and those of eyelids, nose, ears, and lips in particular. He affirms that a completely severed nose cannot be reattached (*Book Three*, Tract 1, Chap. 4, Folio 66), but he does not mention any operation for repairing the defective parts. *Book Five* is dedicated to beauty (*De decoratione*) and how to preserve it. The author describes how to handle naevi, swellings, and other cutaneous alterations and how to improve facial wrinkles and scars (Tract 5, Chap. 5). Finally, *Book Six* deals with fractures. Numerous recommendations are proposed regarding the appropriate type of bandage necessary to stabilize fractured nasal bones and the jaw.



Liber Primus 2

Incipit liber pmus Cirugie magistri petri de largelata de bononia artium & medicine doctoris.

Rogauerũt me socij mei vt ẽm q lege rem eis tertiã & q̃rtam fen. quarti canonis aui cẽne receptas ordinarẽ: q̃ satis sepi⁹ ordinate sũt. Et q: amicus ẽ alter ego cõpellor & cogor eis cõplacere in h. amicitia enĩ fit ppter honestum & nõ ppter aliud. qua pp ad eũ q est ois boni pos sessor: et ois boni libera lis largitor recurro grãm postulãs & exgrens vt cor meũ & mẽtem meã illuminare dignet̃ vt sit recta regula & mẽ sura in hoc. Et vna cũ auerroi in libello quẽ fecit de cõmẽ datõe itellect⁹ nãlis cũ extracto loquar. Laudat⁹ sit ingt de⁹ & pducat nos ad id qd sit volũtas ei⁹ vt sim⁹ fortũati p mo. Et postea. Et h est vt virginis ad h mihi auxiliũ inuocẽ vt ipsa ad filium. fili⁹ ad prẽm porrigat pces meas secũ accessiũ hz ois bõ ad ipsũ: vbi & qs ẽ hñs filium & prẽm. Fili⁹ aũt patri ostẽdit lat⁹ & vlcera. mater pectus & vbera certe nulla põt eẽ repulsa vbi tot & tãta sint carita tis insignia. Precor igit̃ filiũ deũ patrẽ vt oib⁹ nobis grãs munera & benemerita largiri dignet̃ in hoc & in alijs pagẽdis. In hoc aũt opere sic pcedã: q: in hoc opere erũt sex libri. In prĩo libro psequar de capitulo in ca pitulũ. vt Auice. pcedit ipsi⁹ ordinãdo Ricas. & alias alio rũ antiquorũ ponaz: dimittẽs tñ emperica yameri rose anglicane & aliorũ ẽpericorũ: & semp ad simplicia aliq̃ me extẽdã: penes ẽt theoricã cũ signis: vt me sepe rogauerũt. In 2°. libro ego mẽtionẽ faciã de oib⁹ apatib⁹ a capite vsq ad pedes de gbus Auice. in. 4. nõ fecit mẽtionẽ: & po nã semp signa. In tertio li. ponã de vulnerib⁹ a capite vsq ad pedes dãs modũ vobis curãdi & accidentib⁹ suc currẽdi. In q̃rto ego faciã mẽtionẽ de oib⁹ vlceribus pticularib⁹ a capite vsq ad pedes: q: oium mẽbrorũ de q bus Auice. nõ fecit mẽtionẽ. In qnto ego aliqd loqui volo de decoratiõe incipiẽs a capite vsq ad pedes. In sexto aliqd loq̃r de dislocatiõe & fracturis ossium q̃s bre uius potero adiũgẽs aliqd anothomie. Et ego ista fa ciã solũ ad memoriã mei & meorũ sociorũ & nõ pp aliud q: loq̃r vt alij magistri mei locuti sunt & si nõ cõplete locut⁹ fuero iputet̃ ignorãtie mee & nõ alteri cause: stãs sp corre ctiõi in isto & in oib⁹ alijs magistrorum maiorũ meorũ.

De flegmone. CAP. I.

Flegmon duob⁹ modis capit̃. vno mõ cõiter p oi inflãtione pticu lari: & hoc voluit Auic. cũ dixit. Et scias q no mẽ flõnis in lingua grecorũ ẽ absolutuz sup oẽ q ẽ inflãmatũ: & hoc vult ẽt Ga. in prĩo de sinthomate & egritudine. Alio mõ capit̃ pprie p apate ex sanguine vo & puro generato vel ex alio currẽte cursu ei⁹ ẽt sic causat̃. Hec aũt flegmõ 2° mõ accepta ẽ duplex. s. va & nonva. Uera flõn ẽ ex sanguine benigno q est multo plus q̃s indi geat illud mẽbrum: est ergo talis sãguis peccãs solo quã to. Non vera flõn fit ex sanguine non nãli & malo. peccat ergo in q̃li & q̃to. in q̃li põt peccare soluz. Et p noticia horũ apatũ nota q sanguis ẽ hũor calĩs & humidus ĩ sub stãtia tẽperat⁹ ex tẽperatiori pte chili gñatus. Est autem duplex. s. nãlis & ñ nãlis. nãlis hũor ẽ calĩs & hũid⁹. i. suba tẽperat⁹. in colore rubeus. in odore & sapore amicabilis. Sãguis vero nõ nãlis ẽ ille q deuiat ab isto vltra ter minos sue latitudinis quos si trãsit nõ est sanguis nãlis. Egredit̃ aũt illos terminos vno mõ qñ ei⁹ suba efficitur magis grossa vel min⁹ q̃s debeat. Alio mõ exit pprios ter minos qñ subtile adurit. & grossũ remanet absq remo tiõe vel sepatiõe istorũ ptiũ. Tertio modo exit pprios ter minos qñ aliqd aduenit ei deforis qd multipliciter põt fi eri ẽm q multe sunt spẽs colẽ flãtis & melãcolie q̃ cuz co cõmisceri pñt. Ex qb⁹ dictis apparet q ex sanguine ge nerãtur q̃ttuor spẽs apatũ. pmo ex sanguine benigno ge nerat̃ flõn vera. Scdo ex sanguine illaudabili p ad mixtionẽ triplex gñatur apa ẽm q tres hũores possũt se cum pmisceri. vñ si misceat̃ colera cũ sanguie vincẽte vo cat̃ flõn erisipilaides. Et si flã flõn vndimiades. Et si me lãcolia flõn sephiroides. Tertio ex sanguine illauda bili rõne sui modi sube: q: sanguis est nimis subtilis vel grossus põt gñari flõn q̃ põt dici vera. Et lz Auicẽna di xerit & sanguis illaudabilis ẽ subtilis vel grossus: q: ex h videt̃ velle sanguinẽ subtilẽ & grossũ esse laudabilez. tñ dico ego q iste sanguis nõ est laudabilis pprie & simpli citer: ẽ tñ laudabilis fz qd. & h voluit Auicena: quõ ẽ lau dabilis ẽm qd. isto modo: q: illi cui inest nãliter vt sãguis grossus inest melãcolico sibi sano nãliter: & sanguis colic⁹ inest colerico sibi sano: nõ tñ absolute q: in cõparatõe ad sanguinẽ tẽperatũ innãlis & illaudabilis est. Iste ergo sũt spẽs apatis: & q sit inaturalis patet: q: exit pprios termi nos sanguinis nãlis. Quarto ex sanguine illaudabili p adustionẽ ẽm subtilitatẽ & grossitiẽ sui gñantur oẽs pu stule & crustose vsq ad estiomenũ. vt sunt carbũculi prũa ignis psicus aut sacer ignis.

Cause aũt flõnis sũt tres. s. primitiua vt ẽ incisio aut fra ctura aut vlceratio: aut vlcera que sunt in mẽbro & ppter dolorẽ declinat mã ad locũ & retinet̃ in vijs vacuis & fit flegmõ. Est ergo cã extrinseca corpori. Cã ergo pmitiua ẽ res ex qua pucnit dispositio aduẽtu prio aut nõ pmo.

Cã secũda est añs: & illa ẽ multipliciter repletionalis humoralis cõplexionalis & cõpositiõalis: ex quo pz q ma la cõplexio & dolor sunt cã añs. & sit debilitas membri. & aliter nõ declaro: q: aliter me plongare nolo: q: in quoli betis p me ordinatis me plongaui. Causa ergo añs ẽ ex qua puenit dispositio aduentu non prĩo. Cã ãt piũcta est ipse sanguis añs in loco y apato apposito vel. y. Cã ergo cõiũcta ẽ ista ex q̃ prouenit dispositio aduẽtu p.

Habet autẽ flõn quattuor tẽpora. principiũ. augmẽtũ. statũ: & declinationẽ: Principiũ declarat̃ p presentiã ipsarũ cãrum piũctarũ scilicet cũ incipiũt apparere. Aug^m co gnoscit̃ p adiectionẽ magnitudis & remissiõis. Stat⁹ aũt cognoscit̃ p aggregationẽ materiei: & illic aggregatur mã si debet aggregari. Declinatio ẽ quãdo incipit ten dere ad lenitatem & debilitatem. Et si vis maiorẽ decla rationez vide questiones p me factas de hoc. Et nota q ista tẽpora nõ minus debes notar̃ q̃s egritudinem. vñ ignoratis istis & cura egritudis ignorat̃. Et notauit Auic. 4ª pmi cũ dixit tẽpus egritudinis est. vt sciam⁹ in quo tẽ pore ẽ egritudo. verbi gratia si egritudo est in pncipio su per ipsũ apponim⁹ q solũ repercutit. Terminat̃ aũt apa quattuor modis. prio modo p resolutionẽ. secundo p saniationẽ. 3°. p putrefactionẽ. 4°. p petrificationem. pmũ declarat̃ ab Auice. cũ dixit: & tu qdem scis illud qd ratifi cat̃: qm pulsatio incipit in tẽsione: & inflãmatio icipit i se datione. Scdm declarat̃ etiaz p ipsũ in sequenti vbo cũ dixit. & scis illud qd aggregat̃ p adiectionẽ pulsatiõis & calĩtatis & fixionem vtriusq. Tertiũ declarat̃ cũ di xit. & scis id qd putrefit ppter difficultatẽ digestiõis & te nebrositatẽ & vehemẽtiã tensionis. Quartũ declarat̃ alibi. quia ex nimia resolutione subtile resoluitur & gros sum remanet.

A 2

Fig. 2.11 The first page of P. Argellata *Cirurgia*. Two puttos (cherubs) are included in the woodcut initial. Venezia, Ottaviano Scoto per Boneto Locatelli, 1497

2.4.2.2 Surgery in Germany

From the thirteenth to the fifteenth centuries, Germany was far behind Italy and France in the progress of medicine and surgery. Having no university for learning and training, German surgeons were unable to read Latin. They were uneducated craftsmen, organized in guilds. However, from the fourteenth century, the translation into German of the basic Latin surgical texts by Theodoric, Roger of Salerno, Bruno of Longoburgo, Lanfranchi, Guglielmus of Saliceto, and in particular Guy of Chauliac, originally written in French, allowed German surgery to fill in the gap and make significant progress.

Thus, during the fifteenth century, Germany was eventually able to produce its own contributions, in the vernacular, and devoted essentially to the management of general wounds and gunshot wounds in particular.

The problem of gunshot wounds grew steadily over the years. Surgeons had to face a completely different situation with respect to the traditional arrow injury. Deep, large lacerations, burns, peculiar lesions considered poisoned, requiring the necessity of removing the gun powder, which was supposed to have penetrated into the wound, and the barbaric practice of using red-hot cauteries or pouring boiling oil or water on the wound for cleansing was common. With the great wars, the presence of army surgeons, or field surgeons as they were called, was regarded as essential.

The first wound surgeon of great repute was **von Pfolfprundt**, followed by three Alsatian surgeons. They are, in chronological order, **Hyeronimus Brunschwig**, **Hans von Gersdorff**, and **Walther Hermann Ryff**.

Heinrich von Pfolfprundt

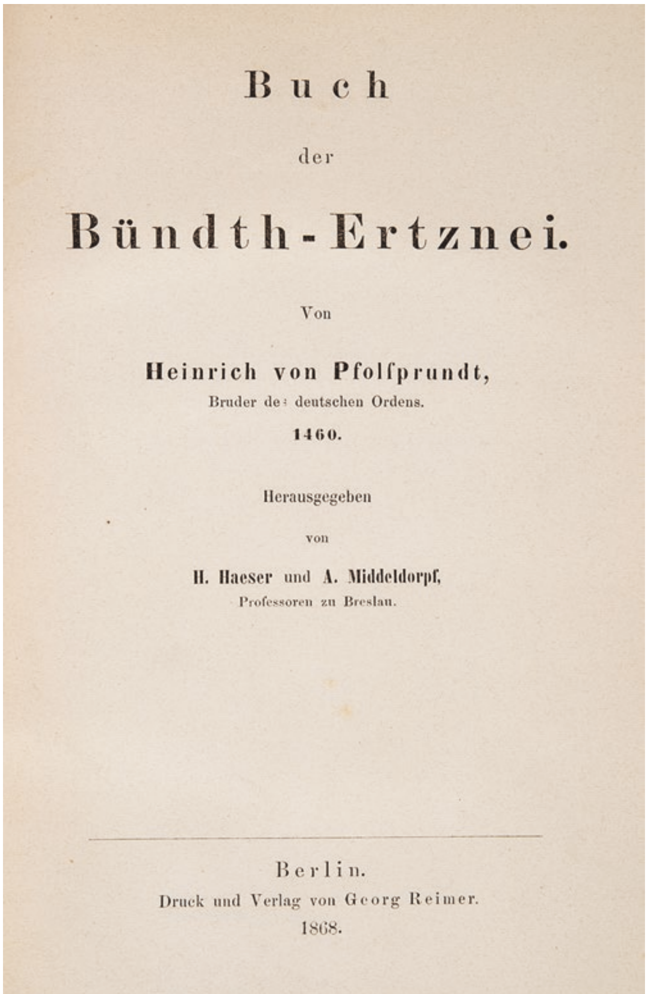
Buch der Bündth-Ertznei (The Book on Wounds) by **Heinrich von Pfolfprundt** (ca. 1415–1465), written in 1460 and drawn from personal experience of general practice, but not published until 1868, was the first one on this topic [19] (Fig. 2.12).

The book remained unknown for more than 400 years, hidden in manuscript form in the library of Erfurt University (Germany), when **H. Haeser** (1811–1885) and **A. Middeldorpf** (1824–1868) came fortuitously into its possession and issued it with commentary and notes. In the foreword of the work, Haeser and Middeldorpf trace an overview of the fifteenth-century history of surgery in general and of nasal reconstruction in particular (pp. 32–38).

Heinrich von Pfolfprundt was born in Bavaria about 1415. He became a knight of the Teutonic Order in 1450. He was trained as a military surgeon but also as a barber surgeon and actively participated in the Siege of Marienburg from 1454 to 1457. He was a skillful surgeon, but uneducated. He died around 1465.

Buch der Bündth-Ertznei is an extremely important document for the history of nasal reconstruction. It is the only contemporary medical text that describes in detail the technique of nasal reconstruction using skin taken from the arm, the so-called Branca's (or Italian) procedure, devised by Antonio Branca from Catania (Sicily), about the second half of the fifteenth century [10, 20].

Heinrich von Pfolfprundt affirms that he learned the technique from an Italian, probably a traveller, who had seen the operation directly: *he taught it to me, one who had helped many people with it and earned much money from it*. In the chapter entitled: *To make a new nose for one who lost it completely and the dog has eaten it* (pages 29-31), Pfolfprundt supplies a detailed description of the operation. The English translation is quoted from Gnudi Webster [21]: *Take a piece of parchment or leather and cut it depending on the wound of the nose, so large and so long as the nose was previously. You must bend it at the upper part of the nose, so that the nose does not become too broad. Then take the same parchment or leather and lay it behind the elbow where it is thick and paint it around with ink* (…). *Take a good sharp cutting blade or scissor and cut through the skin and take a piece with it* (…). *Allow the same flap you have cut to hang from the arm and do not cut completely. Now raise the arm up to the head and suture the flap directly to the nose in the same size as it was before* (…). *Then you must bind the arm on the head and below the elbow (…) This usually requires 8 to 10 days or until you see it is united and healing. Then cut the flap off, but not too short, so that it may afterwards extend somewhat beyond the nose* (…). The report of the operation continues. Much emphasis is given on the details to achieve a good shape of the nostrils and to maintain the airway's patency. *If someone comes to you whose nose has been hacked off, and his wound healed, so cut the skin away widely enough down to the raw flesh, and proceed as before, after which heal it also. It undoubtedly works. It has been proven.*



Buch
der
Bündth-Ertznei.
Von
Heinrich von Pfolfprundt,
Bruder des deutschen Ordens.
1460.
Herausgegeben
von
H. Haeser und A. Middeldorpf,
Professoren zu Breslau.

Berlin.
Druck und Verlag von Georg Reimer.
1868.

Fig. 2.12 Title page of *Buch der Bündth-Ertznei*, edited by Haeser H. and Middledorpf A. Berlin, Reimer 1868

Hyeronimus Brunschwig

Hyeronimus Brunschwig (ca. 1450–1512) was born in Strasbourg (France) and gained his surgical training through apprenticeship, travelling and reading scientific texts. He affirmed that he had studied more than 3000 volumes of the ancients and contemporary masters, learning from them whatever he could. He practiced wound surgery in Alsace, Cologne, and the Rhine area. There is no information about his service as an army surgeon. He died about 1512.

His book, *Cirurgia*, plays a capital role in the history of medicine being the first printed textbook on surgery that was fully illustrated [22]. Brunschwig had the advantage that his text was published in Strasbourg, a city with a great printing tradition where Gutenberg, the inventor of movable type printing, worked for a certain period. Written in German, it was first printed on July 14, 1497, by the Grüninger press in Strasbourg. However, in December of the same year, Hans Schönsperger in Augsburg issued a pirated version of high quality and with the errata in the Grüninger edition fully corrected. *Cirurgia* is considered among the most beautiful medical texts of the fifteenth century when two editions were published, both of them in 1497, and reissued three more times during the sixteenth century (1513, 1534 and 1539).

Divided into seven sections, *Cirurgia* deals mainly with treatment of diseases and injuries related to surgery such as management of general wounds, gunshot wounds, sores, fractures, and luxations. It was intended for use by the general practitioner, barber-surgeons, barbers, and isolated surgeons living in lonely villages. Apart from trephination and amputation, no major specialist operations like herniotomy, lithotomy, or cataract surgeries are described. The book is illustrated with 47 amazing full-page and two smaller woodcuts accurately executed by a clever, unknown artist. Illustrations were intended to adorn the book, not to explain the contents of the text, nor to have any scientific value. On the contrary, they have great importance in depicting fifteenth-century costumes, medical habits, and interior decorations.

The work opens with the image of "wound-man" (Fig. 2.13) and continues with other scenes representing physicians in splendid attire, with their assistants and students, and patients lying in beds, sitting on chairs, or standing in upright position, showing their facial, thoracic, or abdominal wounds (Fig. 2.14). Reduction of fractures, skull wounds, and teeth wiring for stabilization of fractured jaws is illustrated. For the first time, the instruments necessary to perform operations are accurately displayed (Fig. 2.15), as well as the preparation of drugs and the interior of a pharmacy. For nasal traumas, Brunschwig affirms that *if the nose is completely cut off, it may not be reunited* (Tract 3, Chap. 9, Folio 58).

Fig. 2.13 The “wound-man” showing the most likely causes of injuries. (From: Brunschwig H. *Dis ist das Buch der Cirurgia*. Augsburg, Hans Schönsperger, 1497)

Der ander tractat

Das drit capitel des andern tractetlins ſagt von der verbindung vnd heylung der kleinen wunden damit dann die haut verwundt iſt.

¶ Item hie iſt beſchriben von den wunden die do gehawen oder geſchlagen werden allein durch die haut biß auff daz fleiſch wie du die vnderſtan ſolt zů heylen. vnd in wölichen weg das beſchehen ſoll.

Fig. 2.14 The facial wound. The patient sitting on a chair in his home shows a facial wound to the surgeon, wearing long attire, and to his assistants. (From: Brunschwig H. *Dis ist das Buch der Cirurgia*. Augsburg, Hans Schönsperger, 1497)

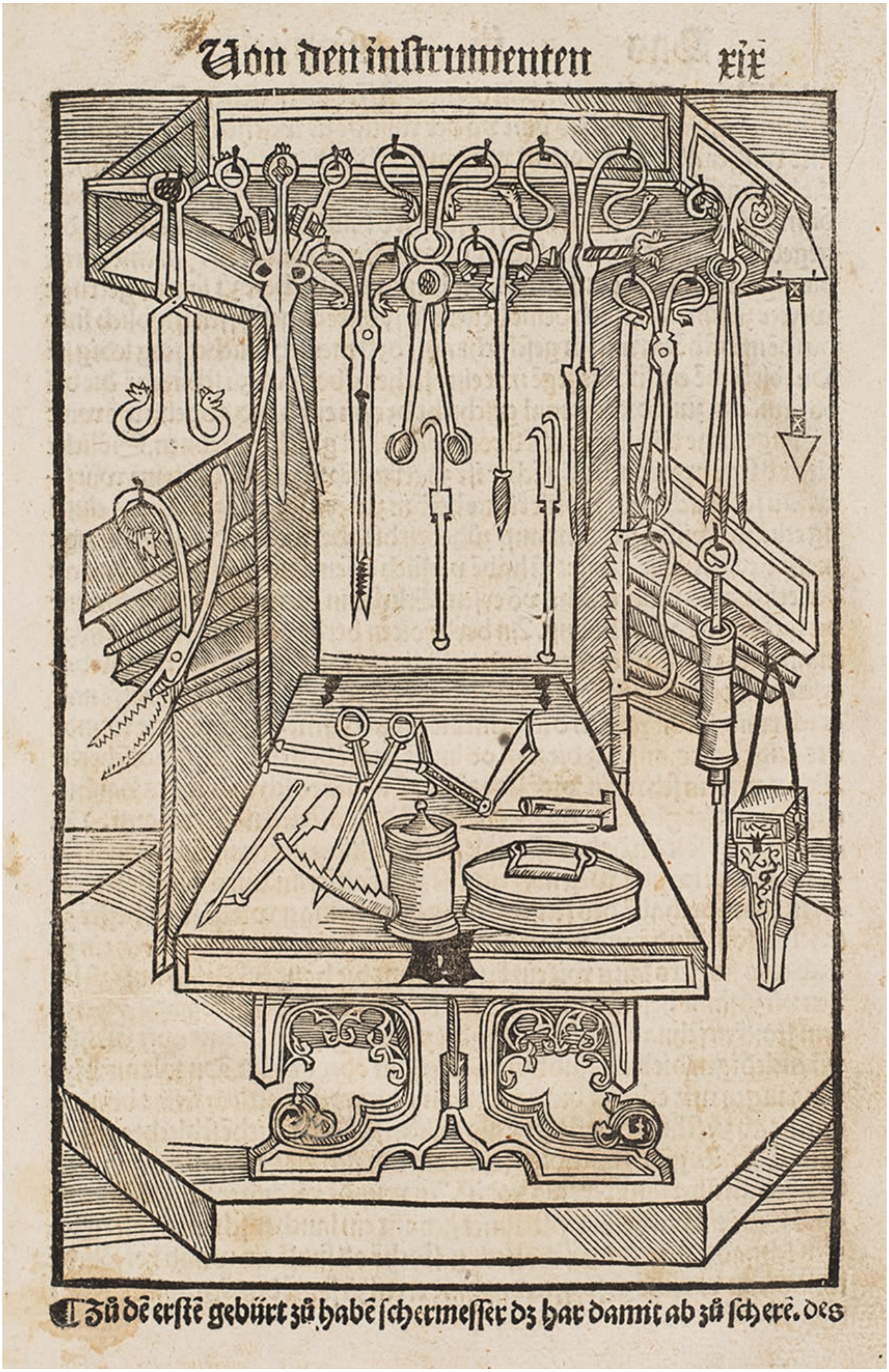


Fig. 2.15 The cupboard, containing instruments used by the wound surgeon. To the right hangs a syringe with the piston. (From: Brunschwig H. *Dis ist das Buch der Cirurgia*. Augsburg, Hans Schönsperger, 1497)

Hans von Gersdorff

Hans von Gersdorff (ca. 1455–1529) was an early German wound surgeon. He was born in Strasbourg (France) about 1455. His surgical training was by apprenticeship and travelling as an army surgeon. He acquired great experience during his military service and summarized it in a textbook *Das Feldtbuch der Wundartzney* (The Fieldbook of Wound Surgery), written in the vernacular, first published in Strasbourg in 1517 with beautiful, though dramatic woodcut illustrations attributed to the famous artist **Hans Wechtlin** (ca. 1480–1526) [23]. The operative techniques and the armamentarium used were shown, as well as a battlefield scene with the removal of an arrow from the chest of a soldier (Fig. 2.16), including images of a tripod screw device for elevating depressed bone fragments from the skull (Fig. 2.17); limb amputation, the first one to appear in the history of medical illustration (Fig. 2.18); and the use of cautery for open wounds of the thigh (Fig. 2.19). The book was very successful and went through numerous editions over the years.

Fig. 2.16 Battlefield scene with the removal of an arrow from the chest of a soldier. (From: Gersdorff von H. *Feldtbuch der Wundartzney*. Strasbourg, J. Schott, 1517)

Fig. 2.17 Tripod screw device for elevating depressed bone fragments from the fractured skull. (From: Gersdorff von H. *Feldtbuch der Wundartzney*. Strasbourg, J. Schott, 1517)

Fig. 2.18 The first printed scene of limb amputation appeared in the history of the medical illustration. On the right, in standing position, a man with an amputated hand, whose stump is covered by an animal bladder. (From: Gersdorff von H. *Feldtbuch der Wundartzney*. Strassburg, J. Schott, 1517)

Fig. 2.19 Use of hot cautery for the treatment of an open wound of the thigh. (From: Gersdorff von H. *Feldtbuch der Wundartzney*. Strasbourg, J. Schott, 1517)

Walther Hermann Ryff

Walther Hermann Ryff (ca. 1500–1548) was the fourth of the early German wound surgeons, probably born in Strasbourg around 1500. We have no information regarding his surgical training. He was a town physician in Strasbourg and later in Nüremberg and a very prolific author who wrote on many subjects from surgery to orthopedics, medicine, anatomy, obstetrics, astrology, alchemy, botany, mathematics, and pharmacy. His *Grosz Chirurgei oder volkommene Wundartnzei. Chirurgischen Handtwirkung eigentlicher Bericht und Inhalt alles so der Wundartnzei angehörig* (The Great Surgery, or complete Wound Treatment. Surgical Results of Related to Wound Treatment) [24] was first published in Frankfurt in 1545 and reissued several times. It is a very thick compendium on the surgical management of injuries but includes few innovative procedures. Hundreds of woodcuts of surgical instruments, cauteries, and orthopedic devices, like splints for fractures and traction machines for dislocations, are shown in the book—many of them copied from previous works. Andreas Vesalius considered him "a Strasbourg plagiarist." The very crude scene of a leg amputation at the beginning (Fig. 2.20) is clearly inspired by a similar one published in *Feldtbuch der Wundarztney* (1517) by Hans von Gersdorff. Ryff illustrates a facial wound, whose edges are approximated with a sort of running suture (Fig. 2.21), and the basic armamentarium necessary for the wound surgeon, including the *spongia soporifera* (soporific sponge) (Fig. 2.22).

At the request of the publisher, Christian Egenolff, Ryff produced many popular well-illustrated and scholarly works. For this, he plays an important role in the evolution of sixteenth-century surgery, before Ambroise Paré.

Fig. 2.20 The surgeon with one attendant is sawing the leg of a patient with a tourniquet to control heavy bleeding. A priest assists the patient. The *spongia soporifera* (soporific sponge) lies on the floor. The very crude, dramatic scene is clearly inspired by a similar one, published by H. von Gersdorff (1517). (From: Ryff WH. *Grosz Chirurgei oder volkommene Wundartnzei* (…) Frankfurt, Heirs Christian Egenolff, 1559)

Fig. 2.21 The needles and the suturing materials available in the sixteenth century. (From: Ryff WH. *Grosz Chirurgei oder volkommene Wundartnzei* (…) Frankfurt, Heirs Christian Egenolff, 1559)

Fig. 2.22 The portable kit, containing the basic armamentarium in use to the "wound surgeon": suturing materials, *spongia soporifera*, syringe, knife, probe, and scissors. (From: Ryff WH. *Grosz Chirurgei oder volkommene Wundartnzei* (…) Frankfurt, Heirs Christian Egenolff, 1559)

2.5 The Invention and Spread of Printing and Its Impact on Culture: Venice, the Center of the Publishing Industry

2.5.1 Johannes Gutenberg

In 1436, **Johannes Gutenberg** (ca. 1398–1468), a goldsmith from Mainz (Germany), invented movable type [25]. Fifteen years later, he began his Bible project and in 1455, 200 copies of the two-volume Bible were printed in Mainz and sold. The cost was something comparable to 3 years' salary for an average clerk.

2.5.2 The Development of Printing

The extraordinary influence of this invention needs scarcely to be mentioned. It favored the rise of a humanistic culture, the spread of education, and the development of science. Learning to read was made easier. Before that, a monk bent over his parchment or vellum might take months or years to copy a single book (Fig. 2.23); now a printing press could produce numerous copies in a short period of time (Fig. 2.24). New libraries in universities and monasteries were expressly created.

However, printing required special materials, first of all the paper. Before the printing era, books were on parchment (*sheep skin*) or on vellum (*calf skin*). When the printing era began, they were on paper—the production of which was very expensive and necessitated a dedicated industry. The second requirement was ink made of oil and natural colors and produced using complicated formulas. The third requirement was binding. Books were usually issued in a provisional paper cover. Binding with wood, leather or pigskin could be very expensive. In summary, books were affordable for a limited number of people.

From Germany, where it started, printing spread rapidly throughout Europe to Switzerland, the Netherlands, England, France, and Italy—especially to Rome and Venice. Before the end of the fifteenth century, printers established shops in almost 3,500 European cities.

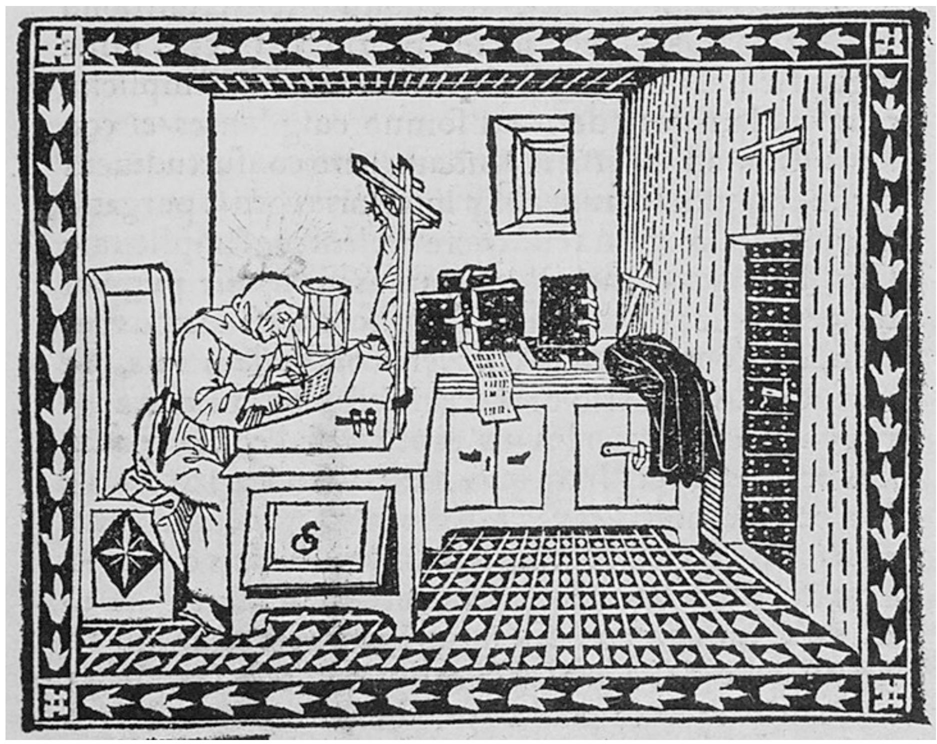


Fig. 2.23 A monk-scribe copying text on a parchment leaf. (From: Savonarola G. *De Simplicitate Christianae Vitae*. Firenze, L. Morgiani, 1496)

Fig. 2.24 A printing press office. The press (*center*); on the right (*foreground*), the typesetting, and on the right (*background*) the assembly of printed sheets to form a book; on the left (*foreground on the floor*), the movable type. (From: Zonca V. *Nuovo Teatro di Machine et Edificii*. Padova, F. Bertelli, 1656)

2.5.3 Venice: Capital of the Printing Industry

Venice was considered the ideal place for starting a new activity for book production. It boasted the best and most advanced distribution system of the period, for its maritime power and as a center of commerce and finance. Moreover, it was extremely liberal. Therefore, there was fierce competition to open a printing house in Venice as publishing became a booming industry. In 1473, there were 12 printers, among them Nicolas Jenson, from France, well-known for the quality of his books [26]. By the turn of century, that number rose to more than two hundred—the highest concentration of printers in the world in that period.

What did these printers produce? Anything that would sell: for the clergy, missals, bibles, psalters, and religious texts; for musicians, sheet music; for lawyers, records of jurisprudence, classical legal codes, and law books; for physicians, medical/surgical tracts; and for apothecaries, herbal remedy recipes. How many copies were printed each time? Usually between 500 and 1000. Best sellers are between 2000 and 3000 copies [26]. By the end of the sixteenth century, the different Venetian publishing houses issued about 4500 editions (e.g., just the Scoto house had more than 150 titles in its catalogue). If we multiply the 4500 editions by the number of copies, 500, we can roughly estimate the total number of books printed over the sixteenth century in Venice [26]. This was big business.

By contrast, books printed during the fifteenth century, from the origin until 1500 included, are called ***Incunables*** (*from*: cunae = cradle). As a common denominator, they are austere, written in gothic types, double column, in folio. Usually, they have no illustrations, apart from the often floriated woodcut initial (Fig. 2.11).

In such a challenging market, we can easily understand why books were copied and printed illegally, with fake title pages, authors, and place of publication. To circumvent this clandestine business, special rules were established. First of all, the right to print, before publishing, the so-called *Imprimatur*, was required. In Venice, it was granted by the Council of Ten, along with a Certificate of Registration. Then, to limit plagiarism, a copyright was established. Whether these rules functioned as intended, it is difficult to say, as we shall see later.

The most famous Venetian publishing dynasties in this period were Aldo Manuzio, Scoto, Valgrisi, Giunta, Sessa, and Bindoni.

2.5.3.1 Aldo: One of the Most Renowned Printing Houses in Venice

Aldo Manuzio (1450–1515) created a well-known printing house, internationally appreciated, that survived after his death in 1515 and continued until 1595. Apart from the high quality of publications, Aldo had the original idea to produce the first portable books, the *libelli portatiles*, that could fit in a saddlebag. At that time, books were printed in large format, the so-called in-folio, mainly for monasteries and universities. His device (logo) was the dolphin and anchor (quickness combined with firmness) (Fig. 2.25).

Fig. 2.25 The woodcut printer's device (logo) of Aldo Manuzio (1450–1515): the dolphin and anchor (quickness combined with firmness)

2.5.3.2 Scoto: A Very Active Venetian Printing House

Another important printer was **Ottaviano Scoto** (ca. 1440–1498) who came to Venice from Monza (near Milan). After his death in 1498, the activity of the Scoto *bottega* continued until 1600 with his heirs. The printer's device (logo) was a circle surmounted by a double cross and the initials O.S.M. (Ottaviano Scoto Monza) (Fig. 2.26). Beyond the books on theology, philosophy, and literature, Scoto published numerous medical texts, often in association with another printer, Bonetus Locatellus. Among these were *Conciliator* by Petrus de Abano, illustrated with the first printed image of abdominal musculature (1496), *Cirurgia* (On Surgery) by Petrus de Argellata (1497), *Cyrurgia* (On Surgery) by Guy de Chauliac (1498), and works by Hippocrates and Galen.

Fig. 2.26 The woodcut printer's device (logo) of Ottaviano Scoto (ca 1440–1498): a circle surmounted by a double cross and the initials O.S.M. (Ottaviano Scoto Monza)

2.5.3.3 Gregorius de' Gregoriis: An Exclusive Printing House

Before the end of the fifteenth century, the Venetian printing house of **Gregorius de' Gregoriis** issued a masterpiece of medical illustration, *Fasciculo de Medicina* by **Johannes de Ketham**, a medical encyclopedia containing the first woodcut of cadaveric dissection in the medical literature for the *Anatomia* by Mondino de' Luzzi (1491) (see Sects. 2.5.3.2 and 8.4.2). The work was very successful and was reissued numerous times.

To conclude this brief and somehow incomplete overview of the Venetian printers, we have to acknowledge their outstanding contribution to the development of learning and the progress of culture. As far as plastic surgery is concerned, the publication of medical, surgical, and anatomical texts substantially favored the advancement of the specialty.

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3 The Renaissance

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The Renaissance: Salient Events in Anatomy, Surgery, and Plastic Surgery

- The Renaissance period in medicine and surgery is characterized by the spread of **epidemic diseases**, syphilis, and plague.
- Treatment of **gunshot wounds** is something unknown to physicians and surgeons. Considering them poisoned, they use barbaric procedures to cleanse and decontaminate them with red hot iron or by pouring boiling oil on them.
- **Ambroise Paré** revolutionizes the management of wound treatment by applying instead a soothing ointment made of egg yolk, oil of roses, and turpentine with successful outcomes.
- In 1518, Jacopo Berengario da Carpi publishes first tract on **head traumas** ever printed.
- Andreas Vesalius publishes an epoch-marking textbook on **anatomy,** *De humani corporis* ***Fabrica***, in 1543.
- The first illustrated tract on **eye surgery** is printed in 1583 by George Bartisch.
- **Nasal reconstruction** begins in the western world in Sicily in the fifteenth century, performed by members of the **Branca** family, initially with local flaps and then with the arm flap (*Italian method*). It continues in Calabria in the sixteenth century by the **Vianeo** family, with the arm flap technique.
- Nasal reconstruction is performed in Bologna by **Gaspare Tagliacozzi** (1545–1599) who issues *De Curtorum Chirurgia per Insitionem* in 1597, systematizing the technique. He is considered the **founder of plastic surgery**.

General Considerations

The period that follows the Middle Ages is called the Renaissance. The term means rebirth—of fine arts, culture, philosophy and sciences—after a period of stagnation. The founding of universities and the invention of printing that occurred during the Middle Ages significantly contributed to the development of this process.

In the field of medicine, health improved considerably, thanks to the construction of new hospitals. The *Ca' Granda* (Big House) in Milan was established by order of Francesco Sforza, Duke of Milan (1401–1466), in 1456 and commissioned to the Florentine architect, Antonio Averulino, nicknamed the Filarete, a great achievement for the unique technical innovations adopted. The *Ospedale della Vita e della Morte* (Hospital of Life and Death) grew during the thirteenth and fourteenth centuries in Bologna and was expanded in 1596 with the construction of a new ward, large enough to accommodate 26 beds [1].

In general, in the Renaissance period, there was a positive, innovative spirit and great ferment in the fields of medicine, surgery, medical education, and training. The period was characterized by the strong desire to expand medical, surgical, and anatomical knowledge. Greek culture was resurrected. The translation of Hippocrates' and Galen's texts in Latin favored their diffusion. The publication of the first textbook on surgery, *Cirurgia* by **Petrus de Argellata**, issued in 1497 in Venice, contributed to make the methods for managing wounds, head traumas, fractures, and luxations available to medical circles (see Sect. 2.4.2.1). The *Fasciculus Medicinae* by **Johannes de Ketham**, printed in 1491, which included Mondino's Anatomy, explained the inner structure of the human body and showed for the first time the image of a cadaveric dissection. Apart from those already existing in Italy and in France, new universities were established throughout Europe—in Spain, Valencia (1501), Santiago (1504), and Granada (1531); in Germany, Wittenberg (1502), Marburg (1527), and Königsberg (1544); in the Netherlands, Leiden (1575); in Scotland, Edinburgh (1582); and in Ireland, Dublin (1593).

3.1 Medicine and Surgery in the Sixteenth Century

Three major concerns affected medicine and surgery during the Renaissance period: **epidemic diseases, gunshot wounds**, and **head injuries**.

3.1.1 Epidemic Diseases

Although the topic is beyond the scope of this book, we cannot avoid mentioning the two dramatic epidemics, already arisen in the previous century, that struck humanity during the Renaissance: syphilis and plague. **Syphilis** spread throughout Europe and was treated with mercury and fumigations; whether with positive or negative results was a matter of dispute. **Plague** spanned the fourteenth to the eighteenth centuries and reappeared every year in Europe and in Mediterranean regions with continuous waves and tragic consequences. Hygienic rules, lockdown, social distancing, and quarantine were the gold standard to prevent diffusion of the disease. Fortunately, nowadays, after almost 300 million deaths, bubonic plague, the most devastating acute infectious disease known to man, has almost completely disappeared, thanks to the isolation of the *Yersinia pestis* bacterium and to antibiotic therapy.

3.1.2 Treatment of Gunshot Wounds

The treatment of **gunshot wounds** reflected something unknown to physicians and surgeons. The diffusion of gunpowder and firearms completely changed the course of battles, creating new types of injuries necessitating different handling modalities to manage the consequences, so-called battlefield surgery (Fig. 3.1). Endless discussions arose among physicians and surgeons of the period concerning whether or not gunshot wounds were poisonous. Early tracts did consider gunshot wounds to be poisoned, requiring barbaric procedures to cleanse and decontaminate them, with red hot iron or by pouring boiling oil on them. Fortunately, **Ambroise Paré** revolutionized this trend and, around the middle of the sixteenth century, dramatically changed physicians' attitudes toward the approach to gunshot wounds.

Fig. 3.1 Soldier with firearm to defend the castle from assault. (From: R. Vegetius. *De Re militari*. Erfurt, Hans Knapp, 1511)

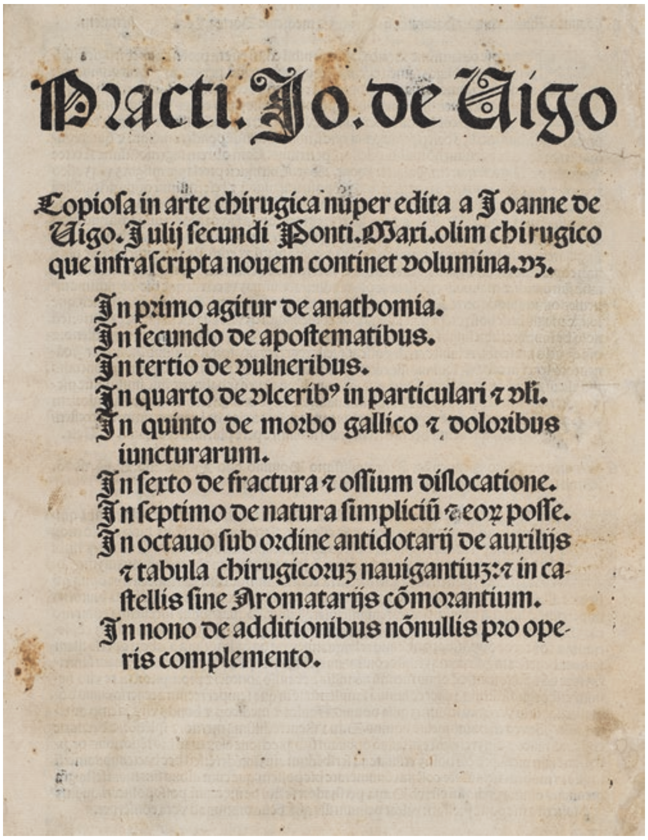
3.1.2.1 Giovanni da Vigo

Giovanni da Vigo (ca. 1460–1525) was the first author in Italy to write about gunshot wounds. His *Practica copiosa in Arte Chirurgica* (Ample Practice in Surgery), published in 1514, was the most complete text on surgery after that of Guy de Chauliac [2] (Fig. 3.2). It dealt with two major problems of that time: gunshot wounds, for which he recommended cautery and boiling oil, and syphilis, for which he suggested mercury.

The work included nine books. *Book One* focused on anatomy, particularly necessary for the surgeon. *Books Two to Four* were devoted to management of tumors, wounds, and sores. *Book Five* was on syphilis. *Book Six* addressed fractures and luxations. *Book Seven* summarized drugs. *Book Eight* described medicinals. *Book Nine* included the Addenda. Regarding wound management, Vigo suggested ligating vessels to prevent bleeding. Gunshot wounds were classified as crushed, burned, or poisoned. Treatment varied according to this classification. The bullet entry point was first cleansed with hot cautery. Then boiling oil was poured into it. *Aegyptiacum* ointment was applied afterward. He was one of the first to propose the use of gold leaf to fill in tooth cavities in dentistry.

Although the contents of *Practica copiosa* were not original, but merely a compilation of different procedures drawn from various authors improved with Vigo's personal experience, the work enjoyed enormous success, remaining the leading surgical text in European universities for almost two hundred years. It was translated into different languages (Italian, Spanish, English, French, and German) and went through an astonishing 52 editions.

Born in Rapallo (near Genoa, Italy), Giovanni da Vigo spent a great part of his professional life in Rome. In 1503, he was called by then Cardinal Giuliano della Rovere, later Pope Julius II, to become the personal physician to the Pope.



Practi. Jo. de Vigo

Copiosa in arte chirugica nuper edita a Joanne de Vigo. Julij secundi Ponti. Mari. olim chirugico que infrascripta novem continet volumina. vz.

In primo agitur de anathomia.
In secundo de apostematibus.
In tertio de vulneribus.
In quarto de ulcerib9 in particulari et vli.
In quinto de morbo gallico et doloribus iuncturarum.
In sexto de fractura et ossium dislocatione.
In septimo de natura simplicium et eorum posse.
In octavo sub ordine antidotarij de auxilijs et tabula chirugicorum navigantium: et in castellis sine Aromatarijs comorantium.
In nono de additionibus nonnullis pro operis complemento.

Fig. 3.2 Title page of *Practi*(*ca*) (…) *copiosa in arte Chirurgica*, by Giovanni de Vigo issued in 1520 in Venice

3.1.2.2 Alfonso Ferri

The same attitude toward the management of gunshot wounds, still considered poisonous, was advocated by **Alfonso Ferri** (ca. 1515–1595) in his *De Sclopetorum sive Archibusorum Vulneribus* (On the Wounds of Firearms or Arquebus) [3] (Fig. 3.3). He also described how to remove a bullet from inside the body. Once the bullet had been located, using a probe he invented (Fig. 3.4), Ferri introduced the *Alphonsinum*, a sophisticated three-armed forceps especially designed by him, and therefore named after him, to grab the bullet. By pushing the handle of the instrument downward, the arms sprang apart and the bullet would lie in the middle of the device. By retracting the handle, the bullet, firmly incorporated within the arms of the forceps, could be removed easily (Fig. 3.5).

The tract, first published in Rome in 1552, enjoyed enormous success for being one of the first on the topic and for the accurate analysis of gunshot wounds either from a medical or surgical standpoint. It was reprinted numerous times independently, or associated with other collected works, or included in encyclopedic publications on surgery.

Born in Naples, probably around 1515, Ferri studied medicine and surgery and practiced partly in Naples and partly in Rome. In 1535, he was invited to Rome by Pope Paul III becoming his personal physician, a position that Ferri maintained with his successors Pope Paul IV and Pope Giulio III. He was a lecturer at the University of Rome until 1561, when he returned to Naples where he taught surgery at Naples University until 1589 and died presumably about 1595.

Fig. 3.3 Supposed portrait of Alfonso Ferri, inscribed in the woodcut initial "A." (From: *De Sclopetorum sive Archibusorum Vulneribus*. Leiden, Mathias Bonhomme, 1553)

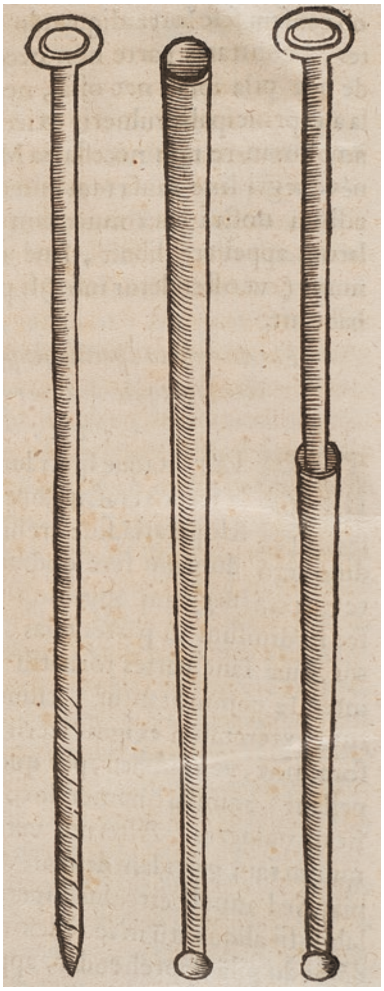


Fig. 3.4 The probe designed by A. Ferri to locate a bullet in the body. (From: *De Sclopetorum sive Archibusorum Vulneribus*. Leiden, Mathias Bonhomme, 1553)

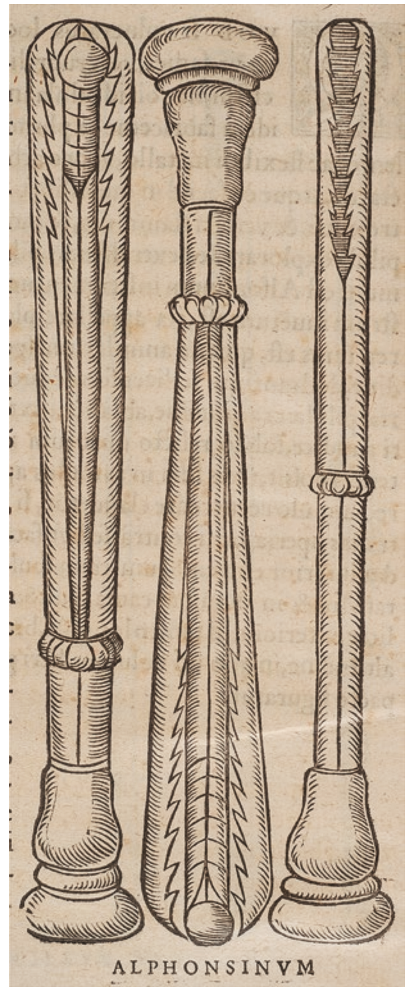


Fig. 3.5 The *Alphonsinum*, a three-armed forceps invented by A. Ferri to grab the bullet in the depth of the body. (*center*) The bullet is firmly incorporated within the arms of the forceps. (From: *De Sclopetorum sive Archibusorum Vulneribus*. Leiden, Mathias Bonhomme, 1553)

3.1.2.3 Ambroise Paré

It was during the siege of Turin (1536-1537) that the famous French surgeon **Ambroise Paré** (1510–1590) (see Sect. 3.2.2 for biography) carried out the first prospective double-blind *clinical trial* in history—by chance. He ran out of oil, so he used simple dressings instead, applying a soothing ointment made of egg yolk, oil of roses, and turpentine to the wounds, and noticed that it relieved pain and sealed the wound effectively. When he returned to the battlefield the following morning, he compared the two groups of patients. Those traditionally treated with boiling oil and cauterization were in agony, whereas those treated with a simple dressing had recovered, with less pain and no sign of infection due to the antiseptic properties of turpentine. He drew the conclusion that the less invasive methods were far superior to the traditional ones, with great benefit for the soldiers. He reported his observation in *La Methode de Traicter les Playes Faictes par Hacquebutes et autres bastons à feu* (On the Method of Treating Arquebus and other Firearms Injuries), issued in Paris in 1545 [4].

Three other authors provided a significant contribution to the study and management of gunshot wounds: **Bartolomeo Maggi, Leonardo Botallo**, and **Laurent Joubert.**

3.1.2.4 Bartolomeo Maggi

Bartolomeo Maggi (1477–1552) of Bologna was a lecturer in anatomy and surgery at Bologna University from 1541 to 1552 and court physician to Pope Julius III. As an army surgeon, he treated wounded soldiers of the papal troops during of the war of Parma (1551) and the siege of Mirandola (1551). His nephew, **Giulio Cesare Aranzio** (1530–1589), was a celebrated anatomist at Bologna University and the teacher of **Gaspare Tagliacozzi** (1545–1599) (see Sect. 3.3.5.2). Maggi wrote *De Vulnerum sclopetorum et bombardarum curatione Tractatus* (Tract on the healing of wounds of firearms and bombards) [5]. However, due to his sudden death, the work was posthumously published by **Gian Battista Maggi**, Bartolomeo's brother. *De Vulnerum sclopetorum* (…) is considered the first book dedicated solely to gunshot wounds and their treatment, using rational methods (Fig. 3.6). In agreement with Paré (1510–1590), Maggi strongly opposed the contemporary belief that gunshot wounds were toxic, from the presence of poisoned gunpowder, avoiding the current practice of pouring boiling oil on the wound for cleansing. He demonstrated instead that wounds caused by gunpowder neither burn nor are poisoned. In fact, shells propelled by firearms do not burn. Moreover, their components, sulfur, saltpeter, and silica carbonate, neither have the characteristic of poison nor become poisonous when mixed, and the mixture can be tasted without any ill side effect. On the contrary, he emphasized that gunshot wounds are similar to contusions. They produce a severe local and general trauma with varying consequences, depending on the gravity of the lesion.

He recommended early bullet excision by means of dedicated instruments, like straight and curved forceps—and forceps with detachable blades (Fig. 3.7)—most of them invented by him. For bullet removal, the soldier was requested to stand in the same position he was in when wounded. He also advocated removal of the grains of gunpowder, using special probes. Local treatment of the wound was by excision of the dead tissue (necrectomy), accurate rinsing by water, and dressing with a mixture of egg yolk, aloe, and sea salt. Finally, he carefully examined the nature of gangrene and considered possible amputation modalities. If gangrene appeared, as a consequence of inflammation and infection, cauterization was not advisable, but immediate amputation was recommended. After the operation, the stump was immersed in boiling oil containing sulfur to prevent postoperative hemorrhage.

De Vulnerum sclopetorum (…) was very successful and considered of great scientific value. It was included in an encyclopedia of the top surgical works of the time, edited by **Conrad Gesner** (1516–1565) and published in Zürich in 1555, under the title *De Chirurgia Scriptores Optimi* [6].

BARTHOLO
MEI MAGGII DE VVLNERVM
SCLOPETORVM, ET BOMBAR-
darum curatione Tractatus.

MERITO

Bononiæ per Bartholomeum Bonardum
Anno M. D. LII.

Fig. 3.6 Title page of *De Vulnerum sclopetorum et bombardarum Curatione Tractatus* by Bartolomeus Maggi, published in 1552 in Bologna

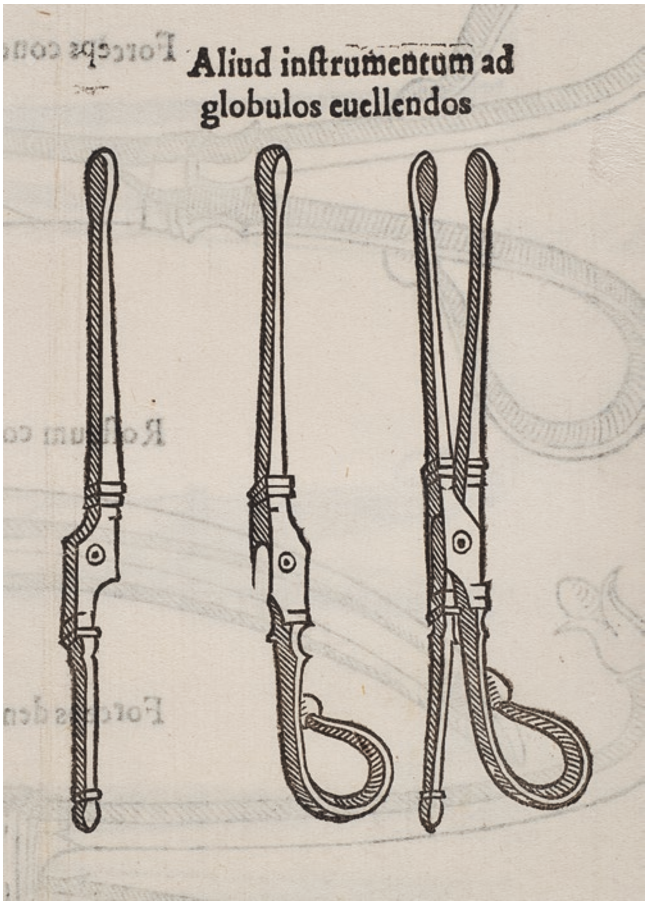
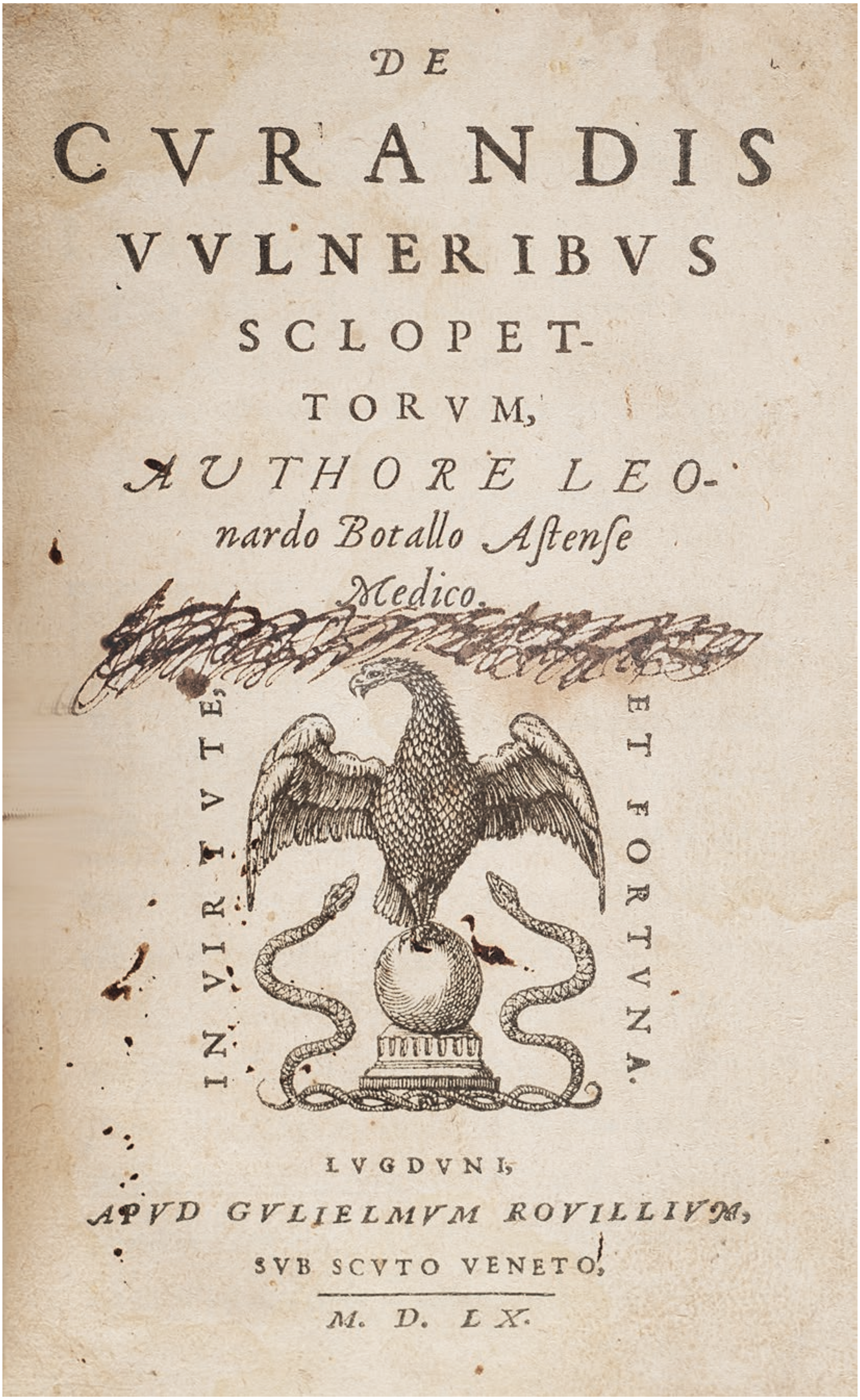


Fig. 3.7 The forceps with detachable blades, designed by B. Maggi, to remove the bullet from the body. (From: *De Vulnerum sclopetorum et bombardarum Curatione Tractatus*. Bologna, B. Bonardo, 1552)

3.1.2.5 Leonardo Botallo

Maggi's theories were accepted by his contemporaries albeit with great difficulty. **Leonardo Botallo** (ca. 1519–1587) from Asti (Piedmont), an army surgeon, supported Maggi's views in *De Curandis Vulneribus Sclopetorum* (On the management of the wounds of firearms) first published in Lyon in 1560 [7] (Fig. 3.8). Local therapy included honey and rose oil packed into the wound, covered by lint and wound cleansing. He was concerned about the neurological consequences of head traumas. In case of injury to the inner table, the skull had to be exposed immediately and the depressed bone elevated. Penetration of a bullet into the skull had a negative prognosis, and presence of splinters required their careful removal.

In 1560, Botallo moved to Paris, where he became personal physician of King Charles IX. During his service at the French royal court, he enjoyed the favor and protection of the Queen, Catherine de' Medici. He cured Henry I, Duke of Guise, who was injured in the cheek and ear as a consequence of a gunshot wound. The name Botallo is associated with *Botallo's duct* (ductus arteriosus), *Botallo's foramen* (foramen ovale), and *Botallo's ligament* (ligamentum arteriosum). He died in 1587, probably in Chenonceaux or Blois.



DE

CVRANDIS VVLNERIBVS SCLOPET-TORVM,

AVTHORE LEO-nardo Botallo Astense Medico.

IN VIRTVTE, ET FORTVNA.

LVGDVNI,

APVD GVLIELMVM ROVILLIVM,

SVB SCVTO VENETO.

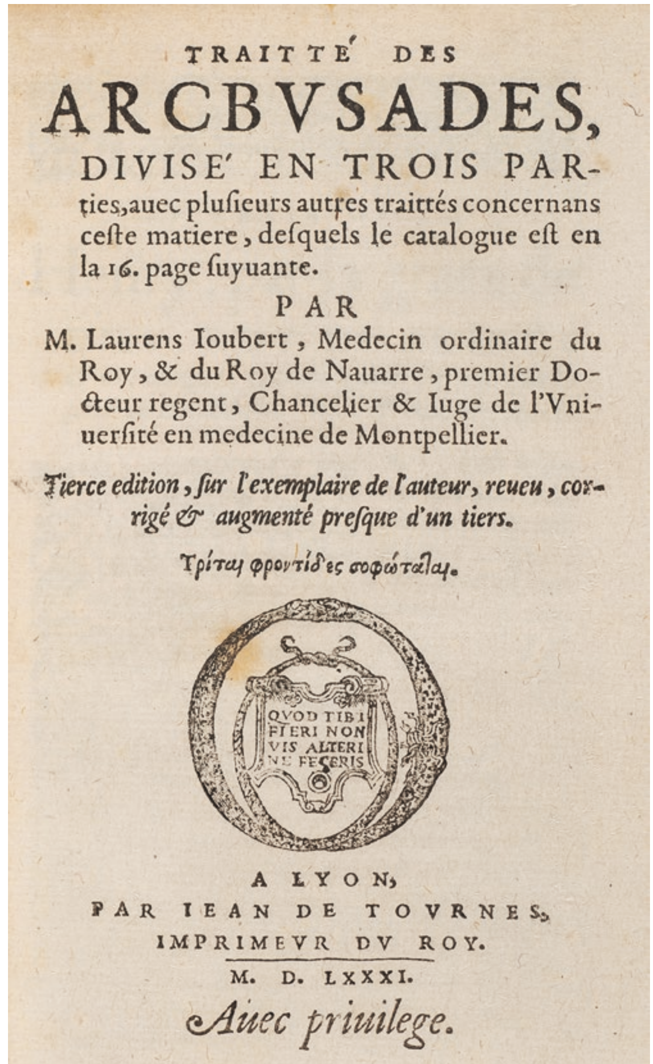
M. D. LX.

Fig. 3.8 Title page of *De curandis Vulneribus sclopetorum* by Leonardo Botallo, published in 1560 in Lyon

3.1.2.6 Laurent Joubert

The third author who wrote an important tract on gunshot wounds was **Laurent Joubert** (1529–1583), personal physician to King Henry II of France and Chancellor of the Medical Faculty of Montpellier University (Fig. 3.9). He served the royal army in the campaign of 1569. A contemporary of Ambroise Paré, Joubert published a very fine booklet, *Traité des Arcbusades* (Tract on Arquebus) first issued in 1570 and dedicated to Henry III [8] (Fig. 3.10), which went through three editions. He strongly contested the general trend of using boiling oil for wound cleansing. He used ointments at the most suitable temperature, either warm or cold. He was concerned about obtaining a good scar: *Comment on fera belle cicatrice, qui paroisse peu ou point* (How to make a nice scar, which appears minimally visible or unnoticeable).

Fig. 3.9 Portrait of Laurent Joubert (1529–1583), personal physician to King Henry III of France and Chancellor of the Medical Faculty at Montpellier University



TRAITTE' DES
ARCBVSADES,
DIVISE' EN TROIS PARties, auec pluſieurs autres traittés concernans ceſte matiere, deſquels le catalogue eſt en la 16. page ſuyuante.

PAR

M. Laurens Ioubert, Medecin ordinaire du Roy, & du Roy de Nauarre, premier Docteur regent, Chancelier & Iuge de l'Vniuerſité en medecine de Montpellier.

Tierce edition, ſur l'exemplaire de l'auteur, reueu, corrigé & augmenté preſque d'un tiers.

Τρίται φροντίδες σοφώτεραι.

QVOD TIBI FIERI NON VIS ALTERI NE FECERIS

A LYON,
PAR IEAN DE TOVRNES,
IMPRIMEVR DV ROY.
M. D. LXXXI.
Auec priuilege.

Fig. 3.10 Title page of *Traité des Arcbusades* by Laurent Joubert, published in 1581 in Lyon

3.1.3 Treatment of Head Wounds

Apart from the epidemics and gunshot wounds, another of the major concerns of Renaissance surgery was the treatment of head traumas. Various authors wrote on this topic over the years. Among them are **Berengario**, **Ingrassia**, **Paré**, **Fallopio**, **Dalla Croce**, and **Carcano Leone**.

3.1.3.1 Jacopo Berengario da Carpi

Jacopo Berengario da Carpi (or Jacopo Barigazzi) (ca. 1460–1530) [9] was born in Carpi, near Modena (northern Italy) about 1460. He was brought up at the court of Lionello Pio, noble of Carpi, and educated by the best teachers of the period, among them Aldo Manuzio (ca. 1450–1515), printer and humanist. However, Jacopo manifested a rebellious, violent character. During a riot in his home city, he was imprisoned for having misspoken of the Duke of Ferrara, Ercole I. He was condemned either to pay a fine of 100 ducats or to have his nose amputated. His father paid the fine, saving Jacopo's nose, but Jacopo had to leave the city of Carpi. He established himself in Bologna, where he graduated in medicine, becoming a lecturer in anatomy and surgery at the *Studium* of Bologna [10] (Fig. 3.11). Very smart and well educated, he practiced medicine and surgery. His fame spread rapidly beyond Bologna, and he was requested for consultation in different Italian cities, to visit and cure prominent, important patients. In 1517, he successfully treated Lorenzo de' Medici, Duke of Urbino, for a severe occipital injury.

Upon his return to Bologna, he wrote *Tractatus de Fractura calvae sive Cranei* (Treatise on Fractures of the Calvaria or Cranium) to show other physicians how to manage head traumas properly [11, 12]. He published two other important illustrated works dealing with anatomy (see Sect. 8.4.3.1): in 1521, *Commentaria cum amplissimis Additionibus supra Anatomiam Mundini* (Commentaries with many Additions, on the Anatomy of Mondino) [13], and in 1522 *Isagogae Breves Perlucidae ac Uberrimae in Anatomiam Humani Corporis* (Short Introduction on the Anatomy of the Human Body) [14]. He was one of the first to cure syphilis with mercury, claiming that he could heal patients definitively. For this, he charged patients one hundred ducats paid in advance. He amassed a conspicuous fortune that allowed him to lead a wealthy life and to buy a magnificent palace in Bologna where he could store his important art and book collections.

In 1526, he was in Rome to visit and cure Cardinal Pompeo Colonna, who was affected by facial cancer. While in Rome, he also treated other patients affected by syphilis and met Benvenuto Cellini (1500–1571), well-known goldsmith and sculptor, and bought a pair of silver vases from him. Giorgio Vasari (1511–1574), a painter and art historian, reported that Berengario, as compensation for his successful treatment, instead of money, requested a painting by Raphael Sanzio from Cardinal Colonna, *The Infant St. John in the Wilderness*, which is now in the Uffizi Gallery in Florence [15].

Upon his return from Rome, Berengario, for unknown reasons, lost his position of lecturer in anatomy and surgery at the Bologna *Studium*. In 1529, he moved to Ferrara, becoming court physician and surgeon to Duke Alfonso d'Este, husband of Lucrezia Borgia. He died in Ferrara about 1530. He bequeathed his considerable fortune to Alfonso and his nephews Gaspare and Damiano.

De Fractura calvae sive cranei, written in very pompous and verbose language, is a relatively unknown work, but its importance in the history of the management of head injuries is unquestioned. *Tractatus de Fractura calvae sive Cranei* (Treatise on fracture of the Calvaria or Skull), published in 1518 in Bologna by Jacopo Berengario da Carpi, was the first tract on head traumas ever printed and should be regarded as a reference point for all the tracts on the same subject published a few years later [9, 11, 12].

Dedicated to Lorenzo de' Medici, Duke of Urbino, who suffered a skull fracture in a battle in 1517, *De Fractura calvae* (…) originated following a dispute between Berengario and other physicians over the possible treatment of Lorenzo de' Medici. The work opens with a title page showing a profile of the human head with the representation of the three cerebral ventricles (Fig. 3.12). The contents are divided into two parts. In *Part One*, the author deals with the different types of injuries. Three modalities are recognized as possible cause: contusion, perforation, and cut (Fig. 3.13). From a prognostic point of view, it is important to establish whether the inner or the outer tables are affected. Finally, Berengario discusses the mechanism of contrecoup injuries. In *Part Two*, Berengario analyzes symptoms, prognosis, and treatment. Among the symptoms, he considers vomiting, loss of speech, torpor, loss of equilibrium, and vertigo. For prognosis, he emphasizes that head injuries should never be underestimated. Consequences may be dramatic. Predictable factors for prognosis are dural involvement, bone necrosis, infection, general conditions, and posture. Regarding treatment, Berengario explains that it can be performed either conservatively or surgically. In the first case, medical treatment with lint dressing soaked with egg yolk, or local poultice, which recipe is supplied, helps to stimulate wound healing. Should a surgical operation for evacuating a hematoma or raising a depressed bone be necessary, craniotomy has to be considered. The temporal bone is the ideal site for starting the procedure. The author illustrates the instruments necessary to perform the operation: trephine (*verticulum*) for penetrating the bone and getting access to the dura (Fig. 3.14); using a variety of burrs (*terebra*), each one with specific indication (Fig. 3.15); elevators for raising depressed bony fragments (Fig. 3.16); forceps for cutting and removing bone; chisels for incising; and a mallet. Finally, the technique for carrying out the craniotomy is discussed step by step.

Fig. 3.11 Supposed portrait of J. Berengario da Carpi, here indicated as *Carpus*, supervising a cadaveric dissection. (From: J. Berengario da Carpi *Isagogae Breves Perlucidae ac Uberrimae in Anatomiam Humani Corporis*. Bologna, Benedictus Hectoris, 1523)

Fig. 3.12 The brain ventricles. In the contemporary popular belief, they represented the site of the three mental faculties: common sense, cognitive function, and imagination. Title page of J. Berengario da Carpi. *De Fractura calvae sive Cranei*, Bologna, Hieronymus de Benedictis, 1518

Fig. 3.13 Different types of head injuries: contusion, perforation, and cut. Title page of *Tractatus perutilis et completus de Fractura Cranei* (Treatise useful and complete on the fracture of the skull). 3rd ed. by J. Berengario da Carpi. Venezia, G. de Nicolini de' Sabio, 1535

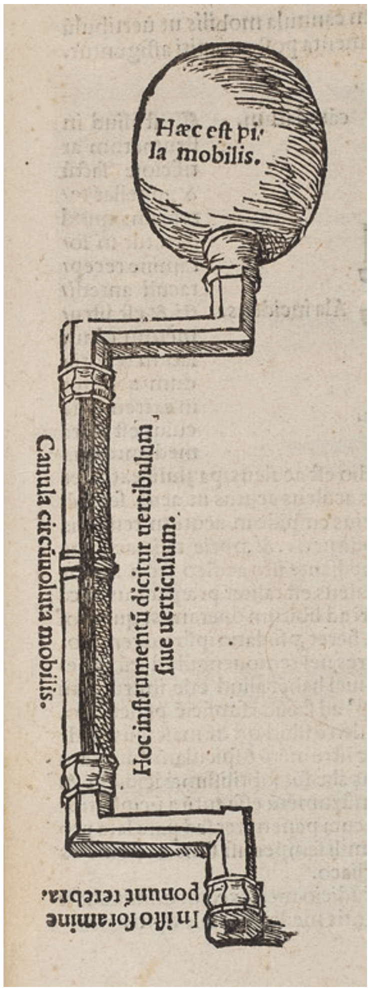


Fig. 3.14 Drill with a rotating handle. (From: J. Berengario da Carpi. *De Fractura calvae sive Cranei*, Bologna, Hieronymus de Benedictis, 1518)

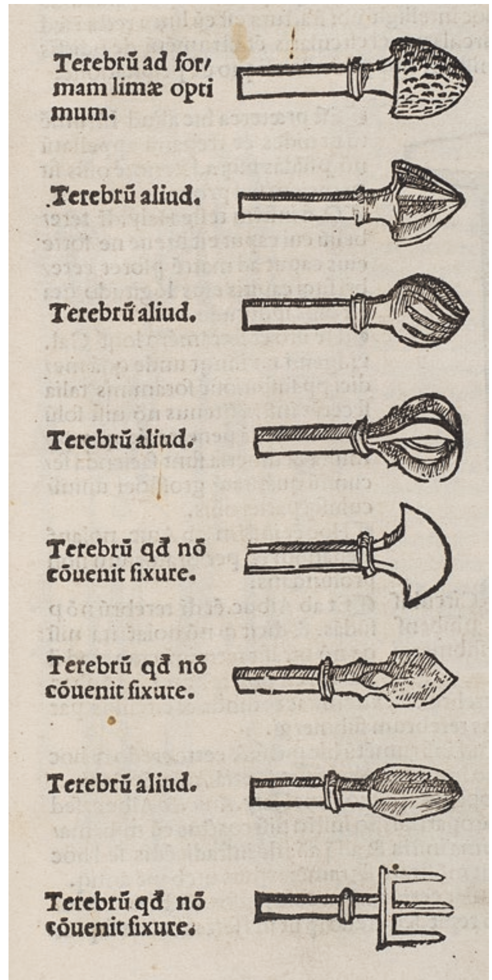


Fig. 3.15 Set of burrs (Latin *Terebra*) for craniotomy. (From: J. Berengario da Carpi. *De Fractura calvae sive Cranei*, Bologna, Hieronymus de Benedictis, 1518)

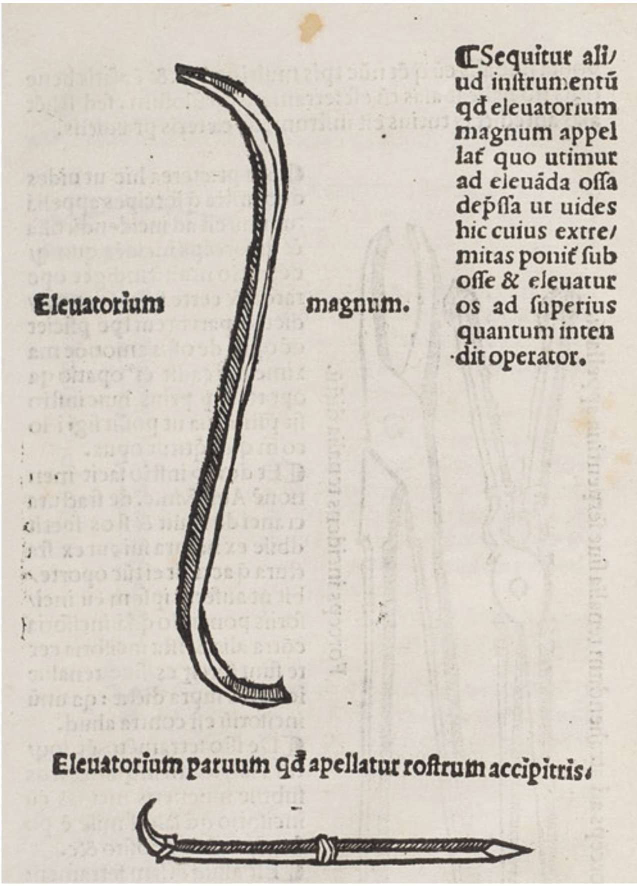


Fig. 3.16 Elevators (Latin *Elevatorium*) for raising depressed skull bone. (From: J. Berengario da Carpi. *De Fractura calvae sive Cranei*, Bologna, Hieronymus de Benedictis, 1518)

3.1.3.2 Giovanni Filippo Ingrassia

Giovanni Filippo Ingrassia (1510–1580) was born in Regalbuto, Sicily, studied medicine in Padua, and was later appointed Professor of Medicine and Anatomy in Naples. In 1560, he returned to Palermo where, by order of King Philip II of Spain, he was nominated protophysician of Sicily. He wrote numerous works—the most important considered to be *De ossibus* (On bones). In 1547, he published an *Iatrapologia*, a strong complaint against Sicilian physicians, continuously divided in local controversies (Iatrapology) and unable to produce anything of scientific value. As an appendix to the main text, he added an account on head injuries, *Quaestio quae Capitis Vulneribus ac phrenitidi medicamenta conveniant* (Question regarding the medicinals convenient for Head Injuries and Meningitis), where he discussed the best way to handle head traumas, either medically or surgically [16] (Fig. 3.17).

IATRAPOLOGIA

LIBER QVO MVLTA ADVERSVS
barbaros medicos diſputantur, collegijq́; modus
oſtenditur. ac multæ quæſtiones tam phyſi=
cæ quam chirurgicæ diſcutiuntur.

IOAN. PHILIPPO INGRASSIA
medico ac philoſopho, in Neapolitano ſtudio
ordinarie publiceq́; profitente, authore.

EIVSDEM QVÆSTIO, QVÆ CAPI=
tis uulneribus ac phrenitidi medicamēta cōueniant.

VIRTVTE DVCE
COMITE FORTVNA.

VENETIIS
IOAN. GRYPHIVS EXCVDEBAT.

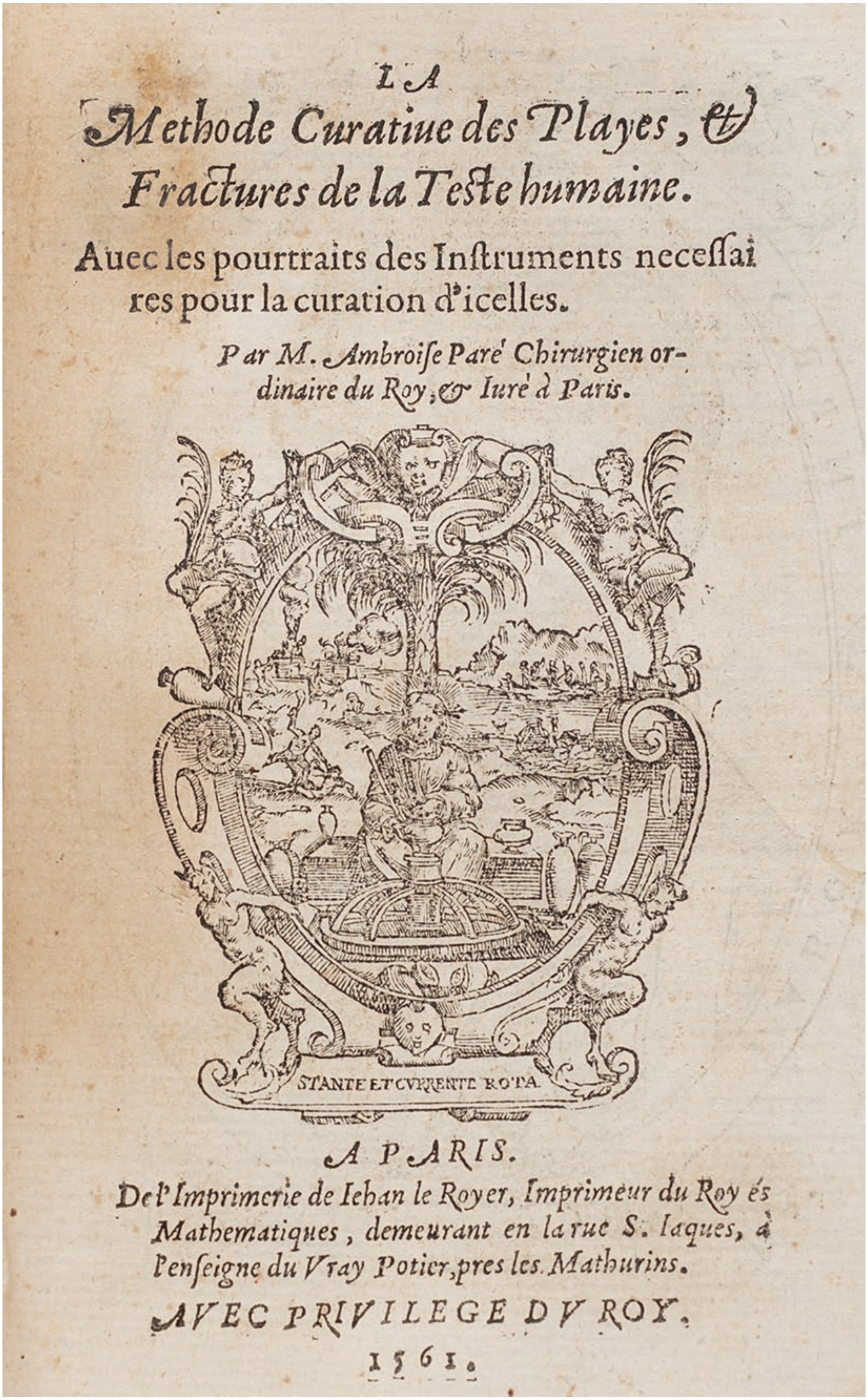
1547 ?

Fig. 3.17 Title page of *Iatrapologia* (…) *Quaestio Capitis Vulneribus* by Giovanni Filippo Ingrassia, published in 1547 in Venice

3.1.3.3 Ambroise Paré

Ambroise Paré (1510–1590) (see Sect. 3.2.2 for biography) in 1561 published *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtraits des Instruments Necessaires pour la Curation d'icelles* (the method of treating wounds and fractures of the human head. with illustrations of the instruments necessary to treat them) [17] (Fig. 3.18). The tract was originated following the death of King Henry II of France from the strike of a spear in the eye and brain during a tournament to celebrate the wedding of King Philip of Spain to Elisabeth of France. Paré described the orbital trauma, the ensuing death of the King after 11 days of agony, and the final autopsy.

The work is divided into two parts. *Part One* is devoted to the anatomy of the head and neck. It includes 19 anatomical figures mainly reproduced from Vesalius. Paré was a strong supporter of the importance of anatomy as a prerequisite for surgery. *Part Two* is on the clinical aspects of the wounds of the head and face. He shows the surgical instruments necessary for the management of head traumas: chisels, trephines (Fig. 3.19), forceps, cautery, and others. Regarding the face, he illustrates eye and nasal prostheses, to replace the missing parts. In case of posttraumatic amputation of the nose, he did not advocate nasal reconstruction using flaps, but preferred an artificial nose instead, a quicker and less invasive solution. Palatal fistulae are best managed with obturators to re-establish phonation and to avoid passage of food into the nose. He depicts these devices and how to insert them. To avoid unpleasant scars, he keeps the margins of the wound approximated by the application of two pieces of lint glued to the wound edges. Margins are approached gradually to reduce tension. The procedure is illustrated by one of the most famous figures in the history of surgery, the first representation of a facial wound closure (Fig. 3.20).



LA
Methode Curatiue des Playes, &
Fractures de la Teste humaine.
Auec les pourtraits des Inſtruments neceſſai
res pour la curation d'icelles.
Par M. Ambroiſe Paré Chirurgien or-
dinaire du Roy, & Iuré à Paris.

STANTE ET CVRRENTE ROTA.

A PARIS.
De l'Imprimerie de Iehan le Royer, Imprimeur du Roy és
Mathematiques, demeurant en la rue S. Iaques, à
l'enſeigne du Vray Potier, pres les Mathurins.
AVEC PRIVILEGE DV ROY.
1561.

Fig. 3.18 Title page of *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles.* Ambroise Paré. Paris, Iehan le Royer, 1561

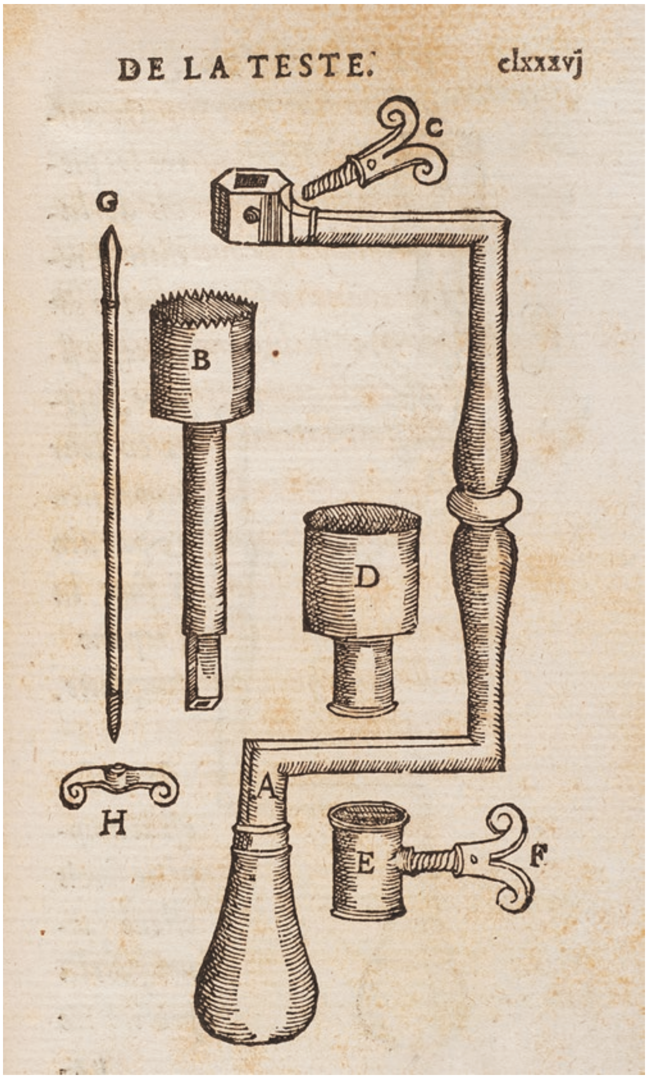


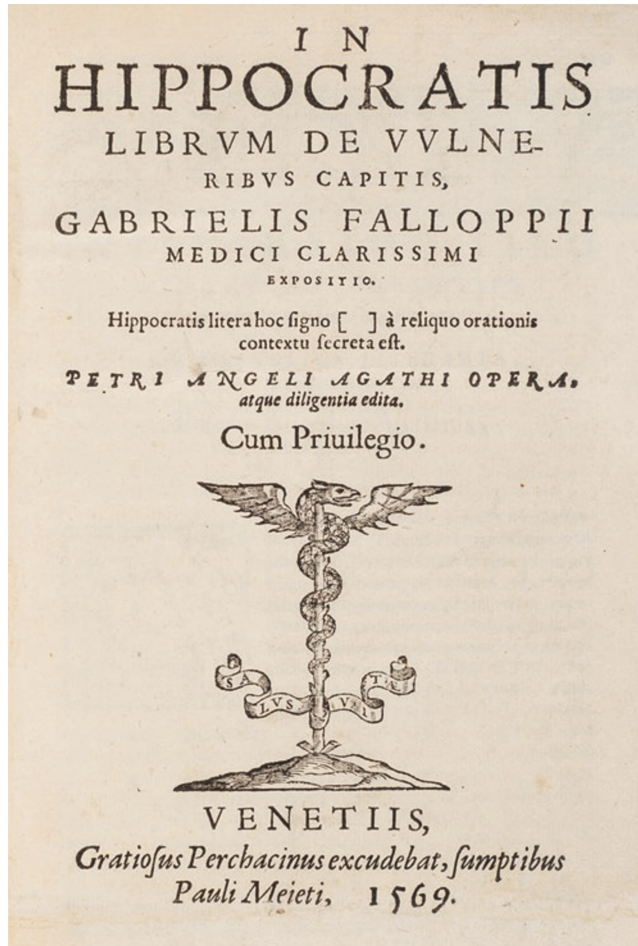
Fig. 3.19 The trephine and the burrs used by A. Paré for performing a craniotomy. (From: A. Paré *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

Fig. 3.20 First representation of a facial wound closure. Two pieces of lint glued to the wound edges are approached gradually to reduce tension and to avoid the widening or breakdown of the scar. (From: A. Paré. *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

3.1.3.4 Gabriele Fallopio

Gabriele Fallopio (1523–1562), considered the most outstanding Italian anatomist of the sixteenth century, was born in Modena (northern Italy). After his classical studies in his native city, he became a priest. He later graduated in medicine in Modena and practiced surgery. He moved to Ferrara, where he was a student of **Antonio Brasavola** (1500–1550) and **G. B. Canano** (1515–1579), and was named Chair of Pharmacy. In 1549, he was appointed Professor of Anatomy at Pisa University on the invitation of Cosimo I de' Medici. He remained there until 1551. At Realdo Colombo's death in 1559, he was offered the prestigious Chair of Anatomy at Padua University. He lectured with great appreciation by his students until his premature death in 1562, aged 39, from tuberculosis. He was succeeded by his student, **Hyeronimus Fabricius ab Aquapendente** (1537–1619).

An excellent and accurate dissector, he made important and fundamental contributions to anatomy, discovering the aqueduct, the ear's labyrinth, and the uterine tubes, eponymously named after him. During his lifetime, he published only one book, *Observationes anatomicae*, in 1561, at his own expense and without illustrations, where he collected his anatomical discoveries. The rest of his writings, originally lecture notes, were posthumously published by his students. He significantly contributed to the treatment of head traumas by revising and updating Hippocrates' work, *On the injuries of the Head*. His commentary *In Hippocratis Librum de Vulneribus Capitis* (…) *expositio* (Exposition on the book by Hippocrates on Head injuries) was first published in Venice in 1566 based on lecture notes assembled by one of Fallopio's students [18] (Fig. 3.21). The work, besides elucidating Hippocrates' text on cranial anatomy, covers an updated anatomy of the brain, the treatment of cranial fractures, injuries to the brain, convulsions, inflammations, and meningitis. Fallopio's detailed knowledge of the anatomy of the head assisted him in advancing surgical practice and in dealing with head wounds.


IN
HIPPOCRATIS
LIBRVM DE VVLNE-
RIBVS CAPITIS,
GABRIELIS FALLOPPII
MEDICI CLARISSIMI
EXPOSITIO.
Hippocratis litera hoc ſigno [ ] à reliquo orationis contextu ſecreta eſt.
PETRI ANGELI AGATHI OPERA, atque diligentia edita.
Cum Priuilegio.

VENETIIS,
Gratioſus Perchacinus excudebat, ſumptibus Pauli Meieti, 1569.

Fig. 3.21 Title page of *In Hippocratis Librum de Vulneribus Capitis expositio*, by G. Fallopio. Venezia, Paolo Meietto, 1569

3.1.3.5 Giovanni Andrea dalla Croce

Giovanni Andrea dalla Croce (1509 or 1511–1575) was born in Venice where he studied medicine and practiced with his father, a barber surgeon. In 1532, he became a member of the College of Surgeons of Venice. He achieved a great reputation and his surgical operations were well attended. From 1538 to 1546, he lived in Feltre (north of Venice), where he worked in the fields of medicine and surgery. Back in Venice, he married and was appointed physician to the Venetian fleet. At the same time, he pursued his anatomical and surgical studies. In 1573, he published *Chirurgiae, libri septem* in Latin [19] and in the following year in Italian [20]. The book had great success, thanks to its contents and the numerous illustrations, and was translated into different languages. It was reissued in 1583 in Italian with a different and more ambitious title *Chirurgia universale e perfetta* (Surgery universal and complete) and in 1596 in Latin *Chirurgiae universalis opus absolutum.* He died in Venice in 1575, aged 61, possibly of plague.

Chirurgia is divided into seven books. Although not specifically devoted to head traumas, it has an important section on this topic, with illustrations of surgical instruments and operation scenes. *Book One* deals with the skull's anatomy, the different types of wounds and concussions of the head, their symptoms, and the instruments and trephines necessary to manage head wounds. The postoperative course, treatment, and potential complications are accurately discussed. Dozens of illustrations of the most common surgical instruments available at that time for performing head operations (Fig. 3.22), as well as the first images in the history of medicine of a step-by-step neurosurgical operation, are shown.

Croce introduces the reader to a typical sixteenth-century operating room, with the patient lying in prone position. The first half-page woodcut illustrates the preparation of the patient beforehand (Fig. 3.23a), followed by two other amazing woodcuts showing the well-organized medical services, with the attendants arranging the instruments necessary for the procedure on a tray, while the surgeon is using two different types of trephines and burrs for cranial bone perforation and for accessing the dura. Soaked lint bandages are prepared in the meantime (Fig. 3.23b, c). *Book Two* is on management of facial wounds. To avoid an unpleasant, wide scar, Croce glues two pieces of lint on either side of the wound margins. A mobile string is passed through them. By pulling the string, the edges of the wound are gradually approximated and maintained united (Fig. 3.24). *Book Three* is on the nerves. *Book Four* deals with thoracic wounds. *Book Five* is on abdominal wounds. *Book Six* explains the technique of arrow extractions. A wide variety of arrows is presented, with two full-page woodcut illustrations showing arrow removal from the thorax of a severely injured soldier on the battlefield. An assistant holds a tray with the instruments necessary for the procedure (Fig. 3.25). Both illustrations are reproduced from Tagaultius [21]. Finally, *Book Seven* describes the different types of instruments available at that time for bullet removal.

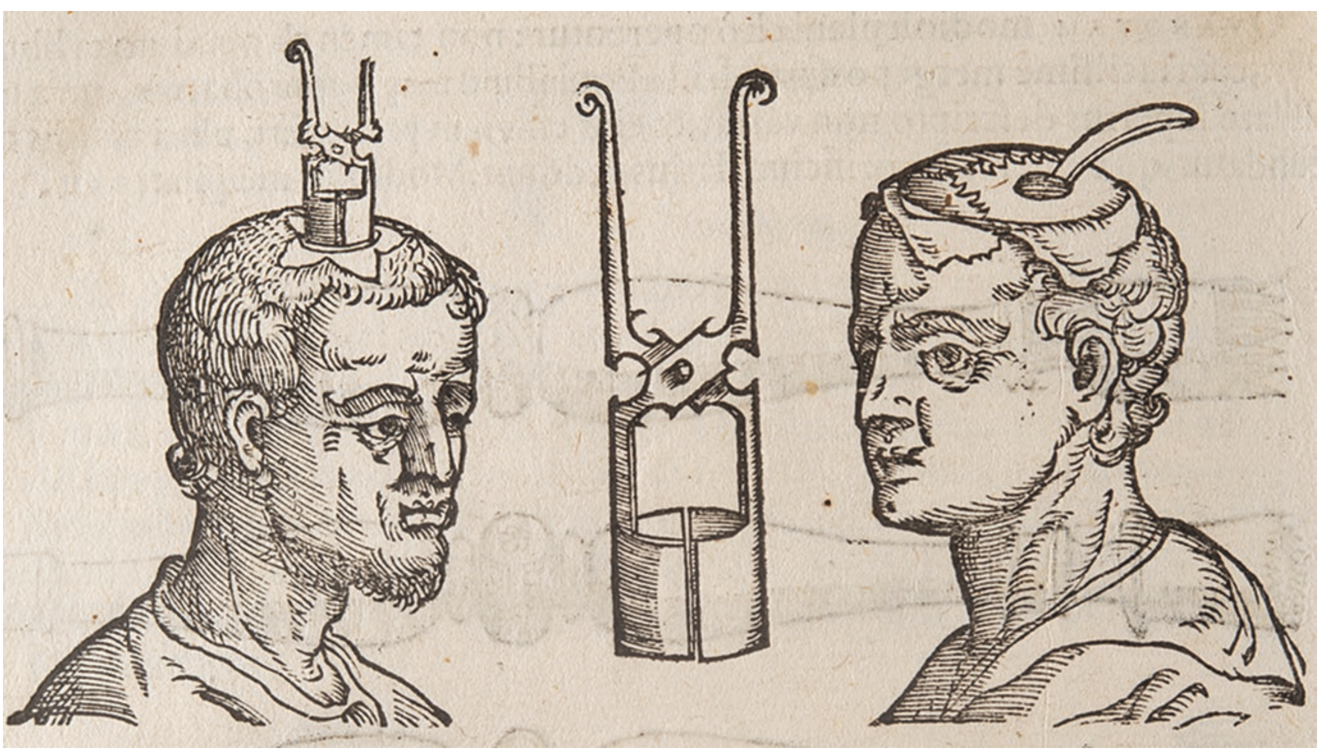


Fig. 3.22 Craniotomy and the instrument to perform it. (From: GA dalla Croce. *Chirurgiae, Libri septem*. Venezia, G. Ziletti, 1573)

Fig. 3.23 (**a**–**c**) A step-by-step neurosurgical operation, the first images in history. *Top*: a typical sixteenth-century operating room with the preparation of the patient before surgery. The patient lies in prone position behind the curtains. The surgeon makes the operative field ready, while an attendant keeps the instruments available on a tray. In the foreground an attendant warms the soaked lints. In the background a woman is praying. *Middle*: the surgeon is performing the craniotomy, while an attendant is illuminating the operative field with a candle. A woman is praying. *Lower*: the surgeon is performing the craniotomy using a different trephine. A woman is praying. (From: GA dalla Croce *Chirurgiae, Libri septem*. Venezia, G. Ziletti, 1573)

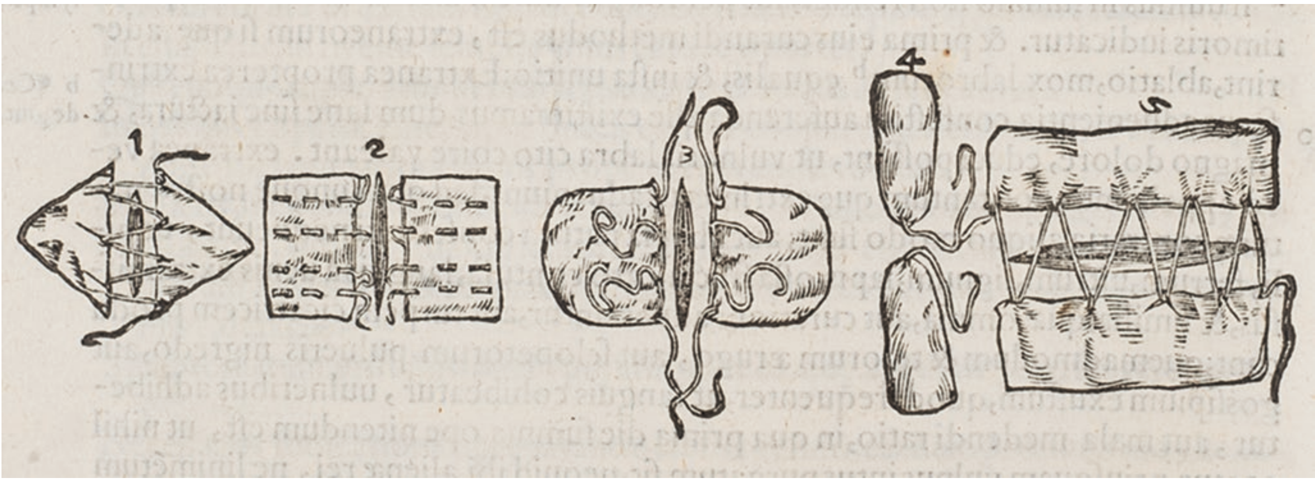


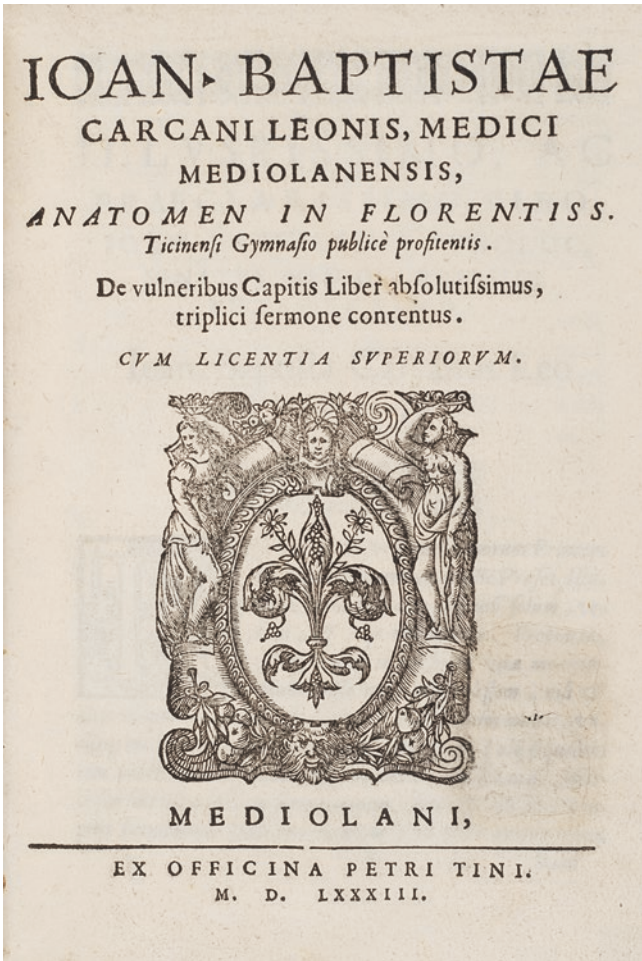
Fig. 3.24 Management of facial scar. To avoid an unpleasant, wide scar, the author glues two pieces of lint on either side of the wound margins. A mobile string is passed through them. By pulling the string, the edges of the wound are gradually approximated and maintained united. A forerunner version of modern Steri-Strips. (From: GA dalla Croce. *Chirurgiae, Libri septem* (Surgery in seven books). Venezia, G. Ziletti, 1573)

Fig. 3.25 A surgical operation on the battlefield. The surgeon tries to extract an arrow from the thorax of a severely injured soldier. An assistant holds a tray with the instruments necessary for the procedure. (From: GA dalla Croce. *Chirurgiae, Libri septem*. Venezia, G. Ziletti, 1573)

3.1.3.6 Giovanni Battista Carcano Leone

Giovanni Battista Carcano Leone (1536–1606) [22] wrote one of the few tracts, entirely devoted to head traumas. He was born in Milan and studied medicine at Pavia University with a particular interest in anatomy. At 19 years of age, he was appointed Head Surgeon of the Spanish troops of the Duke of Alba, participating as an army surgeon in the siege of Santhià (Piedmont). On that occasion he studied the gunshot wounds carefully, concluding that they were not poisonous. About 1555, he was appointed the head of the military hospital in Milan. During that period, he visited **Gabriele Fallopio** (1523–1562), celebrated anatomist and surgeon at Padua University, becoming one of his favorite students and potential successor. But, at Fallopio's death, the Senate of Padua chose **Fabricius ab Acquapendente** as the successor. Carcano returned to Pavia and was nominated lecturer on anatomy at that University from 1573 to 1605. He died in 1606, aged 70.

Carcano Leone summarized in a well-documented treatise, *De Vulneribus Capitis Liber Absolutissimus* (On the Definitive Book of Head Injuries), published in Milan in 1583 [23] (Fig. 3.26), what previous authors had reported over the years regarding head traumas and wrote how the different types of head wounds were described—and the ideal treatment recommended. The work was divided into three books. In *Book One*, Carcano described the symptoms that a surgeon should know before deciding for a trephination. *Book Two* dealt with the technique for accessing the dura, abrasion, and scraping the periosteum and bone for management of head traumas and fractures. In case of comminute fractures, Carcano suggested placing bony fragments into their original anatomical position. In *Book Three* he explained the technique for trephination, listed the indications for this procedure, and showed the appropriate size of the burr for performing the cranial trephination. He recommended exposure of the dura with multiple trephinations when symptoms of compression did not subside or in the presence of a subdural hematoma.



IOAN. BAPTISTAE
CARCANI LEONIS, MEDICI
MEDIOLANENSIS,
ANATOMEN IN FLORENTISS.
Ticinensi Gymnasio publicè profitentis.
De vulneribus Capitis Liber absolutissimus,
triplici sermone contentus.
CVM LICENTIA SVPERIORVM.
MEDIOLANI,
EX OFFICINA PETRI TINI.
M. D. LXXXIII.

Fig. 3.26 Title page of *De Vulneribus Capitis, liber absolutissimus* by GB Carcano Leone. Milano, 1583

3.1.4 Treatment of Wounds, Facial Wounds, Fractures, and Luxations and General Surgery

Besides the new problems of gunshot wounds and head traumas that originated on the battlefield, the Renaissance surgeon was involved in the routine work of the management of wound healing, fractures, and luxation. Particular attention was devoted to facial surgery in an attempt to obtain an acceptable scar. We have already seen that **Ambroise Paré** and **Giovanni Andrea dalla Croce** dedicated an entire section of their works *La Méthode curative des Playes et Fractures de la Teste Humaine* (1561) and *Chirurgia* (1573), respectively, on the technical details of achieving a good scar, possibly not too wide and minimizing the risk of potential breakdown. Both of them described how to approximate the margins by the application of two pieces of lint glued close to the wound edges and approached gradually to reduce tension (Fig. 3.20). However, dalla Croce's solution seems better because, thanks to mobile strings passed through the glued lint, the midline approximation could be increased gradually, depending on the local conditions established by the surgeon (Fig. 3.24).

3.1.4.1 Paracelsus

One of the most controversial figures of the Renaissance period was **Theophrastus Philippus Bombastus von Hohenheim** better known as **Paracelsus** (1493–1541) (Fig. 3.27), a native of Einsiedeln, near Zürich. Son of a learned physician, **Paracelsus** obtained his medical degree at the University of Ferrara (northeast Italy) in 1515 under Leonicenus. From the beginning, he was attracted by alchemy, astrology, and occult sciences. He travelled all over Europe establishing contacts and learning as much as possible from doctors, barbers, gypsies, midwives, fortune-tellers, and alchemists. He acquired an unusual competence in popular medicine and, in 1527, was appointed Professor of Medicine and City Physician of Basel. However, due to local conflicts, he had to leave the city the following year. He resumed travelling to different European countries, mainly in Germany, practicing and teaching everywhere with success. He died in Salzburg, aged 48, during a dispute in a tavern. A great thinker as well as a prolific writer, genius, and charlatan, he published on a vast number of subjects from medicine to alchemy, astronomy, astrology, and surgery first collected in a thick two-volume publication dated 1603–1605 and reissued in 1658 [24]. He influenced medicine for almost two centuries. His books were extremely successful and reprinted numerous times.

His most important work was *Grosse Wundartzney von allen Wunden*, *Stich*, *Schüssz*, *Bränd*, *Bissz*, *Beynbrüch*, *und alles was die Wundartzney begreifft* (great wound surgery on all wounds, stings, gunshots, burns, bites, leg fractures, and all that concerns wound treatment), first printed in Ulm (Germany) in 1536 and dedicated to Maximilian II of Habsburg (1527–1576), Holy Roman Emperor and King of Hungary and Austria [25]. The first part is addressed to physicians, surgeons, and barbers instructing the reader to treat the patient according to the nature of the disease or of the wound. It follows indications regarding management of wounds caused by arrows, bullets, burns, animal bites, fractures, cancerous swellings, fistulae, and hernias. Treatment was advocated with hygiene, surgery, and astral influence: *Keep the wound clean and distinct and preserve it from outside influences. The basic treatment that I would recommend for healing is that medicines be applied to protect the infected wound from external enemies. If a wound is open and unprotected, it is evident that it cannot heal. It is nature that prepares the destruction of the disease. The physician is merely an instrument to assist nature in its work. The treatment for wounds is therefore a defensive one, to ensure that no mishaps occur and no limitations are posed on nature's effects*. In other words, in agreement with Hippocrates, Paracelsus was convinced that healing was exclusively the province of nature. The physician could only assist natural forces, first of all by supplying adequate nutrition and then by preventing complications that may arise whenever contact between internal tissues and outside air take place. Early closure of the wound by means of nutritive substances was recommended—a very modern concept. On the contrary, according to Paracelsus, the use of sutures was contraindicated. The illustrations in the 1565 edition are by the famous Swiss-German artist and engraver, **Jost Amman** (1539–1591), depicting the interior of a hospital ward (Fig. 3.28) and the treatment of a head injury on the battlefield (Fig. 3.29).

Fig. 3.27 Portrait of TBP Paracelsus, by J. Robusti, named the Tintoret (1518–1594). (From: *Opera omnia Medico-Chemica-Chirurgica.* by TBP Paracelsus. Genève, Anthonij & Samuelis De Tournes, 1658)

Fig. 3.28 The interior of a hospital ward showing a consultation between two doctors examining the urine flask in the foreground and a surgeon amputating the leg of a patient in the background. Woodcut by the well-known engraver Jost Amman (1539–1591). (From: TBP Paracelsus. *Opus Chyrurgicumm* (…) *Wund und Artzney Buch.* Frankfurt, M. Lechler f. Feyerabend u. S. Hüter, 1565)

Fig. 3.29 Treatment of a head injury on the battlefield. Woodcut by the well-known engraver Jost Amman (1539–1591). (From: TBP Paracelsus. *Opus Chyrurgicum* (…) *Wund und Artzney Buch.* Frankfurt, M. Lechler f. Feyerabend u. S. Hüter, 1565)

3.1.4.2 Jean Tagault

In 1541, the King of France, Francis I (1494–1547) decided to establish a Chair of Surgery at the French College of Surgeons in Paris. **Jean Tagault** (ca. 1475–1545), one of the leading French surgeons before Ambroise Paré, eager to participate in the competition, rapidly prepared a surgical textbook *De Chirurgica Institutione libri quinque* (Surgical Institutions, in five books) first issued in 1543 [21]. The text was largely inspired by Guy de Chauliac's *Chirurgia Magna.* The woodcut illustrations were taken from those originally drawn for *Feldtbuch der Wundarztney* (Field Book of Wound Treatment) (1517) by Hans von Gersdorff (ca. 1455–1529). Apparently, the Parisian printer, Christian Wechel, acquired the original wood blocks and employed them for Tagault's book. The plates with the human skeleton, front, rear, and lateral, were plagiarized from *Tabulae Anatomicae sex* by **Andreas Vesalius** (1538). The work is divided into six books: *Book One* deals with tumors and swellings, *Book Two* with wounds, *Book Three* with sores, *Book Four* with fractures, *Book Five* with dislocations, and *Book Six*, written by Houllier d'Etampes, with recipes and remedies for surgical cases. Houllier, in Chap. 10 of his account on surgery, gives details about the approximation of post-traumatic separated parts, like lips, nasal tip, and ears. *De Chirurgica Institutione* was very successful. It went through numerous editions and was translated into French, Italian [26] (Fig. 3.30), and German and was also included in **Conrad Gesner's** (1516–1565) surgical encyclopedia *De Chirurgia scriptores optimi*, Zürich 1555 [6].

Tagault did not succeed in obtaining the professorship position, which was given to the Florentine surgeon Guido Guidi (or Vidius Vidi).

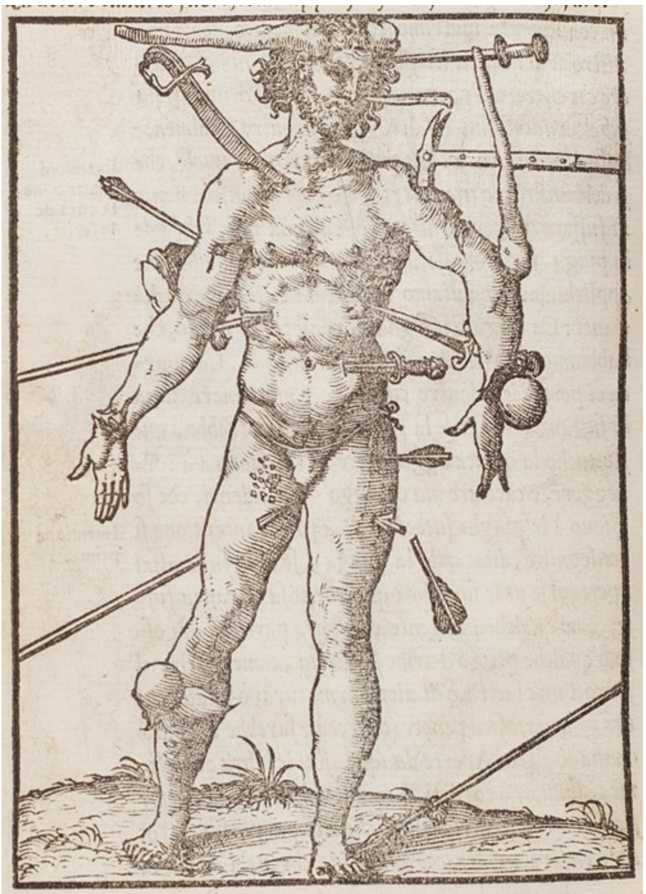


Fig. 3.30 The wounded man. The possible causes of trauma. (From: J. Tagault. *La Chirurgia* (…) *tradotta in buona lingua volgare*. Venezia, M. Tramezzino, 1550)

3.1.4.3 Guido Guidi

Guido Guidi (*Latin* Vidius Vidi) (ca. 1509–1569) was born in Florence (central Italy). His father was a physician and his mother the daughter of the famous painter Domenico Ghirlandaio (1448–1494). It is not known where Guidi studied medicine, most probably at Pisa University. He practiced medicine in Florence. Between 1534 and 1538, he was in Rome to oversee the interpretation and transcription of an important ninth-century Greek codex belonging to the Byzantine physician Niceta and known as *Raccolta di chirurghi greci* (Collection of Greek surgeons), acquired by Lorenzo de' Medici in 1442 and now preserved in the Laurentian Library in Florence. At the suggestion of Cardinal Ridolfi, Guidi carefully studied the unpublished surgical texts of Hippocrates, Galen, and Oribasius in the codex, added his own commentaries, and prepared a copy for the King of France, Francis I, a great patron of the arts. Francis I not only appreciated the donation but proposed its publication to Guidi, who at that time was living in Benvenuto Cellini's beautiful residence in Paris with the printer Pierre Gaultier. The Florentine Cellini (1500–1571), a celebrated sculptor and goldsmith, was a refugee in Paris, for political reasons.

Chirurgia e Graeco in Latinum Conversa (Surgery translated from the Greek into Latin), embellished by superb illustrations, was printed by Gaultier in Cellini's residence in 1544 and dedicated to Francis I, who subsidized the costs [27]. The episode was reported in Cellini's autobiography posthumously published in 1728 [28]. *Chirurgia* included three tracts by Hippocrates, on ulcers (*De ulceribus*), fistulas (*De fistulis*), and head wounds (*De vulneribus capitis*), with the commentary by Guidi. Head wounds had 21 woodcut illustrations of surgical instruments. It was followed by three other Hippocratic tracts, with the commentary of Galen, on fractures (8 woodcuts), on the devices for reduction of dislocations (11 large format woodcuts), and on the business of the physician (no illustration). Finally, three tracts, one by Galen on bandages (138 woodcuts) and two by Oribasius, the first one on laces (18 woodcuts) and the second on traction machines for reduction of dislocations (23 woodcuts)—most of them full page—concluded the work.

Chirurgia is one of the most striking and spectacular scientific textbooks to be printed in the Renaissance. Illustrations of surgical scenes were variously attributed to **Francesco Primaticcio** (1504–1570), to **François Jollat** (1502–1550), or to the school of **Francesco Salviati** (1510–1563). The magnificent full-page plates show different orthopedic procedures. Among them are the reduction of humeral fracture (Fig. 3.31), stabilization of jaw fracture (see Fig. 1.21), reduction of leg fracture (Fig. 3.32), and reduction of shoulder luxation (see Fig. 1.20). The physician, elegantly dressed, wearing a long gown, is taking care of the suffering patient. Some of these illustrations inspired **Ambroise Paré** for his *Dix livres de Chirurgie* (1564).

In the meantime, Francis I nominated Guidi a Professor of Medicine at the Royal College of France, and in 1541, he created the Chair of Surgery expressly for him. As we have seen, Jean Tagault unsuccessfully participated in the competition. At Francis I's death in 1547, without his support, Guidi left Paris. The Grand Duke Cosimo I de' Medici offered him the post of Professor of Philosophy and Medicine at Pisa University, where he started to teach in November 1548. During the period, 1548–1557, he wrote three works—*De Medicamentis, De Chirurgia,* and *De Anatome*—which remained in manuscript form and were eventually published by his nephew, Guido Guidi Junior, in the second half of the sixteenth century and first half of the seventeenth century in three volumes. They were titled *Ars medicinalis* and were first printed in Venice in 1611 [29] and later in 1626 in Frankfurt, 57 years after Guidi's death, as *Opera omnia, sive Ars medicinalis* (Collected works of Medical Art) [30]. Guidi died in Pisa in May 1569, aged 60, and was buried in Florence.

Fig. 3.31 Reduction of humeral fracture. (From: G. Guidi. *Chirurgia è Graeco in Latinum conversa*. Paris, Pierre Gaultier, 1544)

Fig. 3.32 Reduction of leg fracture, using a traction device. (From: G. Guidi. *Chirurgia è Graeco in Latinum conversa*. Paris, Pierre Gaultier, 1544)

3.1.4.4 Caspar Stromayr

Although the manuscript *Practica Copiosa* (Ample Practice) on herniotomy by the wound surgeon **Caspar Stromayr** (died 1566) has little to do with plastic surgery [31], in our opinion it plays an interesting role in the history of surgery for the amazing 186 color illustrations by an unknown artist, possibly by the author himself, about the day-to-day activity of the sixteenth-century surgeon. Management of hernia is presented step by step and in great detail. *Practica Copiosa* begins with the clinical examination of the different types of hernia (Fig. 3.33); the selection of the proper instruments for the operation (Fig. 3.34); the preoperative preparation of the patient with bathing and shaving (Fig. 3.35); the common prayer of the surgeon and his assistants before surgery (Fig. 3.36); the operative procedure, with the patient tied to the operating table in inclined position to allow the guts to get back into the abdomen; the incision and removal of the sac, along with cord and testicle (Fig. 3.37); and finally the postoperative care with the happy surgeon toasting the successful operation (Fig. 3.38). The manuscript remained hidden in the Library of Lindau for more than 350 years. It was rediscovered in 1909, studied by the medical historian W. von Brunn, from Rostock, and eventually published in facsimile in 1925.

Little is known about Caspar Stromayr's life. Probably born in Augsburg, his surgical training was through apprenticeship. In 1557, he was in Zürich with the Swiss surgeon Conrad Gessner, to learn surgery. He later established himself at Lindau (Lake Constance) where he practiced surgery, mainly operations for hernia and cataract. He married the daughter of a surgeon of Lindau and died about 1566.

Fig. 3.33 Preoperative clinical examination of a hernia. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

Fig. 3.34 The selection of proper instruments for the operation. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

Fig. 3.35 The preoperative preparation of the patient with bathing and shaving. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

Fig. 3.36 The common prayer of the surgeon and his assistants before surgery. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

Fig. 3.37 The operative procedure, with the patient tied to the operating table in inclined position, to allow the guts to return to the abdomen. The incision and removal of the sac. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

Fig. 3.38 The postoperative care, with the happy surgeon toasting to the successful operation. (From: C. Stromayr. *Practica Copiosa*. Manuscript, dated July 4, 1559)

3.1.5 Eye Surgery

In medieval Europe and during the Renaissance, ophthalmology was in the hands of itinerant eye surgeons and tooth extractors. These practitioners operated on cataracts in the public marketplace for a little amount of money. The miraculous procedure was almost bloodless and painless. Once the quack left, potential complications may have arisen, and the patient could become totally blind.

3.1.5.1 Georg Bartisch

Georg Bartisch (1535–1607) strongly contrasted these "blindmasters" and "eye-destroyers" of his time. He was born in the German village of Königsbrück (Saxony) and had no formal education. However, his surgical training was through apprenticeship with different eye surgeons, lithotomists, and general surgeons. He travelled and practiced in Saxony, Silesia, and Bohemia before establishing himself in Dresden, where he wrote in the vernacular *Οφθαλμοδουλεια (Ophthalmodouleia), das is Augendienst* (Ophthalmodouleia, or eye-service) [32] and was in the meantime appointed surgeon and oculist at the Court of August, Elector of Saxony. *Augendienst* is the first comprehensive text on the treatment of eye diseases that gives a detailed picture of sixteenth-century eye surgery. Profusely illustrated with large woodcuts made after figures drawn from life by the author, it depicts several eye conditions, including exophthalmos (Fig. 3.39), ptosis of the eyelids, and ectropium (Fig. 3.40), the first representation of blepharochalasis and its correction (Fig. 3.41), an eye operation performed by Bartisch in a clean environment with an assistant (Fig. 3.42), and the patient firmly tied in a chair before the beginning of the procedure (Fig. 3.43). The work is divided into 16 sections which cover anatomy, defects and diseases of the eye and sight (strabismus, cataract), anomalies of eyelids and eyelashes, injuries, pain in the eye, and injuries caused by witches or the devil. In fact, despite his skill in surgery, Bartisch strongly believed in astral and devil influences and in the use of amulets to prevent diseases. For each clinical situation, a medical or surgical treatment was proposed and described in detail. The anatomy of the brain and eye derived from Vesalius was illustrated with superimposed plates. In the history of anatomical illustration, this was a rather new way of presenting anatomy.

Fig. 3.39 Exophthalmos. (From: *Augendienst*, by G. Bartisch. Dresden, Matthes Stöckel, 1583)

Fig. 3.40 Ectropium. (From: *Augendienst*, by G. Bartisch. Dresden, Matthes Stöckel, 1583)

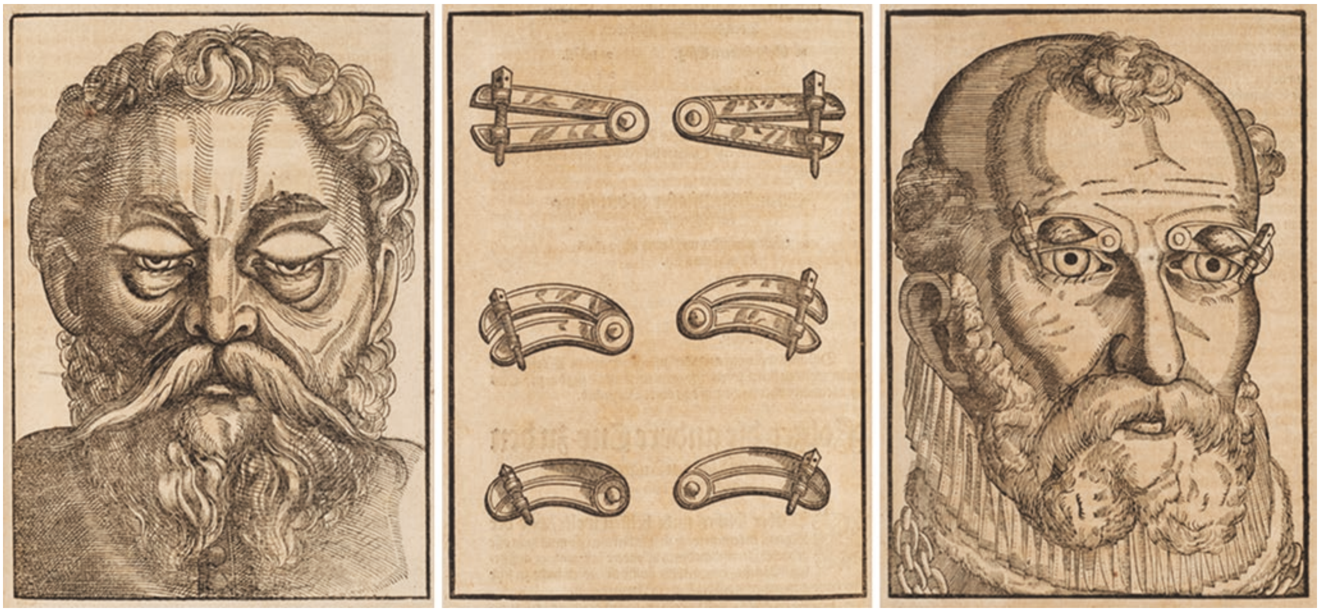


Fig. 3.41 (**a**, **b**, **c**) Blepharochalasis (*left*) and its correction using a guillotine knife designed by Bartisch (*middle*), surgical technique for redundant skin removal (*right*). (From: *Augendienst*, by G. Bartisch. Dresden, Matthes Stöckel, 1583)

Fig. 3.42 The surgeon is operating on a cataract. (From: *Augendienst*, by G. Bartisch. Dresden, Matthes Stöckel, 1583)

Fig. 3.43 The patient tied in the chair before the beginning of the operation. (From: *Augendienst*, by G. Bartisch. Dresden, Matthes Stöckel, 1583)

3.2 Three Leading French Surgeons

Three eminent surgeons dominated the French surgical scene of the middle of the sixteenth century with their great personality, bringing new ideas and innovations: **Pierre Franco, Ambroise Paré**, and later **Jacques Guillemeau.**

3.2.1 Pierre Franco

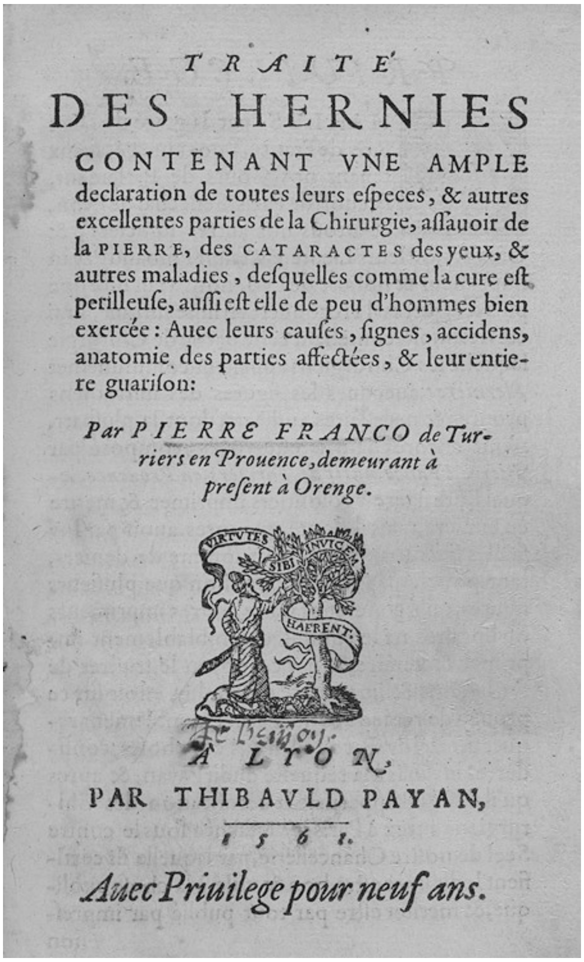
Pierre Franco (ca. 1500–1578) (Fig. 3.44) was born in Turriers, a small town in the lower Alps of Provence (southern France). Although we have no document concerning Franco's education, we know that he did not attend university. He learned surgery probably through apprenticeship, observation, visiting the Masters in Surgery in the south of France, and reading numerous ancient authors, sometimes in Latin and even in Greek. He probably belonged to the category of itinerant practitioners or incisors, without a fixed home, who moved from village to village, often leading a life as barber-surgeons to attend the poor people with lithotomy, herniotomy, couching of cataracts, and bone setting. He indignantly set himself up against the charlatans who pretended to operate without experience.

In 1545, he migrated, probably for religious reasons, to the French part of Switzerland, mainly in Lausanne, a city that had adopted the Calvinist Reformation. His first book, *Petit Traité contenant une des partie principalles de chirurgie* (Small Treatise containing one of the principal parts of surgery), was published in 1556 in Lyon and signed *Pierre Franco, surgeon of Lausanne* [33], accompanied by his motto: *Il faut endurer pour durer* (One must suffer to survive). It deals with hernias, bladder stones, cataracts, pterygion, cleft lip, amputations, and tumors. His main work, *Traité des Hernies* (…) (Treatise on Hernias (…) published in 1561 [34–37] (Fig. 3.45), also includes chapters on anatomy, obstetrics, cleft lip, medicine, and drugs. At that time, he was living in Orange, a commune in the Vaucluse Department in Provence.

Most likely for the same religious reasons, he moved to Switzerland again. In December of 1562 and again in May of 1564, he practiced in Lausanne and received payments from the city of Berne, as Lausanne belonged to the canton of Berne. In 1573, both Berne and Lausanne voted him an annual salary [36]. We assume that from 1573 to 1578, he was in Lausanne, but the 1579 stipend was not paid by Berne, due to his death the year before [36]. For Franco's description of his technique of uni- and bilateral cleft lip suture, see Sect. 9.1.2.4.

The writings of Franco are particularly innovative in different fields: hernias, bladder stones, cataracts, obstetrics, and clefts. According to a few official notices and quotations by people who knew him, Franco was a man of great talent, modesty, and humility. He performed several cadaveric dissections and prepared a whole-body skeleton for teaching purposes. One of these skeletons, with recreated joints, had been exposed to the public to show the movement of the various bones. He was rewarded a prize by the Swiss authorities.

Fig. 3.44 Supposed portrait of Pierre Franco included in a woodcut initial. (From: *Traité des Hernies*, by P. Franco. Lyon, Payan, 1561)



TRAITE'

DES HERNIES

CONTENANT VNE AMPLE declaration de toutes leurs eſpeces, & autres excellentes parties de la Chirurgie, aſſauoir de la PIERRE, des CATARACTES des yeux, & autres maladies, deſquelles comme la cure eſt perilleuſe, auſſi eſt elle de peu d'hommes bien exercée: Auec leurs cauſes, ſignes, accidens, anatomie des parties affectées, & leur entiere guariſon:

Par PIERRE FRANCO de Turriers en Prouence, demeurant à preſent à Orenge.

A LYON,

PAR THIBAVLD PAYAN,

1561.

Auec Priuilege pour neuf ans.

Fig. 3.45 Title page of *Traité des Hernies* (Treatise on Hernias) by P. Franco. Lyon, Payan, 1561

3.2.2 Ambroise Paré

Ambroise Paré (1510–1590), considered the most celebrated surgeon of the Renaissance, was born in 1510 in Laval, near Mayenne (northern France) [22, 38–41]. Little is known of his early life. His parents were humble and his education was meager. He grew up in a barber-surgeon environment in a period when physicians regarded surgery as the lowest level in the medical hierarchy. They treated diseases and left all cutting to the lowly barber-surgeons. Paré's father, his elder brother, and his brother-in-law were also barber-surgeons, under whom he may have served his apprenticeship. He learned neither Latin nor Greek.

In 1529, at the age of 19, he went to Paris to complete his training and became a surgical student at Hôtel Dieu, the most famous public hospital in Paris. By the time Paré entered the Hôtel Dieu, barber-surgeons were incorporated into the education system of the University of Paris. They could attend lectures on anatomy and surgery delivered by the faculty and take the master-barber's examination to gain professional recognition. However, he was too poor to pay for his studies to pass the examination.

In 1537, Paré became an army surgeon and participated in the Piedmont campaign (1537–1538). In 1539, he returned to Paris, now able to pay his fees to be accepted into the Company of Barber-Surgeons. A few months later, he married Jeanne Mazelin, the daughter of a wine merchant, with whom he had three children. While in Paris, he visited the celebrated physician Jacques du Bois (Sylvius) who encouraged him to write on his experience with gunshot wounds. However, the outbreak of war with Spain saw him accompanying the Vicomte Henri de Rohan on campaigns before Perpignan, in the Hainaut (1542), and before Landrecies. This delayed the completion of his work, which was eventually issued in 1545.

For the next 30 years, Paré participated in various military campaigns. France, in fact, was engaged in many wars against Italy, Germany, England, and, last but not least, the civil war against the Huguenots. He achieved a great reputation for his courage and his ability in curing soldiers and treating wounds. He was a tireless worker, and the motto which surrounds in his portrait, *Labor improbus omnia vincit* (Hard work conquers all), well defines the strength of his character (Fig. 3.46). In 1552, he was nominated surgeon to King Henry II. In 1554, the College of St. Côme, the powerful French surgical guild, conferred fellowship on him, despite the lack of formal education and his barber-surgeon origin. During his long life, he was appointed surgeon to four Kings of France: Henry II, Francis II, Charles IX, and Henry III. Famous and well respected, he died in Paris in 1590 from natural causes, in his 80th year.

3.2.2.1 War: A Crucial Factor in the Development and Spread of Paré's Ideas

It is a common belief that Paré's accomplishments were mainly due to France's campaigns in Italy. The war casualties gave him the opportunity to try out novel solutions. He could use new remedies and procedures on wounded soldiers, record his findings, and publish them. We have already seen (see Sect. 3.1.2.3), during the siege of Turin (1536–1537), Paré, by chance, modified completely his treatment plan regarding gunshot wounds with great benefit for the soldiers [4].

The second important innovation was his introduction of artery ligature instead of cauterization during amputation. The usual system of sealing wounds by burning the stump with a red hot iron often failed to arrest the bleeding and caused patients to die of hemorrhage. For a vessel's ligature, he designed a new instrument, the *Bec de Corbin* (crow's beak), a predecessor of modern hemostats. Although ligatures often spread infection, it was still an advance in surgical practice, and most important, it was less painful for the patient. Paré published the technique of using ligatures to prevent hemorrhage during amputation in his *Dix livres de la chirurgie* (Ten Books on Surgery) in 1564 [42].

3.2.2.2 Paré and Anatomy

He was a strong supporter of the value of anatomy as a prerequisite for surgery. His treatises on head traumas and on surgery were always preceded by large sections on the anatomy of the head and of the body, with numerous illustrations, mainly derived from Vesalius. In 1561, he published *Anatomie Universelle du Corps Humain* (Universal Anatomy of the Human Body) in the vernacular [43], illustrated by images plagiarized from Vesalius' *Fabrica* [44]. In doing so, he made Vesalius' text popular and accessible to surgeons.

3.2.2.3 Paré's Works

In the fifteenth and sixteenth centuries, medical books were very expensive; only a few people could afford to buy them. Written in Latin and printed in large format (*in-folio*), they were difficult to handle and only available for consultation in medical faculties or in monasteries.

Paré, who was essentially a practical man, broke the tradition. First of all, he understood the importance of circulating his own ideas and discoveries among the barber-surgeon community. For this reason, he wrote in his native tongue, that is, in French, and not in Latin. Secondly, he published his original works, nowadays extremely rare, in handy volumes, scholarly illustrated, small enough (*in-8vo*) to fit in the military surgeons' knapsacks, so they could find solutions to their problems easily on the battlefield. His surgical works, all issued in small format, could be printed in great numbers and readily obtained. The end result was that Paré's ideas were spread further, despite the fact that he was snubbed by the official physicians and members of the Parisian Medical Faculty for not writing in Latin. Thanks to the success of his publications, he gradually achieved great consideration and popularity.

He was a prolific writer whose principal works included a treatise on gunshot wounds, *La Méthode de traicter les playes faictes par Hacquebutes* (The Method of treating arquebus and other firearms injuries), 1545 [4], reissued in 1552 with a different title, *La Manière de Traicter les Playes Faictes tat par Hacquebutes que par les Fleches* (The Method of Treating Wounds made by Arquebus or Arrows) and significantly expanded in text and illustrations [45]; on head traumas, *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles* (The Method of Treating Wounds and Fractures of the Human Head. With the Illustration of the Instruments necessary to Treat them) 1561 [17]; on surgery, *Dix livres de la Chirurgie* (Ten books on Surgery), 1564 [42]; *Cinque livres de Chirurgie* (Five books on Surgery), 1572 [46]; and *Deux livres de Chirurgie* (Two books on Surgery), 1573, to which he added a treatise on monsters, *Des Monstres tant terrestres que marins, avec leurs portrais* (On Monsters either terrestrial or marine, with their portraits) [47]. Paré collected his works in a single *folio* volume, *Les Oeuvres* (The Works), with 360 illustrations, first published in Paris in 1575 and dedicated to King Henry III of France [48]. The book was frequently reprinted and translated into Latin, German, English, Dutch, and Japanese.

In 1840, Joseph-François **Malgaigne** (1806–1865), the great French surgeon and historian, assembled all the works by Paré in a three-volume edition, *Oeuvres Complètes* (Collected works), to which he added a well-documented commentary on the history of surgery in the Renaissance and on the life of Ambroise Paré issued in 1840–1841 [49]. The bibliography about Paré's works was published by J. Doe in 1937 [50].

3.2.2.4 Paré's Contribution to Plastic Surgery

Ambroise Paré invented many devices including obturators for the palate and stents for nostrils. He created several types of prostheses including artificial eyes made from enameled gold, silver, porcelain, and glass (Fig. 3.50); dentures; artificial noses (Fig. 3.47); artificial auricle (Fig. 7.67); and artificial legs and hands. His *Le Petit Lorrain*, a mechanical iron hand operated by catches and springs, worn by a French Army Captain in battle, is the first example of artificial hand in the history of medicine [45] (Fig. 3.48). Paré significantly improved the management of wounds, especially those resulting from gunshot, by stopping the barbaric use of boiling oil. To facilitate healing, avoiding potential wound breakdown and reducing the risk of unpleasant wide scar formation on the face, he applied adhesive and fastened the wound margins. *Now we shall briefly speak about cheek injuries. If a wound necessitates closure, it should be dry to avoid an unpleasant scar. People fear this event. Particularly pretty women. In doing this, you should take two pieces of canvas, not too thick and not too thin, of a size which fits to the wound and glued*. (…) *They should be applied on either side of the wound margin.* (…) *They should become dry, then sutured and approximated one against the other, as you see from the figure* (Fig. 3.20). *In this way the wound edges will be joined together* [17].

Regarding nasal reconstruction, in *Les Oeuvres* (The Works), Book 22, he wrote: *How to artificially repair a missing nose—In former times there was in Italy a surgeon* (Note: possibly Branca) *who initiated the method of repairing part of the nose that had been cut off. He would cut out the calloused edges on each side of the mutilated nose, as it is usually done in filling up a hare lip. Then with a sharp knife he would cut a hole in the biceps muscle as large as was required for the amputated portion of the nose. The fixation of the arm to the head is described, so that the union between the arm and the stump of the nose takes place. The separation occurs after forty days.* He continued by saying that: *this flesh is not of the same quality nor similar to that of the nose . . . and it can never be of the same shape and color as that which was formerly in the place of the lost nose. The greatest difficulty lies in establishing the nostrils* [48]. He advocated that nasal prosthesis made of gold, silver, or paper was the solution of choice, when the nose is completely severed, avoiding a long-lasting and painful procedure [45] (Fig. 3.47). To provide an easier reduction of the fractured nasal bone, Paré created a tubular support of wood, secured by wires, hollowed inside to facilitate breathing, placed temporarily into the nostril (Fig. 3.49).

He showed the first image of a cleft lip suture in medical literature (Fig. 9.1) and palatal obturators for reducing nasal air escape in cleft palate or in syphilitic palatal perforations (Fig. 9.16). For the description of his technique of cleft lip suture and use of palatal obturators, see Sects. 9.1.2.5 and 9.2.2.1, respectively. He reported and illustrated a vast number of congenital malformations, the so-called monstrosities, some real and others the result of fantasy.

Paré was noted for his modesty and dedication, recording his own achievements with modest satisfaction. His famous phrase, *Je le pensay, et Dieu le guarit* (I treated him, but God cured him), shows his humility. His greatest accomplishment, aside from the development of new surgical techniques, devices, and instruments, was the spreading of information throughout the barber-surgeon community, thereby elevating their surgical knowledge to a more professional level—an early example of Continuing Medical Education.

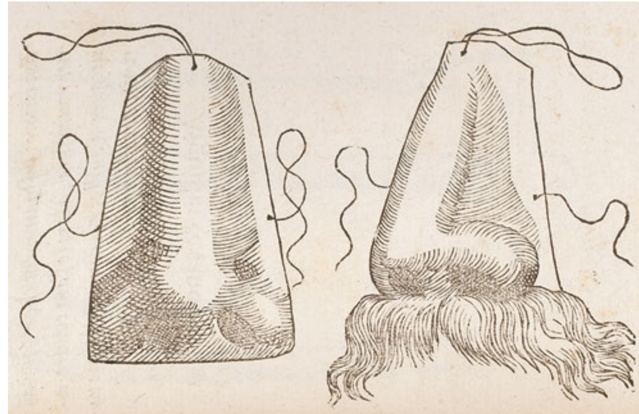


Fig. 3.47 Nasal prosthesis, made of gold, silver, or paper, for replacing a missing nose as a result of an injury. (From: A. Paré *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

Fig. 3.46 Portrait of Ambroise Paré, aged 45, probably by Jean Cousin (ca. 1490–1560), surrounded by his motto *Labor improbus omnia vincit* (Hard work conquers all). (From: A. Paré *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

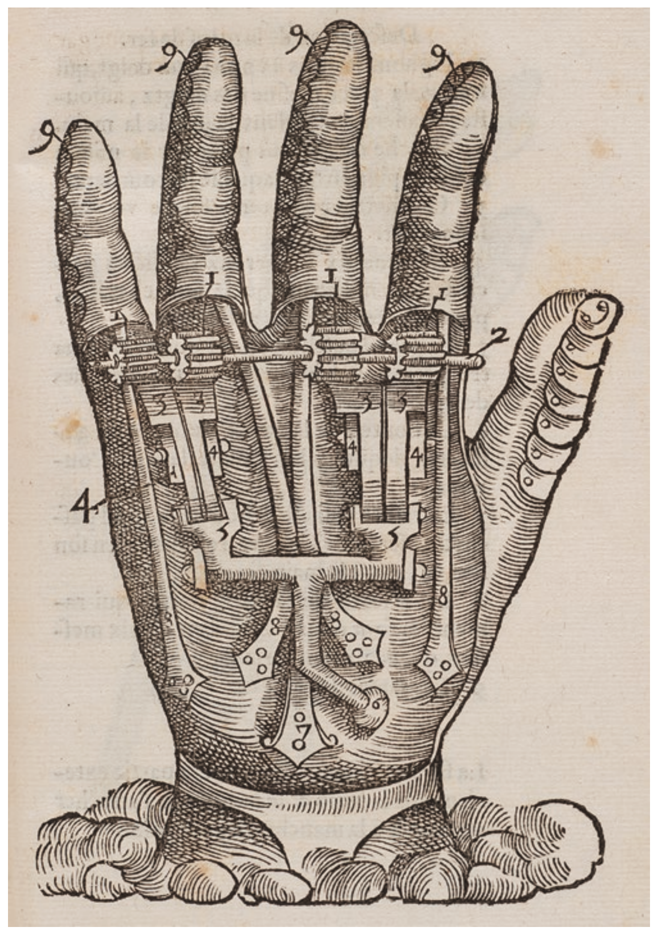


Fig. 3.48 *Le Petit Lorrain* (The Little Lorrain), a mechanical iron hand prosthesis operated by catches and springs, invented by A. Paré and first published in 1552. First example of artificial hand in the history of medicine. (From: Paré A. *La Manière de Traicter les Playes Faictes tat par Hacquebutes que par les Fleches.* Paris, Arnoul l'Angelié, 1552)

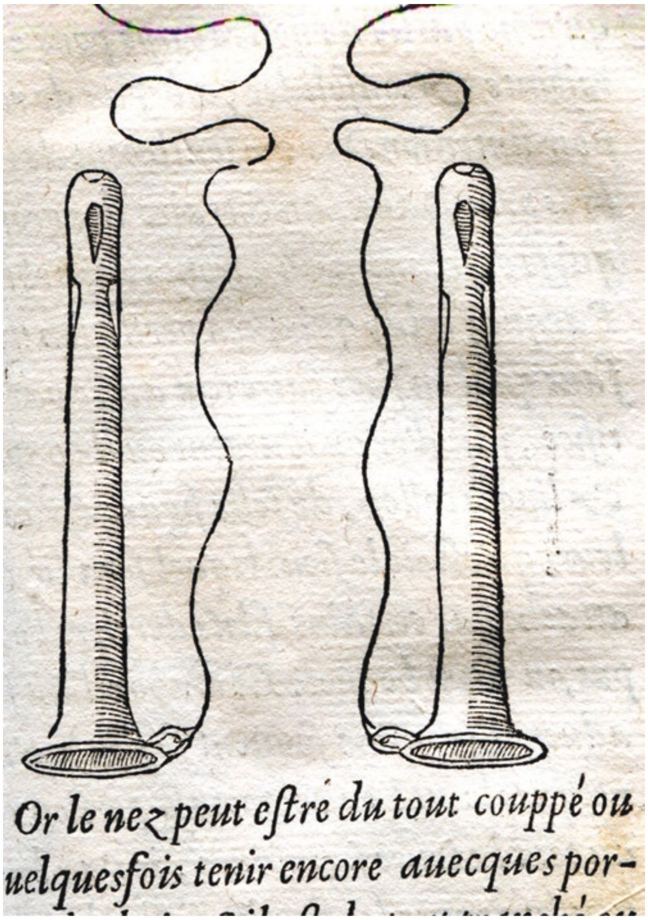


Fig. 3.49 Tubular support of wood, secured by wires, hollowed inside to facilitate breathing, placed temporarily into the nostril to provide an easier reduction of the fractured nasal bone. (From: A. Paré *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

Fig. 3.50 Artificial eyes made from enameled gold or silver. (From: A. Paré *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtrait des Instruments Necessaires pour la Curation d'icelles*. Paris, Iehan le Royer, 1561)

3.2.3 Jacques Guillemeau

Born in Orléans, **Jacques Guillemeau** (1550–1612) was the favored student of Ambroise Paré—and also his father-in-law. He was a surgeon at Hôtel Dieu, the most important hospital in Paris, and personal physician to Charles IX, Henry III, and Henry IV, Kings of France. He devoted himself to surgery on the battlefield and contributed to obstetrics, surgery, cleft lip (see Sect. 9.1.2.6), and ophthalmology. In 1584, Guillemeau published *Traité des maladies de l'oeil* (Treatise on eye diseases) which remained the standard text of ophthalmology for numerous years. He died in 1612, aged 62. His works were assembled in a single *folio* volume, *Les Oewres de Chirurgie* (Collected Surgical Works) first issued in 1598 and dedicated to King Henry IV of France [51]. The beautiful colored title page shows bullet removal, craniotomy, bloodletting, eye surgery, reduction of luxation, and leg amputation (Fig. 3.51). Numerous surgical instruments for different applications are illustrated. Among them is a set for removal of teeth (Fig. 3.52).

Fig. 3.51 Colored page showing some of the most common operations of the sixteenth century: bullet removal, craniotomy, bloodletting, eye surgery, reduction of luxation, and leg amputation. (From: Guillemeau J. *Les Oewres de Chirurgie*. Paris, Nicolas de Louvain, 1598)

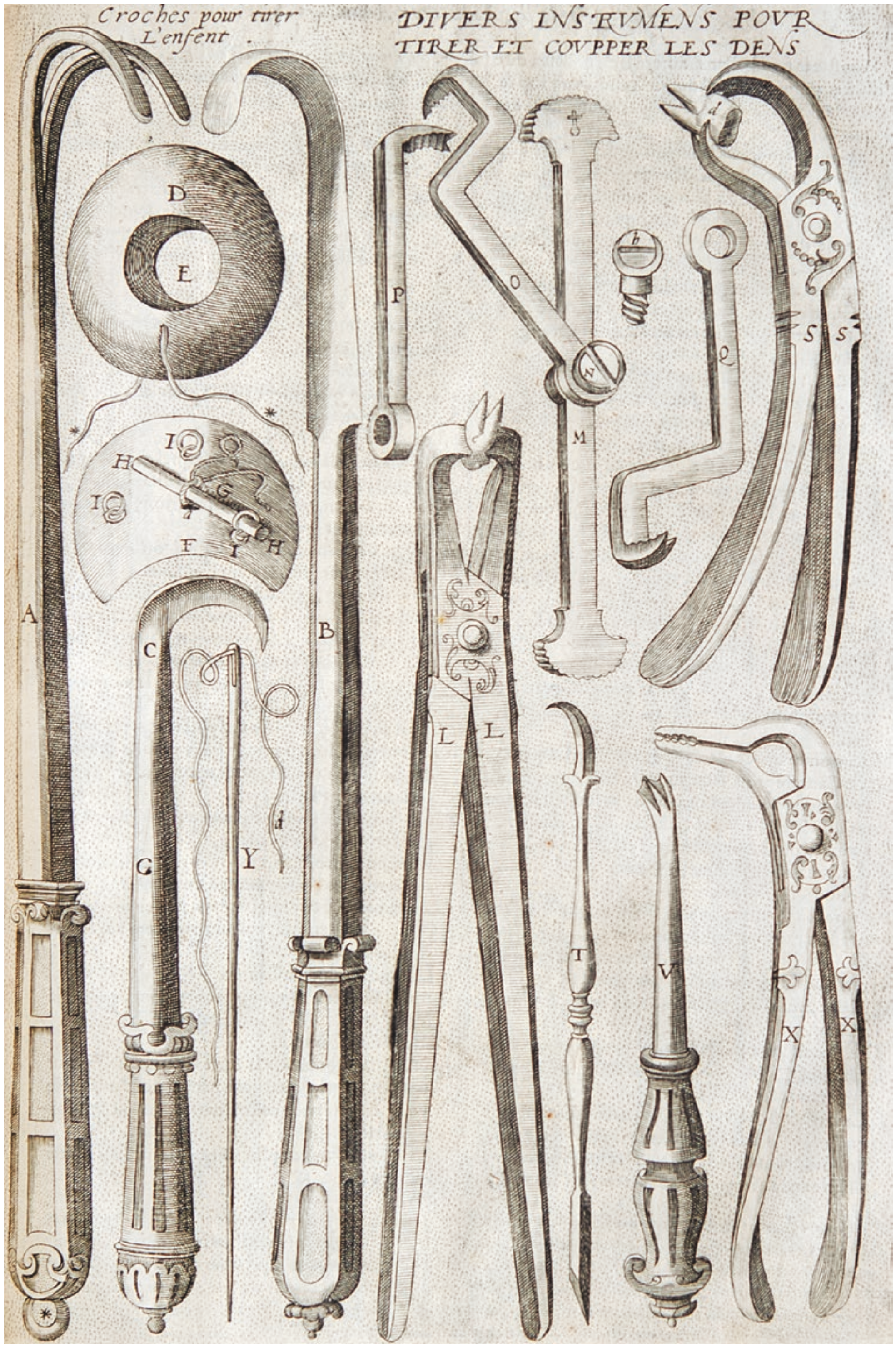


Fig. 3.52 Surgical instruments for removal of teeth. (From: Guillemeau J. *Les Oewres de Chirurgie*. Paris, Nicolas de Louvain, 1598)

3.3 The Nose Saga

Plastic surgery began with the operation of nasal reconstruction. In the western world, nasal repair started first in Sicily about the fifteenth century, continued in Calabria, and was systematized in Bologna with Gaspare Tagliacozzi in 1597.

3.3.1 Sicily

In Sicily, repair of injured noses was performed by members of the Branca family. Why in Sicily, and how the Brancas knew about this technique, is still open to speculation and debate. It is possible that some traveller, adventurer, or missionary who spent a certain period of time in India, having seen the operation of nasal reconstruction, unknown in Europe, brought the information back to the Middle East and from there to Sicily at the time of the Crusades. However, this is pure hypothesis and there is no trace in any document about it.

3.3.1.1 Gustavo Branca

Gustavo Branca (*fl.* first half of the fifteenth century) and his son Antonio practiced in Catania (Sicily). They left no writing and nothing is known about their lives. Their surgical art, transmitted by word of mouth, was kept as an inviolable surgical secret. The only official document recording their names is from 1412 in which Ferdinand I, King of Aragon and Sicily, granted the office of guardian of the seals of customs of the city of Palermo to Branca's father and his son [1]. Gustavo (the elder) developed the technique of nasal repair in his home town of Catania, using skin harvested from the cheek, something very similar to what Sushruta suggested (see Sect. 1.4).

3.3.1.2 Antonio Branca

Antonio Branca (*fl.* middle of the fifteenth century), Gustavo's son, already known as a reconstructive surgeon, made considerable improvements to the operation. Worried about the disfigurements that the technique caused on the face, he selected another donor site, aesthetically less important, that is, the arm, achieving good results in terms of nasal reconstruction, developing what is called *the Italian method*. The impact on the population was dramatic, and within a few years, rumors about this operation spread rapidly beyond Sicily, and contemporary writers mentioned it even in nonmedical publications [1, 52–54]. We have evidence of the Brancas' activity through numerous contemporary witnesses.

3.3.1.3 Pietro Ranzano

Pietro Ranzano (1420–1492), Bishop of Lucera (Sicily), in *Annales Mundi* (World's Annals), a chronicle of events written in 1442, reports: *The Sicilian Gustavo Branca was the most distinguished surgeon of the world. He invented a method for reconstructing amputated noses. His son Antonio made considerable progress to the splendid invention of his father. He discovered how it was possible to restore not only noses, but also mutilated lips and ears*. Regrettably, the text remained hidden in manuscript form in the library of Palermo. Information about this important work came to light 250 years later when the Palermitan historian **Vincenzo Auria** (1625–1710) published *La Sicilia Inventrice* (Sicily Inventor) in 1704, an encyclopedic work that gives details about discoveries made in Sicily in the fields of science, medicine, and the arts [55] (Fig. 3.53).

Fig. 3.53 Engraved title page of *La Sicilia Inventrice* by V. Auria, showing the map of Sicily. (From: V. Auria, *La Sicilia Inventrice*. Palermo, Marino, 1704)

3.3.1.4 Elisio Calenzio

After Ranzanus, the second witness of this operation was the Apulian poet **Elisio Calenzio** (*fl.* fifteenth century), a contemporary of Antonio Branca, who wrote an *Epistola* (Letter) to his friend Orpianus, probably suffering from a mutilated nose [56]. He urged him to go to Sicily to have his nose fixed. *Orpianus, if you want your nose restored, come here to me. For sure men think it is a miracle. The Sicilian Branca, a man of outstanding genius, has learnt how to ingraft a nose, which he either replaces from the arm, or he fixes on one borrowed from a slave. When I saw this, I decided to write to you, thinking that no news could be more welcome. If you come, rest assured that you will return home with a splendid nose as you desire*.

3.3.1.5 Bartolomeo Facius

The third document was by **Bartolomeo Facius** (ca. 1400–1457), historian to Alfonso I of Aragon, King of Naples, who wrote *De Viris illustribus* (On outstanding Men) in about 1456, an account on the life of the most celebrated fifteenth-century personalities, namely, painters, sculptors, poets, jurists, and physicians. It included a detailed report about Branca the father and his son Antonio and their operation for nasal reconstruction. Facius was a contemporary of both Brancas; therefore, the information supplied is of particular relevance for the understanding of the reconstructive nasal operation: *I thought that among the number of outstanding men, worthy of note, I should include the Brancas, father and son, famous surgeons. Branca the father was the originator of an amazing and almost incredible invention. He discovered a method of remaking and replacing noses with the utmost skill. His son, Antonius, made considerable improvements to his father's wonderful invention, for he discovered how to repair mutilated lips and ears as well as noses. Moreover, the flesh cut by his father from the face of the mutilated man in order to make up the nose, he himself used to cut from the man's muscles of his arm to avoid leaving any deformity of the face. The remnants of the mutilated nose were stuck in the cut arm, where the wound was most tightly bound into position, so that the patient had no power whatever to move his head. After fifteen or sometimes twenty days, the piece of flesh that had stuck to the nose was cut apart gradually and afterwards severed and shaped into nostrils with such skill that no join was discernible to the eye and all the deformity disappeared from the face. He cured many injuries that seemed unable to be cured with much skill and medical help*. Regrettably, Facius' account was kept as a manuscript in the library of a distinguished Sienese gentleman, where it remained unpublished for more than three centuries. Once discovered, it was eventually published in 1745 (Fig. 3.54) [57].

Within only a few years, three nonmedical people reported on the art of making a new nose from the arm as witness of the great impact that this operation produced for laymen. The only two contemporary medical works on Branca's procedure were by **Heinrich von Pfolfprundt** (ca. 1415–1465) who wrote *Buch der Bündth-Ertznei* (The Book of Wound Surgery) around 1460 (Fig. 2.12) and by **Alessandro Benedetti**. Readers are invited to refer to Sect. 2.4.2.2.1 for details about Pfolfprundt's contribution.

At Antonio Branca's death, about 1460, the art of nasal reconstruction was discontinued in Sicily.

BARTHOLOMAEI FACII

DE VIRIS ILLUSTRIBUS

L I B E R

NUNC PRIMUM EX MS. COD. IN LUCEM ERUTUS.

RECENSUIT, PRAEFATIONEM, VITAMQUE AUCTORIS

A D D I D I T

LAURENTIUS MEHUS

ETRUSCAE ACADEMIAE CORTONENSIS SOCIUS,

QUI NONNULLAS FACII, ALIORUMQUE

AD IPSUM EPISTOLAS ADJECIT.

FLORENTIAE. ANNO MDCCXLV.

Ex Typographio Joannis Pauli Giovannelli.

PRAESIDIBUS ADPROBANTIBUS.

Proſtant apud CAJETANUM TANZINI Bibliopolam Florentinum.

Fig. 3.54 Title page of *De Viris illustribus*, by B. Facius, with a report about the Brancas. (From: B. Facius, *De Viris illustribus*. Firenze, G. Paolo Giovannelli, 1745)

3.3.1.6 Alessandro Benedetti

In 1502, **Alessandro Benedetti** (ca. 1445–1525), Professor of Anatomy and Surgery at Padua University, published *Historia Corporis Humani sive Anatomice* (History of the Human Body or Anatomy) [58], one of the first printed textbooks on anatomy and certainly the most influential after **Mundinus de Luzzi** (ca. 1275–1326). Benedetti prepared the contents accurately starting in 1483. The dedicatory letter to Maximilian I of Germany, Holy Roman Emperor, is dated 1497, but the book, for unknown reasons, did not appear until 1502 [58]. A second edition was published in Paris in 1514 [59] (Fig. 3.55). The work is divided into five books that describe the human body from head to toe. *Book Four* is entirely devoted to the head with the description of the nose, *De Naso*, in Chapter 39. Benedetti refers to the method of nasal reconstruction according to the Brancas of Sicily, but neither their name nor the sources are quoted. Incidentally, Antonio Branca died ca. 1460, more than 40 years earlier. *At present, ingenious men* (i.e., the Brancas) *have indicated how to correct nasal deformities*. Then he continues to describe the technique: *Their method consists of cutting a little piece of flesh from the patient's arm in the shape of a nose and applying it to the stump. For this, they cut the top layer of skin on the arm with a scalpel. Having made a scarification on the nose, if this is needed, or if the nose has been recently cut off, they bind the arm to the head, so that raw surface adheres to raw surface. When the wounds have conglutinated, they take from the arm with a scalpel as much as is needed for the restoration*. (...) *And so with great dexterity they shape a new nose. They construct nasal passages with great skill*. (...) Where did Benedetti learn the technique to perform the operation? Most likely from a traveller. Did he carry out nasal repair? Possibly not, although details such as flap vascularization, nostril shape, and growing of hairs in the reconstructed nose account for the opposite.

Alessandro Benedetti was born about 1445 in Legnago (Verona, Italy). He studied medicine in Padua from where he graduated about 1475. He practiced medicine on various Greek islands for more than 17 years. Upon his return to Padua in 1490, he was appointed as Chair of Anatomy and Surgery at that University. He wrote several books on anatomy and medicine, but he is best remembered for having planned and built a wooden anatomical theatre that could easily be dismantled, based on the planimetry of Roman amphitheaters. He died in Venice about 1525.

Benedetti was the first to have reported in the western surgical literature the procedure of nasal repair exactly 100 years before Tagliacozzi's publication (1597), if we take the date of the dedicatory letter to Maximilian as the reference point. Therefore, the book is of utmost importance in the history of plastic surgery [60].

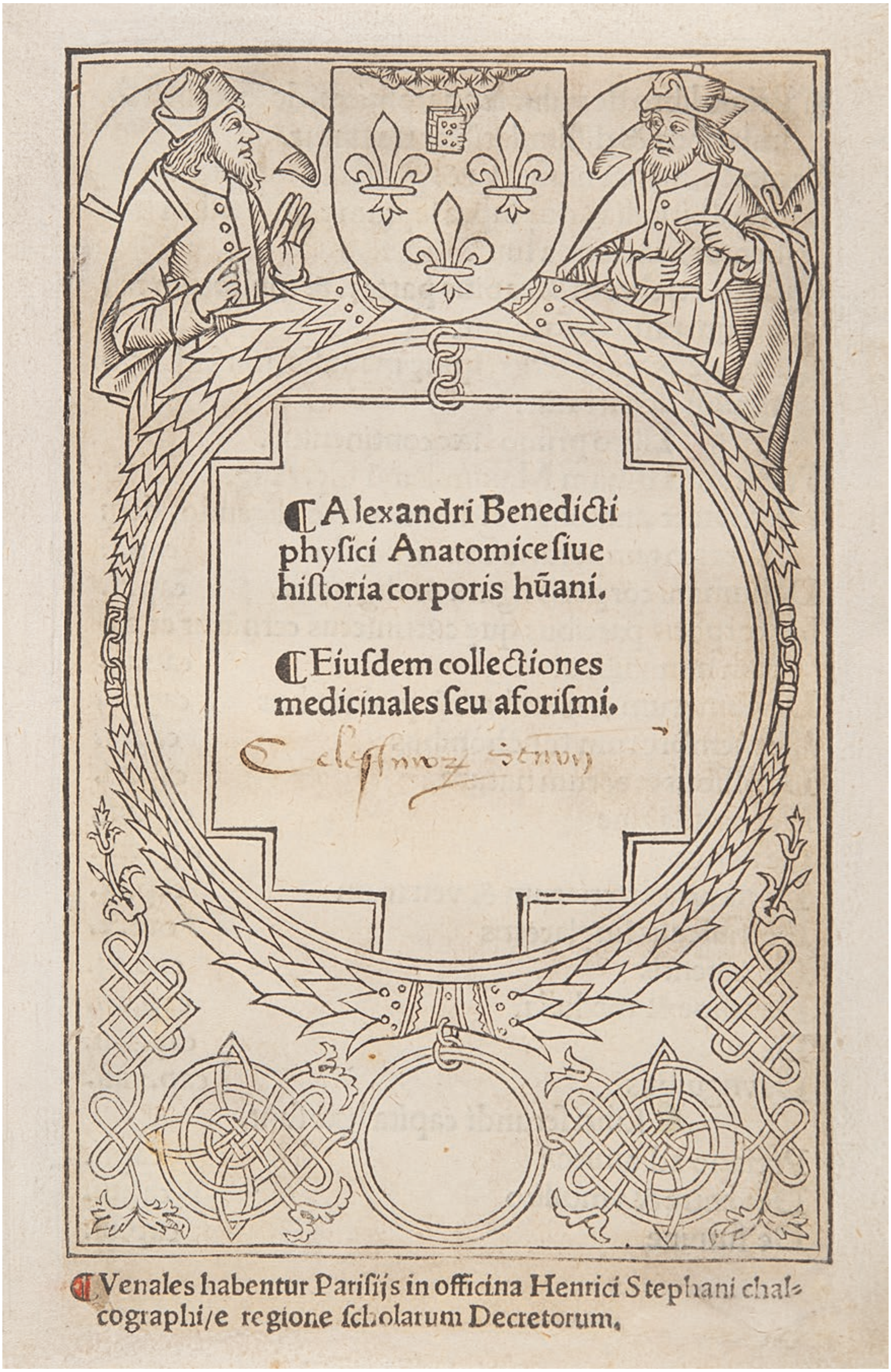


Fig. 3.55 Title page of *Anatomice, sive Historia Corporis Humani* by A. Benedetti. (From: A. Benedetti. *Anatomice* (…), 2nd ed. Paris, Charles Estienne, 1514)

3.3.2 Calabria

After an interval of some years, nasal reconstruction was resumed by members of another family, the **Vianeo** (or Bojano) from Maida, a picturesque village in the inland of Calabria (southern Italy). Although no proof is available, it is possible that, due to the relative proximity of Catania and Maida, the art of nasal reconstruction was transmitted by some traveller [52]. Information about the Vianeo comes from **Gabriele Barrio** (1506–1577), a priest, native of Francica, a village near Tropea, and a contemporary of the Vianeo family, who published *De Antiquitate et Situ Calabria* (On Antiquity and on Site of Calabria) in Rome in 1571 [61], where he gives details about the Vianeos and their work: *Next comes the noble town of Maida, situated in a high and therefore picturesque place.* (…) *From this town arrived* ***Vincenzo Vianeo****, prominent physician and surgeon, who was the first to devise the art of reconstructing mutilated lips and noses*.

3.3.2.1 The Vianeo Family

Vincenzo Vianeo died about 1520 and transmitted the art to his nephew Bernardino (*fl.* first half of the sixteenth century), who moved from Maida to Tropea, a more important city, a bishop's seat, on the northern coast of Calabria, and better located to open a professional practice (Fig. 3.56). Neither Vincenzo nor Bernardino was particularly prominent. Bernardino had two sons **Pietro** (ca. 1510–1571) and **Paolo** (ca. 1505–1560), both of whom became well-known. Apart from their technical capability, we can call them two skilled entrepreneurs, using modern terminology, as they established and organized, around 1540, a flourishing and well-attended clinic in Tropea, specifically dedicated to nasal repair, where they had five rhinoplasty cases every day [62] (Fig. 3.57). Here is Barrio's account: *There is still living in this city* (Tropea) *a citizen called Pietro Vianeo, physician and surgeon, who, among other achievements, restored lips and noses to perfection*.

Fig. 3.56 The village of Tropea, where Pietro and Paolo Vianeo established their clinic for nasal reconstruction, in a seventeenth-century engraved illustration

Fig. 3.57 The interior of a sixteenth-century operating room, most likely similar to the one used by the Vianeo brothers to practice nasal reconstruction. The surgeon is standing at the head of the patient. The first assistant is holding the head, whereas the second assistant is illuminating the operating field. (From: PP Magni. *Discorsi* (…) *intorno al Sanguinar i Corpi Humani* (…). Roma, Bonfadino e Diani, 1584)

3.3.2.2 Contemporaries' Reports on the Vianeos

Evidence of the Vianeos' activity and their clinic for nasal reconstruction in Tropea was reported by numerous contemporaries.

Camillo Porzio

Pietro's fame was so widespread in Italy for more than 20 years (1545–1565) that the Neapolitan historian **Camillo Porzio** (1530–1580) who received a coup-de-sabre to his face amputating his nose went to Tropea to have it fixed. At the completion of the operation, carried out with a skin flap taken from his left arm and held into position for 15 days, he wrote a letter to his friend Cardinal G. Seripando, a Papal Legate representing Pius IV, at the Council of Trent, informing him about the successful outcome of the nasal repair: *I have almost recovered.* (…) *It is indeed true that I suffered the greatest trials, since I had to have skin cut from my left arm in twice the amount of what was lost, where it was treated for more than a month. Then they sewed it to my nose, to which I had to hold my arm attached for fifteen days: my dear sir, this is an operation unknown to the ancients, but of such excellence and so marvellous that it is a great shame of the present century that it is not published and learned by all the surgeons for the benefit of all* (…). *From Tropea, July 9, 1561. The most devoted servant Camillo Porzio*. The letter, now preserved in the National Library of Naples, was posthumously published in 1839 [52, 63]—here reported in the translation made by Gnudi and Webster [1].

Leonardo Fioravanti

Another witness of the two brothers' daily activity, and their operating procedure, is from *Il Tesoro della vita humana*

(Treasure of human life) by **Leonardo Fioravanti** (1517–1588) [62], *excellent doctor and knight*, as he defines himself in the title page of his books (Figs. 3.58 and 3.59). He travelled extensively in Italy, and on board the Spanish fleet, he reached the coasts of northern Africa. In 1549, on the way back to Naples, he disembarked in Tropea (Calabria) with the precise plan to visit the Vianeos and to observe one of their reconstructive nasal operations.

I moved to Tropea where at that time there were two brothers Pietro and Paolo, who made a nose for anyone who had lost his by some accident. (…) At that time, surgeons were extremely jealous about their art, and there was no chance for any visiting physician to be admitted in the operating room. Let's see how Fioravanti shrewdly bypassed the problem: *Being therefore in Tropea, excellently horsed and with a servant, I went to the house of those two physicians, explaining to them that I was a Bolognese gentleman and had come there to talk with them because I had a relative who had his nose amputated on the road to Serravalle in Lombardy, while fighting against the enemies and he wished to know whether he should come or not*. (…) *In the meantime, I went every day to the house of these surgeons, who had five noses scheduled for repair and when they wanted to carry out these operations, they called me to watch and I, pretending I had not the courage to look, I turned my face away, yet my eyes saw perfectly. Thus, I saw the whole secret from beginning to end, and learned it. The procedure is as follows: the first thing they did to a patient scheduled for the operation was to give him a purgative; then in the left arm, between the shoulder and the elbow, they took hold of the skin with pincers and passed a large scalpel between the pincers and the flesh of the muscle.* (…) *They cut the nose stump similarly and then they cut the skin flap at one end and sutured it to the nose and bound it with such skill that there was no way to move the arm until the skin had grown onto the nose, and when it had grown they cut the other end and freshened the lip of the mouth and sewed there the skin of the arm and trimmed it until it was joined to the lip and applied there a metal template in which the new nose could grow to the right proportions and remain well shaped, although somewhat whiter than the rest of the face. And this is the procedure they used in restoring noses* (…). This is the earliest and technically very precise description of the method of nasal reconstruction used by the Vianeo brothers [1, 52–54, 64, 65].

In the same work, Fioravanti supplied one of the earliest reports about the healing of a completely separated nose: *During the time I was in Africa* (…) *a Spanish gentleman Andrés Gutierro was strolling through the camp one day and came to words with a soldier. They drew weapons and with a backhand stroke the soldier cut off Andrés' nose which fell in the sand and I saw it as we were together. The quarrel ended and the poor gentlemen remained without his nose. And I, who had it in my hand, all full of sand, urinated on it, and having washed it with my urine, I attached it and sewed it on very firmly.* (…) *And I had him remain thus for eight days. When I untied it, I found it was well attached once again.* (…) *And this was indeed the truth, and Andrés can describe it because he is still alive and healthy*.

Fioravanti was a very prolific writer. He published on plague (1565), natural secrets (1565), and surgery (1570). His books, a blend of science, magic, superstition, and alchemy, were all very successful, enjoying numerous editions, and were translated into French, German, and English. In 1568, after a 3-year stay in Rome, where he practiced medicine, Fioravanti moved back to Bologna, his home city, to defend his doctoral thesis. After graduation, he was accepted by the College of Physicians. In the meantime, his book *Il Tesoro della vita humana* was published in Venice (1570). Corradi relates that studying this book was strongly recommended to members of the college [52]. Although there is no document that proves it, a direct contact between **Gaspare Tagliacozzi** (1545–1599) and Fioravanti could have been possible. At that time, Tagliacozzi, just graduated from Bologna University, came across *Il Tesoro della vita humana* with its detailed description of the arm flap technique for nasal reconstruction, the postoperative care, and the required instruments. It might have been an inspiration for the newly graduated surgeon to dedicate himself to the art of reconstructing noses. However, in *De curtorum Chirurgia per insitionem* (On the Surgery of injuries by grafting), Tagliacozzi acknowledges his predecessors in Sicily and Calabria, but he doesn't mention Fioravanti's name. After graduation, Fioravanti established himself in Venice, where he practiced medicine and published various works. He died in Venice, about 1588.

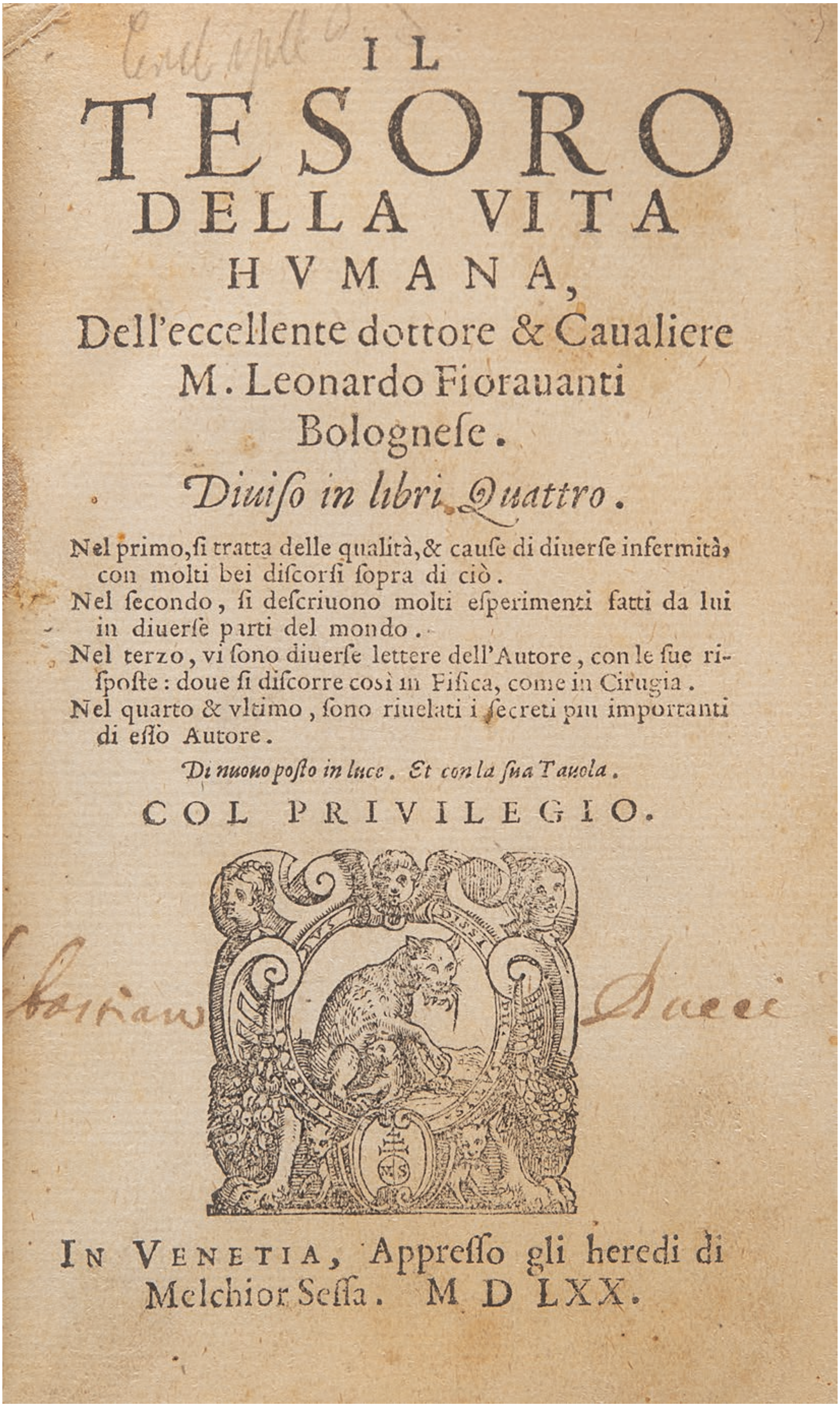

IL
TESORO
DELLA VITA
HVMANA,
Dell'eccellente dottore & Caualiere
M. Leonardo Fiorauanti
Bologneſe.
Diuiſo in libri Quattro.
Nel primo, ſi tratta delle qualità, & cauſe di diuerſe infermità, con molti bei diſcorſi ſopra di ciò.
Nel ſecondo, ſi deſcriuono molti eſperimenti fatti da lui in diuerſe parti del mondo.
Nel terzo, vi ſono diuerſe lettere dell'Autore, con le ſue riſposte: doue ſi diſcorre così in Fiſica, come in Cirugia.
Nel quarto & vltimo, ſono riuelati i ſecreti piu importanti di eſſo Autore.
Di nuouo poſto in luce. Et con la ſua Tauola.
COL PRIVILEGIO.
IN VENETIA, Appreſſo gli heredi di Melchior Seſſa. M D LXX.

Fig. 3.58 Title page of the first edition of *Il Tesoro della vita humana* by L. Fioravanti. Venezia, Sessa, 1570

Fig. 3.59 Portrait of Leonardo Fioravanti (…). (From: *Il Tesoro della vita humana*. Venezia, Sessa, 1570)

Tommaso Campanella

Another witness of the Vianeos' reconstructive work came from **Tommaso Campanella** (1568–1639), philosopher and thinker—and a contemporary of the Vianeos. In his book, *Medicinalium, juxta propria principia* (On Medicines, according to their own principles) [66], he gave a description of the operation for nasal reconstruction carried out in Tropea (Calabria) by members of Vianeo family and affirmed that: *the Calabrians of Tropea know how to make a new nose. I have seen many of these noses which have been reconstructed from the inner arm of the patient, not from another person* (...) (Fig. 3.60). In 1599, freed from Rome where he was imprisoned in the year 1595 under the charge of heresy, Campanella established himself in a monastery in Stilo, a village not far from Tropea (Calabria), where the Vianeos ran their flourishing clinic specialized in nasal reconstruction [1, 52].

At Paolo's death (ca. 1570), **Vianeo** surgical activity in Tropea continued with Roberto, a surgeon and the last member of the family. At his death in 1609, the clinic was closed [67].

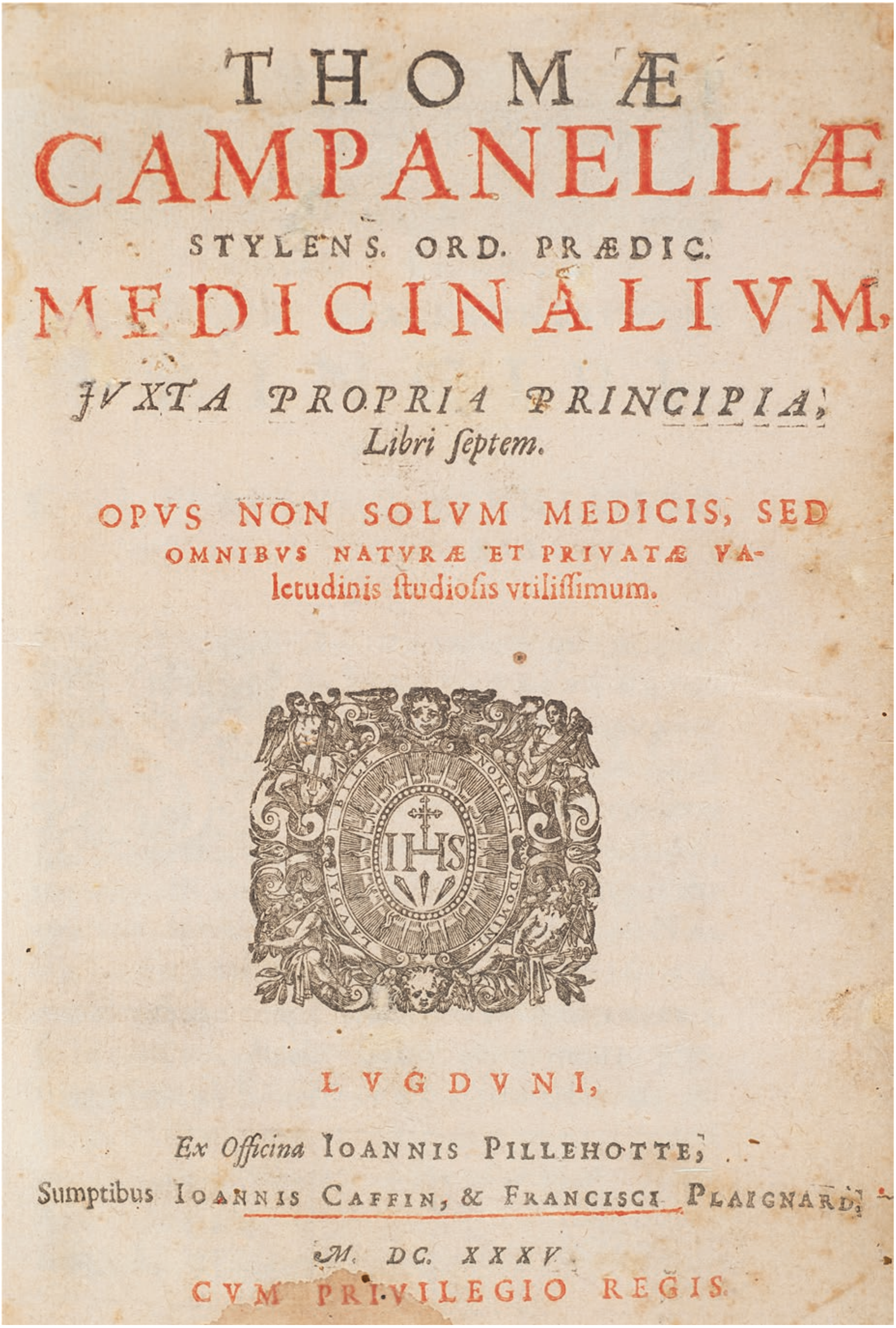

THOMÆ
CAMPANELLÆ
STYLENS. ORD. PRÆDIC.
MEDICINALIVM,
IVXTA PROPRIA PRINCIPIA,
Libri septem.
OPVS NON SOLVM MEDICIS, SED
OMNIBVS NATVRÆ ET PRIVATÆ VA-
letudinis studiosis vtilissimum.
LVGDVNI,
Ex Officina IOANNIS PILLEHOTTE,
Sumptibus IOANNIS CAFFIN, & FRANCISCI PLAIGNARD,
M. DC. XXXV.
CVM PRIVILEGIO REGIS.

Fig. 3.60 Title page of Tommaso Campanella (1568–1639) *Medicinalium, juxta propria principia*. Printed in Lyon in 1635 where the Vianeo technique for nasal reconstruction is reported with enthusiastic comments. Campanella relates that he has seen some operated patients personally

3.3.3 Padua

3.3.3.1 Prospero Borgarucci

In 1567, **Prospero Borgarucci** (ca. 1540–?), successor of Vesalius in the prestigious position of Chair of Anatomy at Padua University, went to Paris where he was appointed physician to the Queen. On that occasion, he acquired an unpublished manuscript on surgery (*Chirurgia Magna*), attributed to Vesalius. It is possible that the text, which contains too many errors to have been written by the author of *De humani Corporis Fabrica* (The Fabric of the Human Body), was the result of class notes of Vesalius' students [1, 52]. Borgarucci revised the manuscript with the help of the text of the *Fabrica*, illustrated it using the blocks plagiarized from Tagault's *Chirurgia* [21], prepared the manuscript, and took care of the publication.

3.3.3.2 Andreas Vesalius

Chirurgia Magna in septem libros digesta (Great Surgery divided in seven books) was first issued in 1568 in Venice by the Valgrisi press, bearing the name of **Andreas Vesalius** (1514–1568), as the author. It was reissued the following year [68].

In describing *De vulneribus nasi curandis* (Management of facial wounds) (Chap. 9), Vesalius/Borgarucci reported the technique of nasal reconstruction, almost 30 years before Tagliacozzi's publication, stating however that repair was by biceps muscle, not by skin from the arm, and that the bandage should last for a period of 40 days: *The nose may be wounded, fractured, abraded or entirely crushed.* (…) *Suppose a man's nose has either just been cut off, or was cut off* (…) *at a considerably earlier time*. (…) *We take an arm, whichever is more convenient to the patient, and by palpation we carefully find the superficial muscle flexing the elbow forward.* (…) *We carefully freshen the places where the nose was formerly, until blood flows freely. Afterwards, we attach the muscle, which has already been prepared, to the face in such a manner that for the space of forty days neither the head nor the arm can be moved at all. We cut free the upper fleshy portion of the muscle* (…) *and we dress both once a day until they have joined together, coalesced and become one substance, the region of the nose with the muscle of the arm.*

3.3.4 Lausanne

3.3.4.1 Jean Griffon

Before Tagliacozzi had issued his book *De Curtorum Chirurgia per Insitionem* (On the Surgery of Injuries by Grafting) in 1597, **Jean Griffon** (ca. 1544–1604) performed a rhinoplasty operation in 1592 in Lausanne (Switzerland) on a girl who had her nose amputated by a soldier, when he unsuccessfully tried to violate her. **Griffon** (or Griffonius) was born in San Miniato (Tuscany), about 1544. He had to quit Tuscany, probably for political reasons, and migrated to Geneva, where he married, becoming a surgeon at Geneva Hospital in 1586, and was granted citizenship. He remained in Geneva for about 1 year, achieving a great reputation. He then moved to Lausanne, where he performed nasal reconstruction. He died in Paris about 1604.

The operation of nasal reconstruction that Griffon was able to carry out, without having seen a single case, was based only on the description by a traveller, a previous Tagliacozzi patient in Bologna.

3.3.4.2 Fabry von Hilden

The episode was reported by **Fabry von Hilden** (1560–1634), one of his students, who later became one the greatest surgeons of his time, in *Observationum et curationum chirurgicarum centuria tertia* (100 cases of surgical observations and treatments). Fabry commented that the result was favorable and successful: *However, in winter when it is very cold, the tip of the nose turns a bit livid.* (…) He added: *The original inventor of this operation was Gaspare Tagliacozzi, by far the most distinguished and learned Professor of Medicine at the University of Bologna.* (…) *Dr. Griffon learned a few details from an Italian who was passing through Lausanne, and had been treated by Dr. Tagliacozzi* [69].

3.3.5 Bologna

3.3.5.1 Giulio Cesare Aranzio

Giulio Cesare Aranzio (1530–1589), nephew of **Bartolomeo Maggi** (1477–1552) (see Sect. 3.1.2.4) studied medicine in Bologna where he obtained his degree in 1548. In 1556, he was appointed Professor of Anatomy and Surgery at Bologna University and was the proponent of the separation of the two disciplines, anatomy and surgery. Once the reform was approved, Aranzio was the first person to hold the professorship of anatomy independently in 1570. Highly appreciated for his studies and lectures, Aranzio wrote important works on embryology, anatomy, and head trauma. About 1565–1569, he regularly and successfully carried out rhinoplasty operations, as documented by Gnudi and Webster, using skin harvested from the arm even though he left no record of it in his writings [1]. At that time, Tagliacozzi was a student of medicine. Possibly, Tagliacozzi, a student of Aranzio, learned the technique of nasal reconstruction directly from him.

3.3.5.2 Gaspare Tagliacozzi

And then came **Gaspare Tagliacozzi** (1545–1599). Rhinoplasty is linked to his name, although, as we have seen, the art of reconstructing noses and lips had already been practiced in southern Italy for almost 150 years.

Born in Bologna into a respected family in 1545, Tagliacozzi studied medicine at Bologna University, from where he graduated in medicine in 1570 and in philosophy in 1576 and was admitted to the College of Medicine and Philosophy. Immediately upon graduation, he was nominated as Professor of Surgery and soon awarded the position of being second to Aranzio in performing cadaveric dissections and gave public demonstrations of anatomy. He was engaged in practicing surgery, working at Bologna's *Ospedale della Vita e della Morte* (Hospital of Life and Death). By careful observation and attention to the different steps, he perfected the arm flap procedure for nasal and lip reconstruction and for auricle repair on some patients [1, 54, 70]. He became an outstanding surgeon, much appreciated not only in Bologna but also in the rest of Italy. In 1586, he wrote a letter to his friend **Gerolamo Mercuriale** (1530–1606), Professor of Medicine at Padua University, describing the nasal reconstruction technique in detail, the modifications he had done to the Vianeos' original procedure, the different indications, the number of cases he had already operated on, and finally the preliminary announcement of the future publication of a book on the subject. The letter was published in the second edition of *De Decoratione* (On Cosmetics) dated 1587 [1, 52, 70, 71] (Fig. 3.61).

In the first edition of *De Decoratione*, dated 1585 [72], Mercuriale acknowledged Tagliacozzi and his procedure, stating that biceps muscle was used for nasal reconstruction. The same error was reported by Paré [48] and Vesalius/Borgarucci [68]. To correct the error and avoid confusion, Tagliacozzi published the abovementioned letter, giving details of the surgical technique [52, 70, 71].

Eleven years elapsed before the revolutionary work *De Curtorum Chirurgia per Insitionem* (On the Surgery of Injuries by Grafting) first appeared in Venice in 1597 [73]. Tagliacozzi entrusted the Venetian publisher, Gaspare Bindoni, with the task of printing his work which required careful preparation of the plates, accuracy in showing every detail, and supervising the quality of the woodcuts personally.

In the meantime, his operative method evolved over many years of tireless and continuous effort looking for perfection and was now ready to guide others in nasal reconstruction. In the dedicatory letter to **Vincenzo Gonzaga** (1562–1612), Duke of Mantua and Monferrato, a patient, friend, and patron of Tagliacozzi's, the author acknowledges the Vianeos by saying: *I heard that there were certain Calabrians who practiced this art, if art can be named, in an inconsistent and empirical way. Thus, I devoted myself to this art with as much care and diligence as I could* (...).

The work, written in a convoluted and even tedious style, is divided into two books, with separate pagination. *Book One* is devoted to the anatomy and physiology of the face, in particular of the nose, lips, and ears. *Book Two* is mainly practical and describes the technique of the reconstruction in detail, emphasizing that it is a risky procedure and those who have not seen the operation should not be encouraged to perform it. Complications such as hemorrhage and necrosis are reported.

The first edition opens with a sumptuous architectural engraved title page, present only here and not in the other editions. It is surmounted by the coat of arms of Vincenzo Gonzaga to whom the work is dedicated (Fig. 3.62). To the left and right, respectively, the statues of Hippocrates and Galen stand in front of the portico. Below, at the center in a scroll, is the publisher's name, Gaspare Bindoni, Junior, and the city name and date, Venice, 1597. In a cartouche is the Bindoni device (logo): the angel Raphael leading Tobias who holds a fish in his left hand. In the background, a pleasant mountain landscape.

The operation of nasal reconstruction is presented step by step, beginning with an illustration of the instruments necessary for carrying out the procedure, followed by the indications for the technique, the outlining of the flap on the arm (Fig. 3.63a), the flap inset with diagram showing the interval between the stitches at the tip of the nose (Fig. 3.64), the type of bandage used to secure the arm into position (Fig. 3.63b), the flap severing and trimming, the final outcome (Fig. 3.63c), and the clinical applications for areas other than the nose, i.e., upper (Fig. 3.65a) and lower lip. The last two plates of the volume are devoted to the repair of upper and lower auricular defects with local folded flaps outlined in the mastoid area.

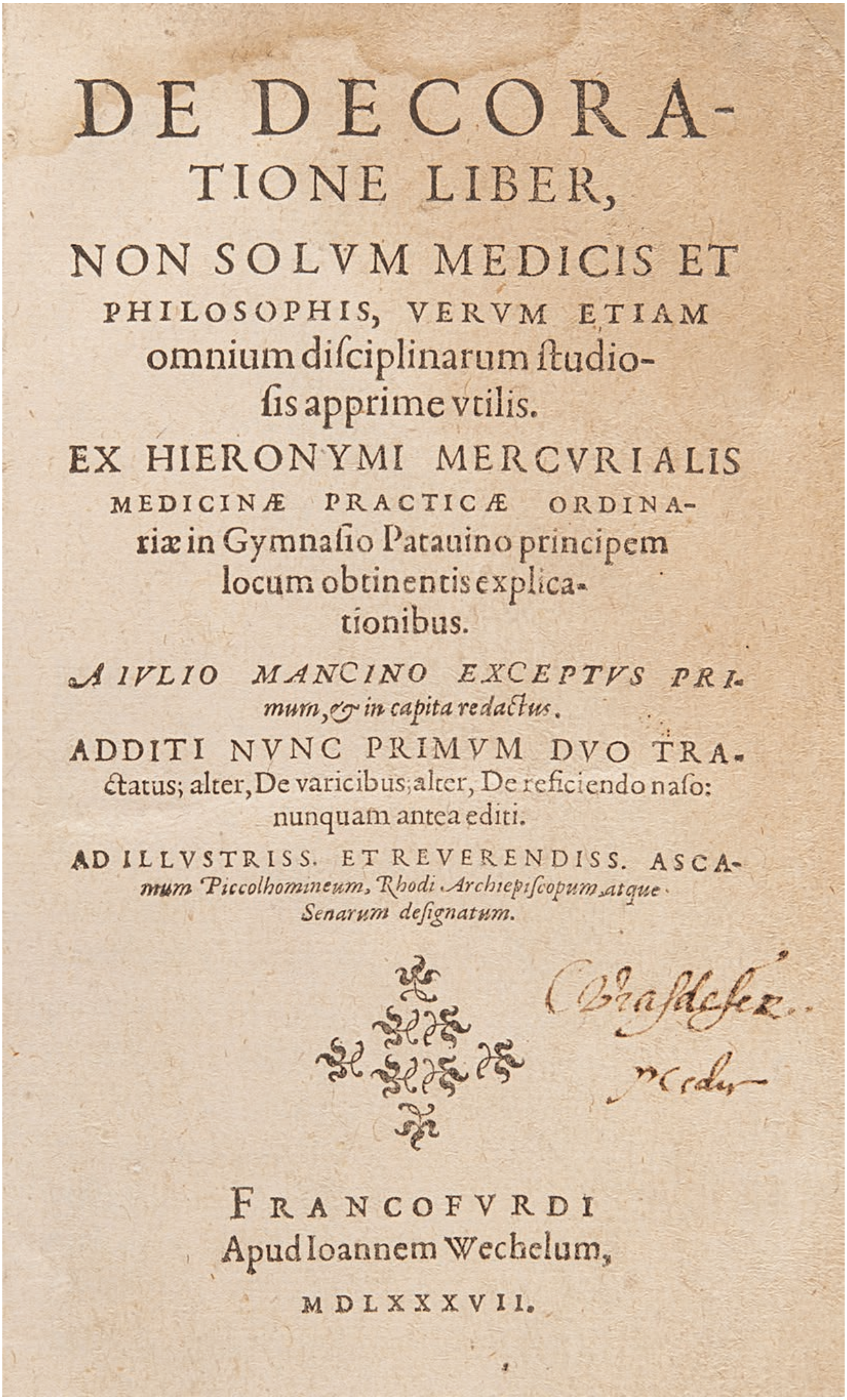
The book was an editorial success, and despite the numerous copies printed, probably 1000, it soon went out of print. This stimulated the printer, Roberto Meietti, already known for similar transgressions, to take advantage of the situation by secretly publishing a pirated edition the same year and in a very short period of time [74]. On comparing the two issues, it appears that in Meietti's version, the paper and the artwork were of lower quality, with less attention to details (Fig. 3.65b). Moreover, the dedicatory letter to Duke Vincenzo Gonzaga, Tagliacozzi's patron, and the right to print (or *imprimatur*) were deliberately missing. On the title page, there appears the large Meietti printer's device (logo), an oval with a plant in the middle, and beside the plant a cock with the head erect and a hen eating the grains fallen to the ground. The motto says: *you will not eat the fruits of lying*, which means: *if you read the books printed by me, you will be reading the truth, not lies* (Fig. 3.66)—something unbelievable for a printer issuing a pirated book! There is no information regarding Tagliacozzi's reaction, or if Meietti was taken to court. As we have anticipated in Sect. 2.5.3, to avoid unpleasant discussions, the Council of Ten closed their eyes! We are aware that the clandestine edition of Tagliacozzi's work is very rare on the market, suggesting that the printer sold a few copies quickly and cheaply, before the book was withdrawn from sale.

Another edition, this time in *8-vo*, to be used on the battlefields and to fit in an army surgeon's knapsack, was demanded. In 1598, the printer Johann Saur in Frankfurt issued a reprint of the text, the second official one in terms of priority, financed by Peter Kopff, using a more appealing title: *Cheirurgia Nova,* (…) *de Narium, Aurium, Labiorumque Defectu, per Insitionem cutis ex humero, arte, hactenus omnibus ignota sarciendo* (New Surgery for restoring Noses, Ears, and Lip defects, by Grafting skin from the humerus artfully, until now unknown to anyone). All the illustrations were maintained, but reduced to the *8-vo* size and with less attention to details [75] (Fig. 3.65c). In a period of revival of reconstructive surgery, a third official edition was issued in 1831, more than 230 years later, by Maximilian Troschel (1805–1867), at the suggestion of **J. F. Dieffenbach** (1792–1847). The edition was very simple, and the original 22 full-page woodcut illustrations were adapted in 6 folding lithographic plates, preceded by an explanatory text of the figures [76] (Fig. 3.65d).

Although incomplete, the *De Curtorum Chirurgia* was translated into English in the seventeenth century by **Alexander Read** [77]. It was also included in a superb well-documented, recent publication by **Martha T**. **Gnudi** and **Jerome P. Webster**, *The Life and Times of Gaspare Tagliacozzi, Surgeon of Bologna*, with commentary about the life of Tagliacozzi and details about life in sixteenth-century Bologna. The legacy generated by this operation in the development of plastic surgery was described in detail [1]. The original text of *De Curtorum Chirurgia* was reported in the encyclopedic four-volume work *Bibliotheca Chirurgica* (Surgical Library) edited by **J.J. Manget** in 1721 in Geneva [78]. At the suggestion of **Robert M. Goldwyn** (1930–2010), the first complete translation in English of *De Curtorum Chirurgia* was issued in 1996 in New York [79].

Tagliacozzi died in Bologna in 1599, aged 54 years. In his will, he specified his desire to be buried in the Church of the Nuns of S. Giovanni Battista in Bologna, giving details regarding his tomb. However, a few months after his death, rumors circulated that during his life, Tagliacozzi had performed magical rites. As a consequence, his body was exhumed, removed from the church, and buried outside in an unconsecrated area. When the suspicions ceased, and at the completion of the work on his tomb, he was reburied in the church [1, 79]. A wooden statue of Tagliacozzi holding a nose in his hand is housed in Bologna's Archiginnasio (Fig. 1, Introduction). After his death, the operation of nasal reconstruction with an arm flap was often quoted, as we shall see, but rarely practiced.

Although Tagliacozzi should not be considered as the discoverer of rhinoplasty, he deserves credit for being the first to make a work of art out of a surgical practice that was left until then at an empirical state of development. For this reason, he is rightly acknowledged as the founder of plastic surgery.



DE DECORA-
TIONE LIBER,
NON SOLVM MEDICIS ET
PHILOSOPHIS, VERVM ETIAM
omnium diſciplinarum ſtudio-
ſis apprime vtilis.
EX HIERONYMI MERCVRIALIS
MEDICINÆ PRACTICÆ ORDINA-
riæ in Gymnaſio Patauino principem
locum obtinentis explica-
tionibus.
*A IVLIO MANCINO EXCEPTVS PRI-
mum, & in capita redactus.*
ADDITI NVNC PRIMVM DVO TRA-
ctatus; alter, De varicibus; alter, De reficiendo naſo:
nunquam antea editi.
AD ILLVSTRISS. ET REVERENDISS. ASCA-
*nium Piccolhomineum, Rhodi Archiepiſcopum atque
Senarum deſignatum.*

FRANCOFVRDI
Apud Ioannem Wechelum,
MDLXXXVII.

Fig. 3.61 Title page of *De decoratione*, second edition, 1587, by Gerolamo Mercuriale (1530–1606), which includes the famous letter by G. Tagliacozzi describing the nasal reconstruction technique in detail and announcing the future publication of his book on the subject

Fig. 3.62 Engraved architectural title page of the 1st edition of *De Curtorum Chirurgia*, 1597, by G. Tagliacozzi surmounted by the coat of arms of Vincenzo Gonzaga, Duke of Mantua, to whom the work is dedicated. To the left and right, respectively, the statues of Hippocrates and Galen stand in front of the portico. Below, at the center in a scroll, is the publisher's name, Gaspare Bindoni junior, and the city name and date, Venezia 1597. In a cartouche is the Bindoni device (logo): the angel Raphael leading Tobias, who holds a fish in his left hand. In the background a pleasant mountain landscape

Fig. 3.63 Nasal reconstruction according to the arm-flap procedure (the so-called Italian method). *Left*: the flap outline on the arm. *Middle*: the complex type of bandage used to secure the arm into position. *Right*: the final outcome. (From: G. Tagliacozzi. *De Curtorum Chirurgia*. Venezia, Bindoni, 1597 (Plate 5, 8, 15))

Fig. 3.64 Diagram showing the interval between the stitches at the tip of the nose. (From: G. Tagliacozzi. *De Curtorum Chirurgia*. Book 2. Chapter 12. Venezia, Bindoni, 1597)

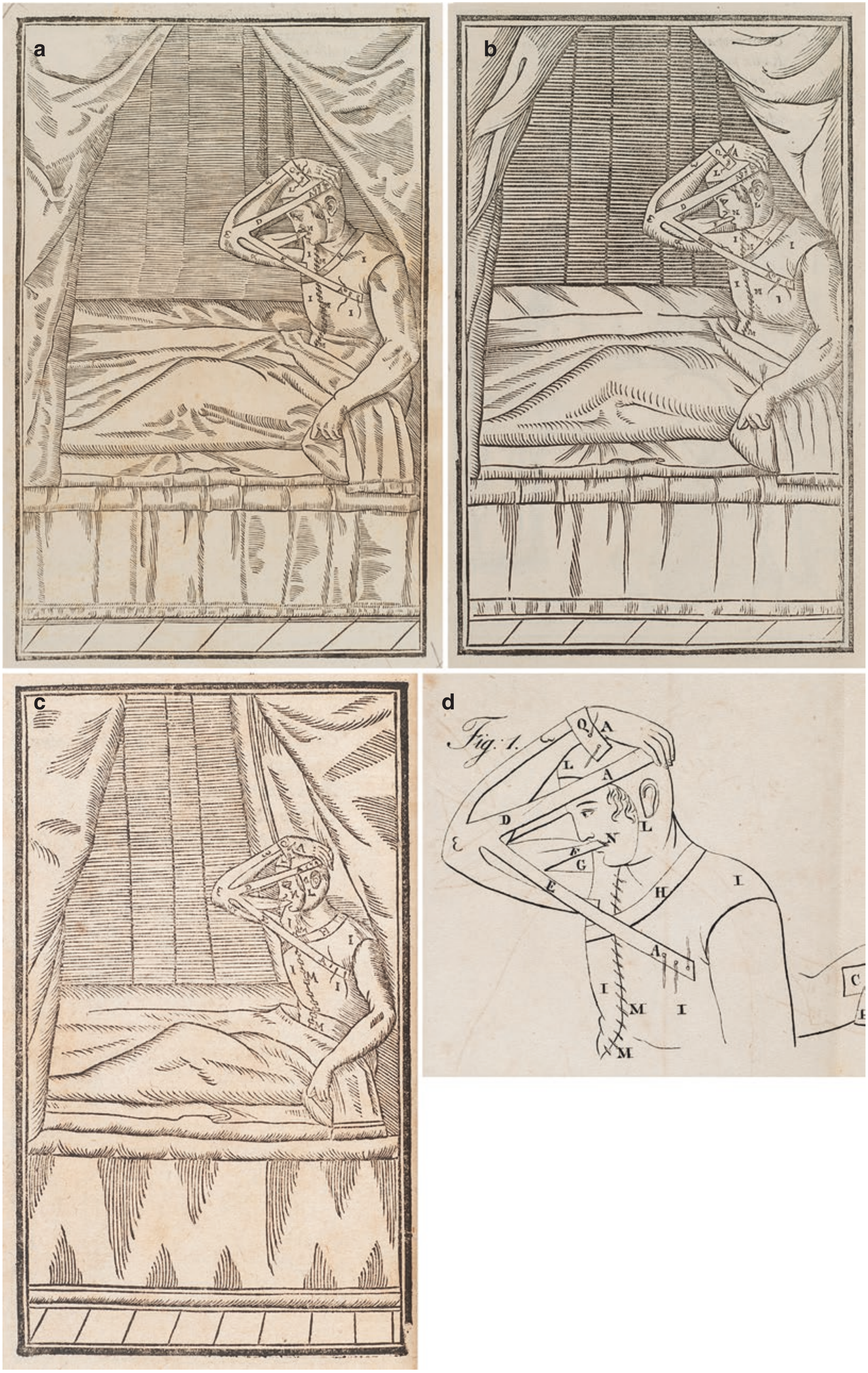
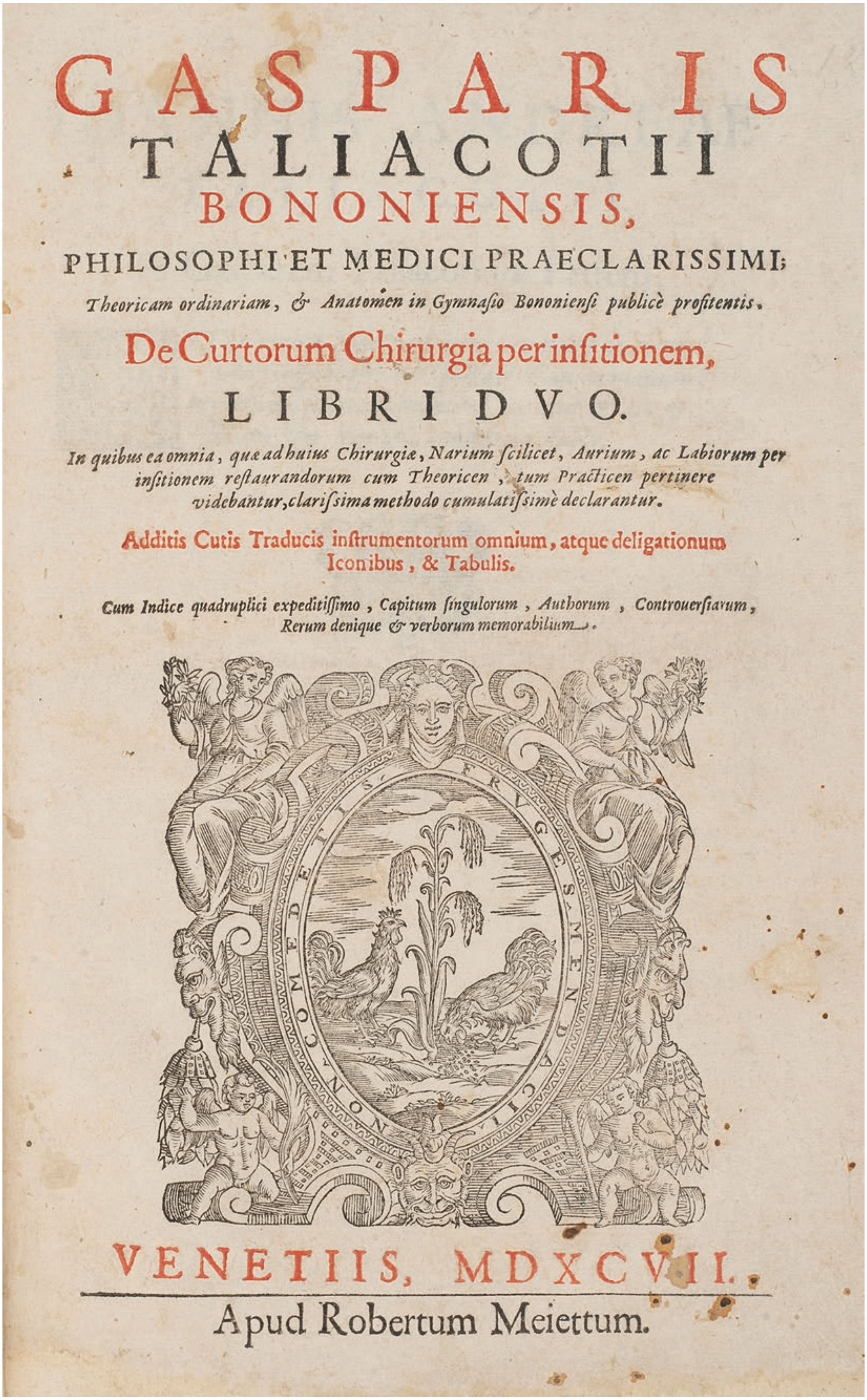


Fig. 3.65 (**a**–**d**) Upper lip reconstruction according to the arm-flap procedure. Comparison of the same plate as it appears in the four editions of the *De Curtorum Chirurgia*. *Left upper*: Venezia, Bindoni, 1597, first edition. *Right upper*: Venezia, Meietti, 1597, pirated edition. *Lower left*: Frankfurt, Saur, 1598, in *8-vo* edition. *Lower right*: Berlin, Reimer, 1831, M. Troschel edition



GASPARIS
TALIACOTII
BONONIENSIS,
PHILOSOPHI ET MEDICI PRAECLARISSIMI;
Theoricam ordinariam, & Anatomen in Gymnaſio Bononienſi publicè profitentis.
De Curtorum Chirurgia per inſitionem,
LIBRI DVO.
In quibus ea omnia, quæ ad huius Chirurgiæ, Narium ſcilicet, Aurium, ac Labiorum per inſitionem reſtaurandorum cum Theoricen, tum Practicen pertinere videbantur, clariſsima methodo cumulatiſsimè declarantur.
Additis Cutis Traducis inſtrumentorum omnium, atque deligationum Iconibus, & Tabulis.
Cum Indice quadruplici expeditiſſimo, Capitum ſingulorum, Authorum, Controuerſiarum, Rerum denique & verborum memorabilium.

VENETIIS, MDXCVII.
Apud Robertum Meiettum.

Fig. 3.66 Meietti's printer's device (logo), with his motto: *you will not eat the fruits of lying*

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4 The Seventeenth and Eighteenth Centuries: The Decline of Plastic Surgery in the Western World

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The Seventeenth and Eighteenth Centuries: Salient Events in Surgery and Plastic Surgery

- **Learned societies** and **scientific organizations** are established in Italy, England, France, and Germany to coordinate and promote research and experiments.
- Plastic surgery disappears almost completely. The arm flap procedure for nasal reconstruction is often reported in medical literature, but rarely practiced and becomes prey to charlatans and mockery. Readers enjoy curious and peculiar stories regarding the art of nasal reconstruction, in particular the use of the arm flap harvested from a servant instead of from the patient's own arm.
- **W. Fabry von Hilden** is one of the most talented German surgeons of the seventeenth century. His *Opera omnia*, issued in 1646, contains a series of unusual surgical cases and their treatment covering the entire field of surgery. Among them are scar contracture of the hand after a burn and the device to maintain the hand straight, breast cancer and axillary lymph node excision, removal of an iron splinter from the eye using a magnet, and upper arm lymphoedema.
- **Johannes Schultes** publishes *Armamentarium Chirurgicum* (Surgical Armamentarium) in 1655, the most influential and successful textbook of surgery in the seventeenth century, with numerous plastic surgery procedures.
- **William Harvey** publishes his discovery of blood circulation in 1628. As a result, physicians and scientists try to inject drugs into the bloodstream to carry them directly to various parts of the body, favoring the healing of wounds, curing diseases, and improving the quality of life. In 1654, **Francesco Folli**, an Italian physician practicing in Florence, conceives the idea of performing transfusions for ailing bodies recovering from sickness, favoring wound healing. However, the first attempt of blood transfusion in animals is attributed to **Richard Lower**, a British physician, who conducts experiments under the supervision of the Royal Society of London in 1665. Two years later, in 1667, **Jean-Baptiste Denis** practices the first animal-to-man transfusion in a 45-year-old man to relieve pain, ensuring longevity and introducing a youthful, healthy spirit into an old individual. The procedure is named *chirurgia transfusoria* (transfusory surgery), a technique that becomes quite popular in England, France, and Italy about 1667–1668. The drama occurs when Denis attempts a second transfusion in two patients who suddenly die. Blood transfusion is immediately discontinued.
- In 1721, Tagliacozzi's *De Curtorum Chirurgia* is reissued in Geneva, and two dissertations on nasal reconstruction are discussed in Uppsala and Paris, denoting an increasing interest in plastic and reconstructive surgery during the eighteenth century.
- In Germany, **Lorenz Heister** publishes *Chirurgie* in 1718, one of the most important surgical tracts of the eighteenth century, with numerous plastic surgery procedures.
- In France, **Jean Louis Petit** is one of the pioneers emphasizing the importance of mastectomy with concurrent excision of pectoralis muscle and axillary lymph nodes, in 1774.
- **Pierre-Joseph Desault** is best remembered for the idea of wound debridement, the basis of reparative surgery in 1795.

4.1 The Decline in the Seventeenth Century

In the first half of the seventeenth century, surgery experienced a period of decay. Commenting on this period, the Swiss physician **Albrecht von Haller** (1708–1777) wrote: *In these times, surgery was languishing in vigor throughout Europe, and particularly in Italy* [1]. There were very few charismatic surgeons. The devastating Thirty Years' War decimated the population throughout central Europe, mainly in Germany. Only army surgeons gained experience and knowledge. Through their tough training on the battlefield, they acquired dexterity and courage and started to operate on cancer, considered incurable until then.

In Italy, the *Studium* of Bologna saw a decreased number of students as a result of the conflicts and of the plague epidemics that affected not only students but also physicians and lecturers [2]. The decline involved other Italian universities, like Padua and Naples. Padua, regarded as one of the most celebrated international centers for medicine in Europe, suffered a period of decay around 1650. On the contrary, northern European universities, in the Netherlands, Denmark, and England, enjoyed a particularly favorable moment. New universities were founded in the Netherlands, Germany, and Sweden: Giessen (1607), Groningen (1614), Dorpat (1632), Utrecht (1636), Åbo (1640), Duisburg (1655), Kiel (1655), and Halle (1694).

4.1.1 Constitution of Learned Societies

One of the greatest legacies of the period was the constitution of **learned societies** and **scientific organizations** to coordinate and promote research and experiments. The idea originated in Italy [3]. The Neapolitan **Giovanni Battista della Porta** (1535–1615), philosopher, polymath, alchemist, astronomer, botanist, and scientist, established the ***Academia Secretorum Naturae*** (Academy of the Secrets of Nature) in 1560. It was probably the first example of this type of organization, followed by the ***Accademia dei Lincei*** (Academy of the Lynxes), founded in Rome in 1603 by the **Marquis Federico Cesi** whose coat of arms included a lynx, an animal with acute sight, symbolizing the observational prowess that science requires. The motto was *minima cura si maxima vis* (Take care of small things to achieve the greatest results). Founding members were scholars and amateur scientists. **Giovanni Battista della Porta** and **Galileo Galilei** were members.

In 1657, Prince Leopoldo of Tuscany and Ferdinando II de' Medici, Grand Duke of Tuscany, established the ***Accademia del Cimento*** (Academy of Experiment) in Florence to perform experiments in every field of science. This organization played an important role in the history of science, being the first society created to fulfill experimental research organizing the first laboratory in Europe for physical sciences. Founding members were a group of disciples of Galileo Galilei including G. Alfonso Borelli, Vincenzo Viviani, and others. The motto was *Provando e riprovando* (Trying and trying again). In 1666, the *Accademia*, after 5 years of meticulous work, issued *Saggi di naturali esperienze fatte nell'Accademia del Cimento* (Essays of natural experiments made in the Accademia del Cimento), their only scientific publication.

In 1660, an *invisible college* of natural philosophers and physicians, something similar to Porta's ***Academia Secretorum Naturae***, was created in London. It evolved as a "learned society" with leading personalities such as **Robert Boyle** and **John Wilkins** as members. In July of 1662, the group received the approval of Charles II, becoming the ***Royal Society of London*** whose motto was *Nullius in verba* (Take nobody's word for it), that is, one has to verify all statements by an appeal to facts, confirmed by experiment. The first issue of *Philosophical Transactions*, the official journal of the society, was published in 1665. It is now the oldest continuously published scientific journal in the world.

In 1666, in Paris, Louis XIV, at the suggestion of **J. Baptiste Colbert** (1619–1683), established the ***Académie Royal des Sciences*** to encourage and foster the spirit of French scientific research. It began publishing *Mémoires de l'Academie des Sciences* (Transactions of the Academy of Sciences) in 1699.

In 1652, based on the academies created in Italy, the ***Academia Naturae Curiosorum*** (Academy of Natural Curiosities), a society of scientists, researchers, and physicians, was founded in Germany, and in 1670, it began publishing the *Miscellanea Curiosa* (Miscellaneous Curiosities), or Ephemerides, one of the oldest scientific journals. By 1687, Leopold I, Emperor of the Holy Roman Empire, raised the academy to the status of an Imperial Academy and named it after himself. The Leopoldina is claimed to be the oldest learned society still existing in the world.

4.1.2 Tagliacozzi's Legacy

After Tagliacozzi's death, plastic surgery, with a few exceptions, disappeared almost completely for two centuries from hospital and clinical activity. Why did this occur? General and specific factors contributed to the progressive lack of interest and oblivion of Tagliacozzi's nasal reconstruction—and reconstructive surgery in general.

The arm flap procedure was not that easy to perform and, if improperly done, may have led the inexperienced surgeon to complications and unfavorable results. Patients were less prone to undergo a complicated, painful, tedious, and long operation. The book *De curtorum Chirurgia* (…) was difficult to obtain and very expensive [4]. Without a direct source of information, books, or lectures, it was virtually impossible to learn the technique. Information concerning indications, step-by-step method, and postoperative care was mainly by oral tradition. This explains the errors in incorrectly describing the procedure as the choice of the bulky biceps muscle as the donor site instead of a pure, thin skin flap; immobilization for 40 days instead of the original 14 days; and use of a sympathetic slave, or sympathetic powder, instead of autologous tissue, as suggested by Tagliacozzi in his book. Plastic surgery fell prey to charlatans.

Regrettably, Tagliacozzi died early, at age 54, so he could neither promote his method sufficiently nor leave his students to perpetuate the procedure in his native Bologna. Thus, the tradition of nasal reconstruction with the arm flap (the Italian method) fell from favor.

As we shall see, Tagliacozzi's name and method was often reported in the European literature, with evidence of serious interest and extensive summaries, but seldom practiced during the seventeenth and eighteenth centuries.

4.1.2.1 Giovanni Battista Cortesi

Giovanni Battista Cortesi (1554–1636) (Fig. 4.1), who studied in Bologna under Aranzio and Tagliacozzi, learned the techniques for nasal reconstruction and in 1583 graduated in medicine. He was appointed Lecturer of Anatomy and Surgery at Bologna and maintained that position until 1599 when he moved to Messina. There he was appointed

Professor of Surgery in the newly established university and remained for 21 years [2, 5, 6]. On the way to Messina, in 1599, he stopped in Tropea to visit the Vianeos, the *inventors of the art* of nasal repair, to learn their technique directly from them. To his great surprise, he didn't meet anyone. Instead, he could only see their instruments about which he wrote: *seemed crude to me*. Cortesi was a true follower and disciple of Tagliacozzi—and the only one who performed his arm flap operation after his death.

During the period 1619–1635, Cortesi published numerous works including *Pharmacopea*, *Miscellaneorum Medicinalium Decades Denae* (Miscellany of Medicines, divided into ten decades) [7], and *De vulneribus capitis* (On head wounds) [8]. He became very famous, treated important personalities, and was appointed chief physician to the Pope and protophysician in Rome. In 1620, Bologna University offered him a position, but Cortesi declined. He died at Reggio Calabria in 1634, aged 80.

The *Miscellaneorum Medicinalium Decades Denae* is an ample work that covers different topics: anatomy (illustrated by 12 woodcuts); nasal reconstruction; natural and unnatural matters; urine; fevers; natural drugs; cauterization; and bloodletting. It begins with a fine engraved architectural frontispiece, incorporating the title (Fig. 4.2). The preface to the reader (*ad lectorem*) is an autobiography, where Cortesi traces his life, the period he spent in Bologna with Aranzio and Tagliacozzi, his trip to Tropea on the way to Messina with the aim of meeting the Vianeos, and his new position at Messina University.

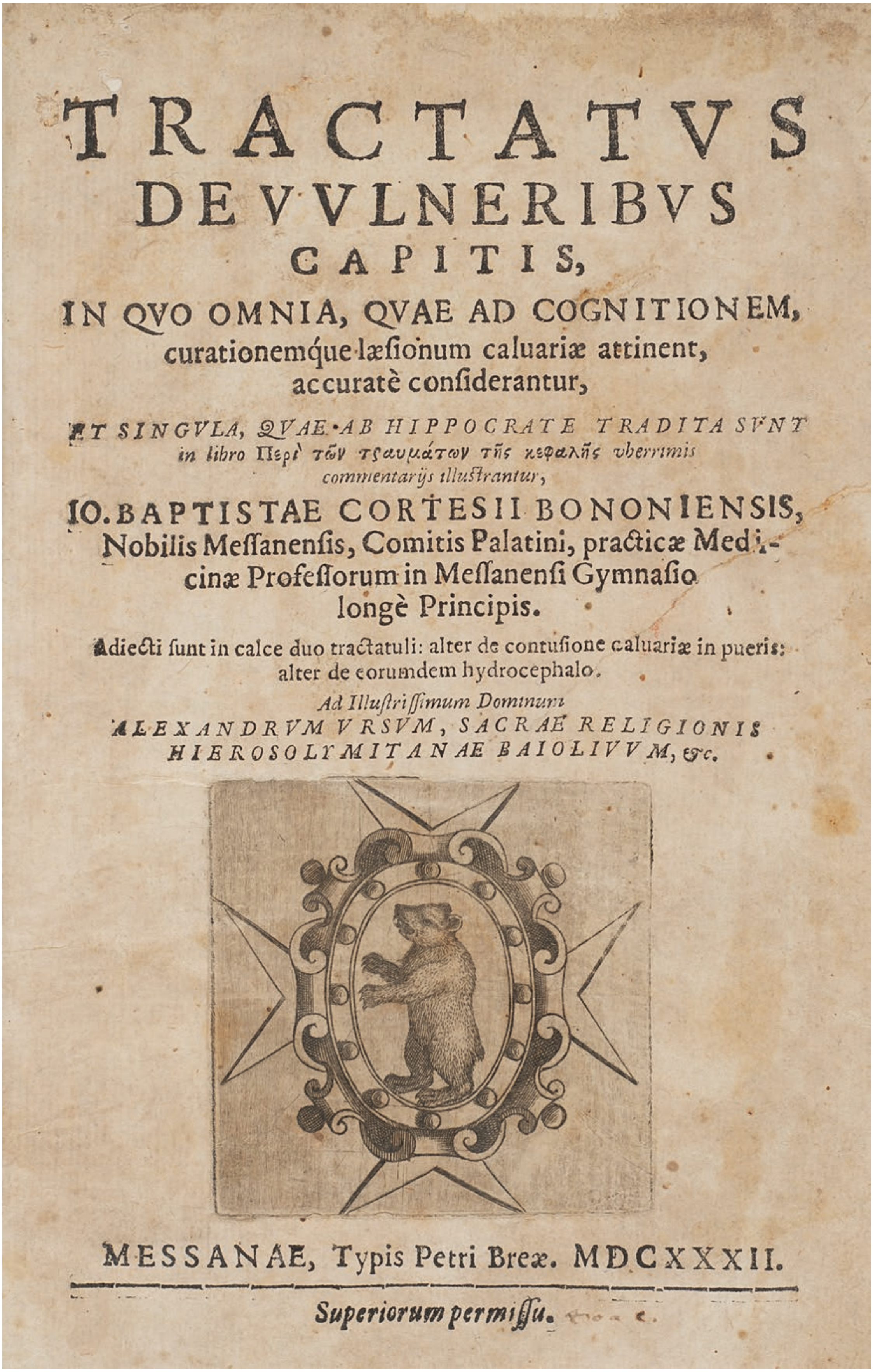
The third decade (*decas tertia*), the most interesting for us, deals with the procedure for nasal repair; lip reconstruction, either for cleft or posttraumatic purposes; and restoration of the auricle. Twenty-two engraved plates, reproduced from Tagliacozzi's *De curtorum chirurgia* (…) and adapted, illustrate the chapter (Fig. 4.3). Although the quality of the images is far beyond the originals included in the book by Tagliacozzi, the text is not particularly innovative. Nevertheless, the work deserves an important place in the history of plastic surgery as it is the only record of the procedure of nasal reconstruction issued in the seventeenth century and written by a disciple of Tagliacozzi [5, 6].

The *Tractatus de Vulneribus capitis* (On head wounds) [8] (Fig. 4.4) reports the original Greek text of Hippocrates on the same subject, including the Latin translation, followed by Cortesi's commentary about the management of head wounds. It is illustrated with numerous engraved plates of surgical instruments to perform craniotomy: the raspatory to abrade the bone and the trephine for perforating it. The trephine is inspired by a similar instrument, first described by Berengario in 1518. Interestingly, the work begins with the images of different features of craniostenosis, probably the first to be printed in the literature, and cases of trigonocephaly (Fig. 4.5 *top*), brachicephaly (Fig. 4.5 *center*), and Crouzon disease (Fig. 4.5 *bottom*).

Fig. 4.1 Engraved portrait of G.B. Cortesi (1554–1636). (From: *Miscellaneorum Medicinalium decades denae.* Messina, Pietro Brea, 1625)

Fig. 4.2 Engraved architectural title page of *Miscellaneorum Medicinalium decades denae*, by G.B. Cortesi, surmounted by the coat of arms of the city of Messina. To the left and right, respectively, the statues of the Reason and Experience. Below, at the center in a frame, city and publisher's name and the date. Messina, Pietro Brea, 1625

Fig. 4.3 Nasal reconstruction according to the arm flap procedure (Italian method): the complex type of bandage used to secure the arm into position. Engraved plate. (From: G.B. Cortesi. *Miscellaneorum Medicinalium decades denae.* Messina, Pietro Brea, 1625)



TRACTATVS
DE VVLNERIBVS
CAPITIS,
IN QVO OMNIA, QVAE AD COGNITIONEM,
curationemque læſionum caluariæ attinent,
accuratè conſiderantur,
ET SINGVLA, QVAE AB HIPPOCRATE TRADITA SVNT
in libro Περὶ τῶν τραυμάτων τῆς κεφαλῆς vberrimis
commentarijs illuſtrantur,
IO. BAPTISTAE CORTESII BONONIENSIS,
Nobilis Meſſanenſis, Comitis Palatini, practicæ Medi-
cinæ Profeſſorum in Meſſanenſi Gymnaſio
longè Principis.
Adiecti ſunt in calce duo tractatuli: alter de contuſione caluariæ in pueris:
alter de eorumdem hydrocephalo.
Ad Illuſtriſſimum Dominum
ALEXANDRVM VRSVM, SACRAE RELIGIONIS
HIEROSOLYMITANAE BAIOLIVVM, &c.

MESSANAE, Typis Petri Breæ. MDCXXXII.
Superiorum permiſſu.

Fig. 4.4 Title page of *Tractatus de Vulneribus Capitis* (Tract on Head wounds), by G.B. Cortesi with the engraved printer's device (logo). Messina, Pietro Brea, 1632

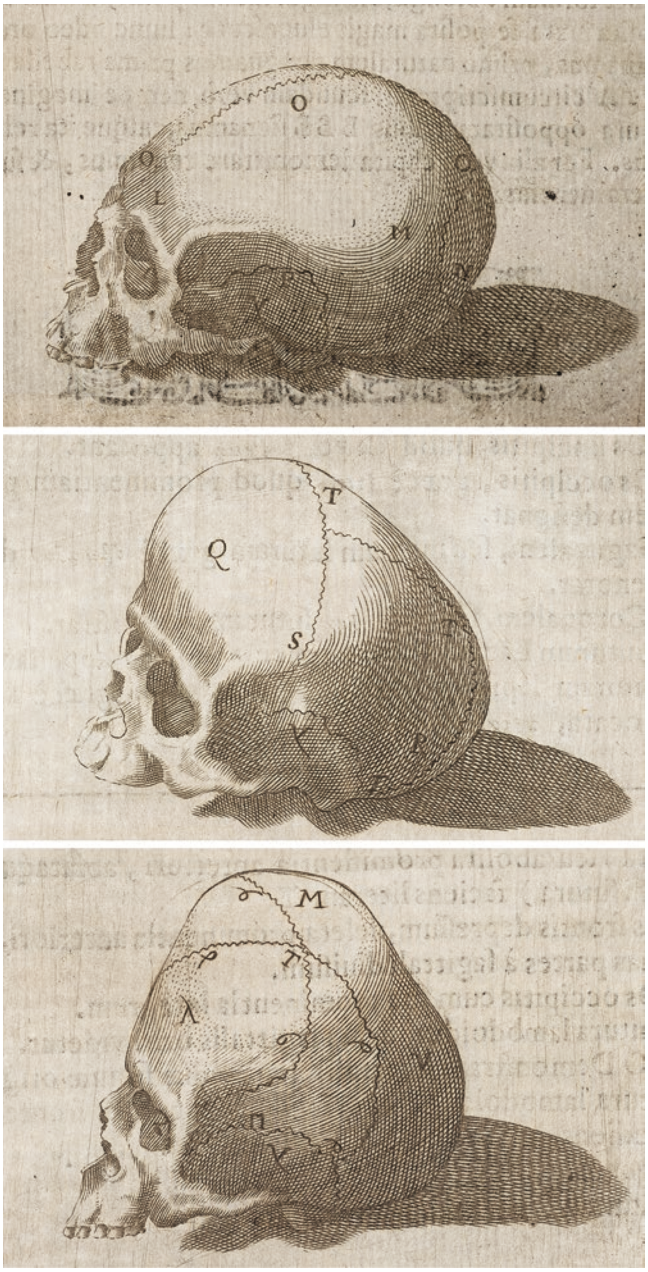


Fig. 4.5 Different features of craniostenosis, probably the first to be printed in the literature: (*top*) trigonocephaly; (*center*) brachicephaly; (*bottom*) Crouzon disease. (From: G.B. Cortesi. *Tractatus de Vulneribus Capitis.* Messina, Pietro Brea, 1632)

4.1.2.2 Thomas Feyens

Although first published in 1649, exactly 50 years after Tagliacozzi's death, *Libri Chirurgici XII* (Twelve Surgical Books) by **Thomas Feyens** (1567–1631) [9] is an important recounting of the procedure of the *Maestro* [5, 6, 9] (Fig. 4.6). The whole final book (p. 99–108) of *Libri Chirurgici XII* is devoted to *De Nasi amputati ex carne brachii restitutione* (Reconstruction of the amputated nose, using the skin taken from the arm). Feyens describes the operation in detail, discusses the advantages and disadvantages, and explains indications and results. He had the authority to do this because during the period when he studied in Bologna (1590–1593), he personally saw some cases either at completion of surgery or in the process of being reconstructed: *I can bear witness that Tagliacozzi, Professor of Anatomy at the University of Bologna, has restored many noses by this art. Which noses I have myself seen both after they have been repaired and while in progress of restoration*. However, he misinterpreted Tagliacozzi's lesson in what he affirms: *the new nose can be taken from the arm of another person*, or the sympathetic slave (see Sect. 4.1.3), strongly disclaimed by Tagliacozzi.

A native of Antwerp, **Feyens** studied in Leiden and moved to Bologna in 1590 to learn surgery directly from Tagliacozzi. In 1593, at the completion of his training, he returned to Flanders where he was appointed as Chair of Medicine at Leuven. He maintained this position until his death in 1631, aged 64.

Two other Tagliacozzi contemporaries who admired the professional skill and doctrine of the *Maestro* were **Fortunio Liceto** and **Antonio Molinetti**.

Fig. 4.6 Allegorical engraved title page showing on the sides of the architectural border two patients, the one on the left with an omphalocele while the other on the right a congenital hip dislocation. At the bottom, numerous surgical instruments and at the center a vignette illustrating Icarus naively flying too close to the sun (*Experientia*), falling down due to his melting wings (*Theoria*), while Daedalus prudently remains at a distance (*Praxis*). The vignette on top illustrates Hermes holding the caduceus, symbol of medicine, in his right hand. (From: Th. Feyens. *Libri Chirurgici* XII (Twelve Surgical Books). Frankfurt, Matthia Goez, 1649)

4.1.2.3 Fortunio Liceto

Fortunio Liceto (1577–1657) was born in Rapallo (Genoa) and studied in Bologna from 1595 to 1599, where he witnessed Tagliacozzi's operations personally [6]. He served as Professor of Philosophy and Medicine at Padua University from 1605 to 1631. A very prolific writer, he published on different topics from monsters, to comets, to the origin of nerves. He died in Padua in 1657, aged 80. In his book on monsters (congenital malformations) *De Monstrorum Caussis, Natura, et Differentiis* (On the Etiology, Nature and Differences of Monsters) [10], published in 1634, he wrote: *while studying* in *Bologna, we have often seen the eminent Professor Tagliacozzi, when he wished to reconstruct a nose, which had been cut off, first freshen the scars of the nose, next fit a part of the arm, deprived of skin to the nose, to make a union, and fasten it together with sutures, for a number of days*.

4.1.2.4 Antonio Molinetti

In his book *Dissertationes Anatomicae, et Pathologicae de Sensibus, & eorum Organis* (Anatomical and Pathological essays on the Senses and their Organs), **Antonio Molinetti** (1620–1675) [6], Professor of Theoretical Medicine at Padua University (replacing Fortunio Liceto) in dealing with the nose, reported that his father, having seen Tagliacozzi's operation personally, reconstructed the nose of a Polish nobleman in 1625, using the arm flap procedure [11].

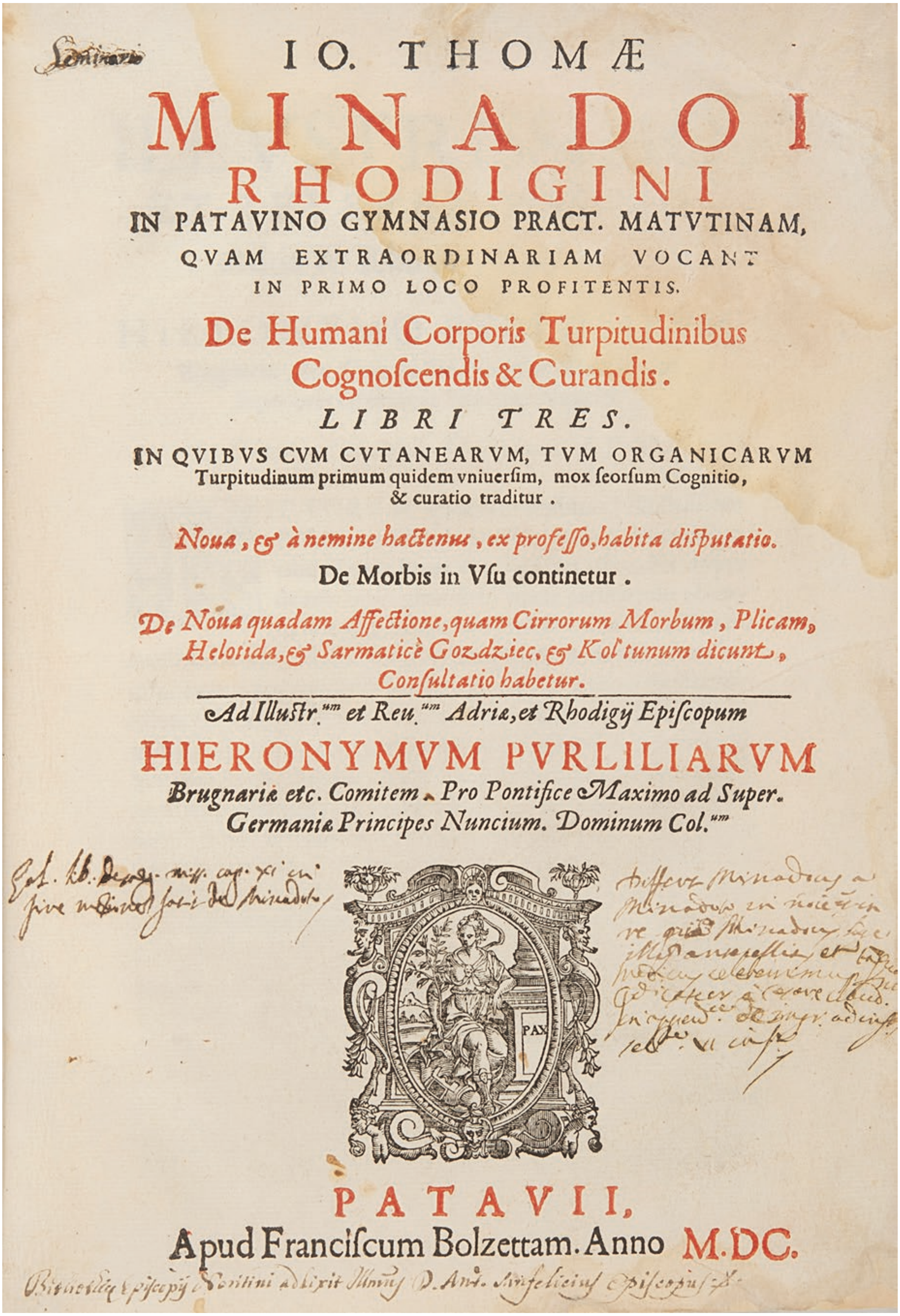
4.1.2.5 Giovanni Tommaso Minadoi

Giovanni Tommaso Minadoi (ca. 1540–1615) [6], born in Rovigo (northern Italy) into a family with a medical tradition, graduated in medicine from Padua University in 1576 and practiced in Venice. In 1578, he accompanied Teodoro Balbi, Consul of the Venetian Republic in Syria and Constantinople, to Constantinople as Balbi's personal physician. He remained there for 7 years, becoming well accepted among the local population for his continuous cures. During this period, he was a witness to the war between the Turks and the Persians and published a very successful report, *La Historia della guerra fra Turchi et Persiani* (The history of the war between the Turks and the Persians), first issued in 1587 and immediately reprinted.

Upon his return to Italy, he established himself in Venice and in 1596 was appointed Professor of Medicine at Padua University. Minadoi practiced in Mantua, Rovigo, and Adria. In 1615, he was called to Florence to treat Cosimo II de' Medici. Regrettably, he became ill and died in Florence that year. Minadoi was a prolific writer and published on measles, arthritis, malignant fever, cosmesis, and on the repair of mutilations.

His *De Humani Corporis Turpitudinibus Conoscendis & Curandis* (On the Knowledge and Treatment of the Deformities of the Human Body), written a few years after **Giovanni Marinello's** *Gli Ornamenti delle Donne* (1562) and **Gerolamo Mercuriale's** *De Decoratione* (1585) [6, 12], is one of the first treatises on hygiene, beauty, and well-being ever published (Fig. 4.7). It deals with the care of skin, teeth, nails, hairs, eyelids, ears, nose, and lips.

The whole of Chapter 40, Book Three, p. 121–22, is devoted to the management of *Curta* (mutilations). He tries to define the different types of wounds to the nose, lips, and ears and the various methods for their treatment. For nasal reconstruction, Minadoi emphasizes that Galen, Celsus, and Aegineta *never brought the work to perfection until Gaspar Taliacotius, whom we have mentioned with honor, managed to add the ultimate refinement to this marvelous method. For whatever Alexander Benedictus, Andreas Vesalius, Ambrosius Pareus, Johannes Schenckius, and others have left in their writings about this topic, they seem to fall far short of that miraculous perfection to which he brought the work, not only in words but in actual practice, with almost countless cases in the too brief course of his life* (…). Minadoi then compares the results of Tagliacozzi's procedure with those reported by Vesalius and Paré and considers Tagliacozzi's method far superior to the others. He finally concludes the chapter by reporting the arm flap procedure for nasal reconstruction in detail. Minadoi's account is particularly relevant in the history of plastic surgery because it is one of the first on this topic, following Tagliacozzi's work, published just 3 years earlier (1597).



IO. THOMÆ

MINADOI

RHODIGINI

IN PATAVINO GYMNASIO PRACT. MATVTINAM,

QVAM EXTRAORDINARIAM VOCANT

IN PRIMO LOCO PROFITENTIS.

De Humani Corporis Turpitudinibus Cognoſcendis & Curandis.

LIBRI TRES.

IN QVIBVS CVM CVTANEARVM, TVM ORGANICARVM Turpitudinum primum quidem vniuerſim, mox ſeorſum Cognitio, & curatio traditur.

Noua, & à nemine hactenus, ex profeſſo, habita diſputatio.

De Morbis in Vſu continetur.

De Noua quadam Affectione, quam Cirrorum Morbum, Plicam, Helotida, & Sarmaticè Gozdziec, & Kol'tunum dicunt, Conſultatio habetur.

Ad Illuſtr.um et Reu.um Adriæ, et Rhodigij Epiſcopum

HIERONYMVM PVRLILIARVM

Brugnariæ etc. Comitem. Pro Pontifice Maximo ad Super. Germaniæ Principes Nuncium. Dominum Col.um

PAX

PATAVII,

Apud Franciſcum Bolzettam. Anno M.DC.

Fig. 4.7 Title page of *De Humani Corporis Turpitudinibus Conoscendis & Curandis* by Giovanni Tommaso Minadoi. Padova, Bolzetta, 1600

4.1.2.6 Johannes Schenck von Grafenberg

The eminent German physician, **Johannes Schenck von Grafenberg** (1530–1598), summarized his studies in the fields of diseases, wounds, and anomalies of the human body, in a seminal work, *Observationum medicarum rararum* (Rare medical observations), posthumously published by his son Georg in 1600 and reprinted in 1609 in a larger folio edition [13] (Fig. 4.8). In describing the injuries of the nose, *De Naribus* (On the Nose), Schenck traced the history of nasal reconstruction, beginning with the Brancas of Catania (Sicily), and gave a clear summary of Tagliacozzi's method describing the arm flap procedure in detail. To offer more consistency to his report, he recalled the letter written by Tagliacozzi to Mercuriale, dated 1586, that first appeared in the *De Decoratione* by Mercuriale (Frankfurt 1587) [14] (Fig. 3.61), where the arm flap technique was presented directly by him, 11 years before the publication of *De curtorum Chirurgia* (…) [4].

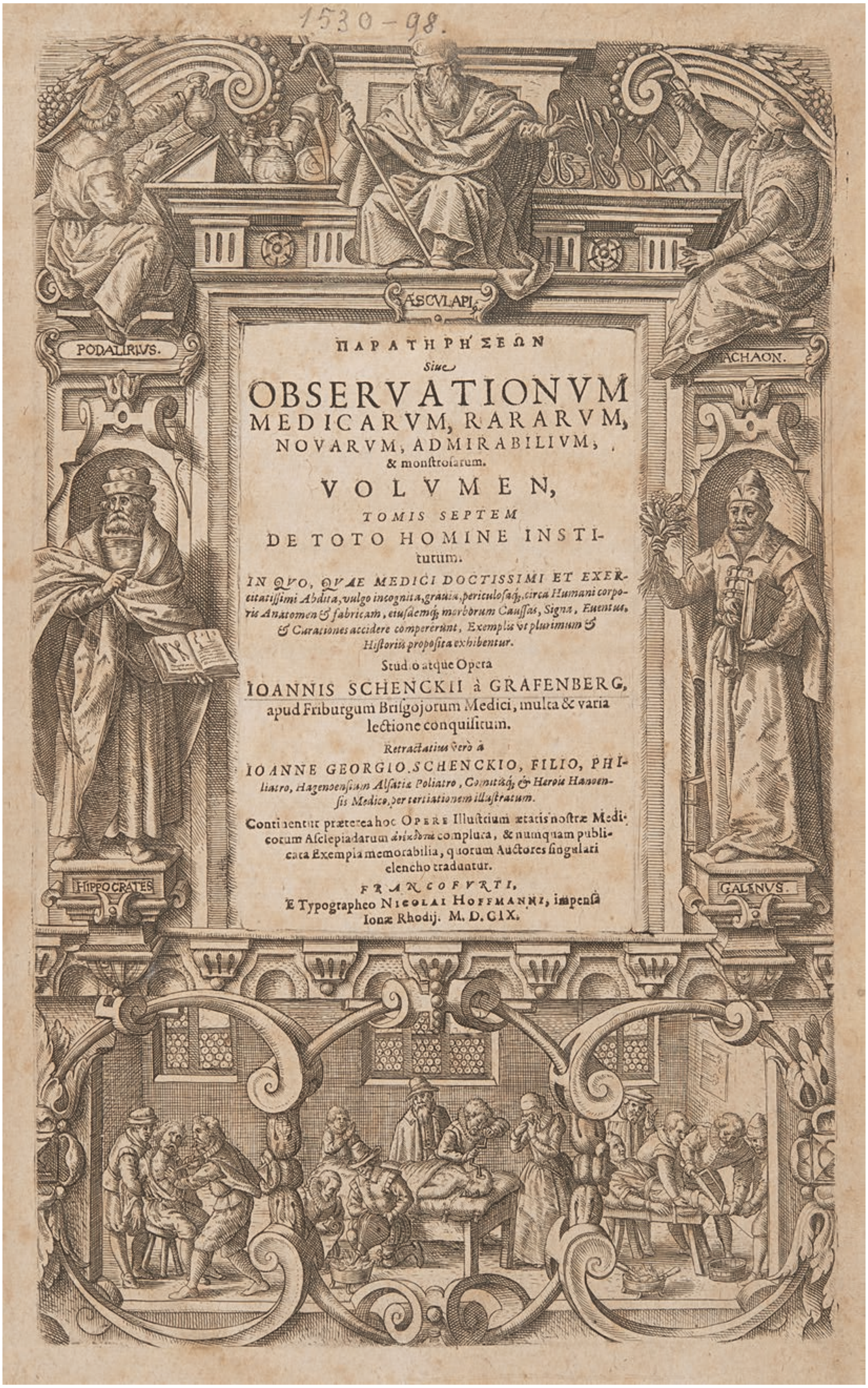


Fig. 4.8 Engraved architectural title page of *Observationum medicarum rararum* by J. Schenk von Grafenberg surrounded by statues of eminent physicians of the past and with the representation of surgical scenes at the bottom, chest arrow removal, craniotomy, leg amputation. Frankfurt, Hoffmann 1609

4.1.2.7 Jean Vigier

Another work, written a few years after the publication of Tagliacozzi's book, was *La grande Chirurgie des Tumeurs* (The great Surgery of Tumors) by **Jean Vigier** (15?–1659) first published in Lyon in 1611 [15] (Fig. 4.9). In Book Two, Chapter 17, dealing with wounds of the nose (*Des playes du Nez*), Vigier explained *si (le nez) est du tout coupé, Taliacotius en einseigne la restauration* (if the nose is completely severed, Tagliacozzi teaches us how to repair it). Vigier considered the arm flap method, the gold standard for repairing an amputated nose. He suggested harvesting the biceps muscle and maintaining the bandage and immobilization for 40 days. Little is known about Jean Vigier. He was from Castres, in the Albigeois region (southern France), and was appointed physician at the Medical Faculty of Montpellier. He died about 1659.

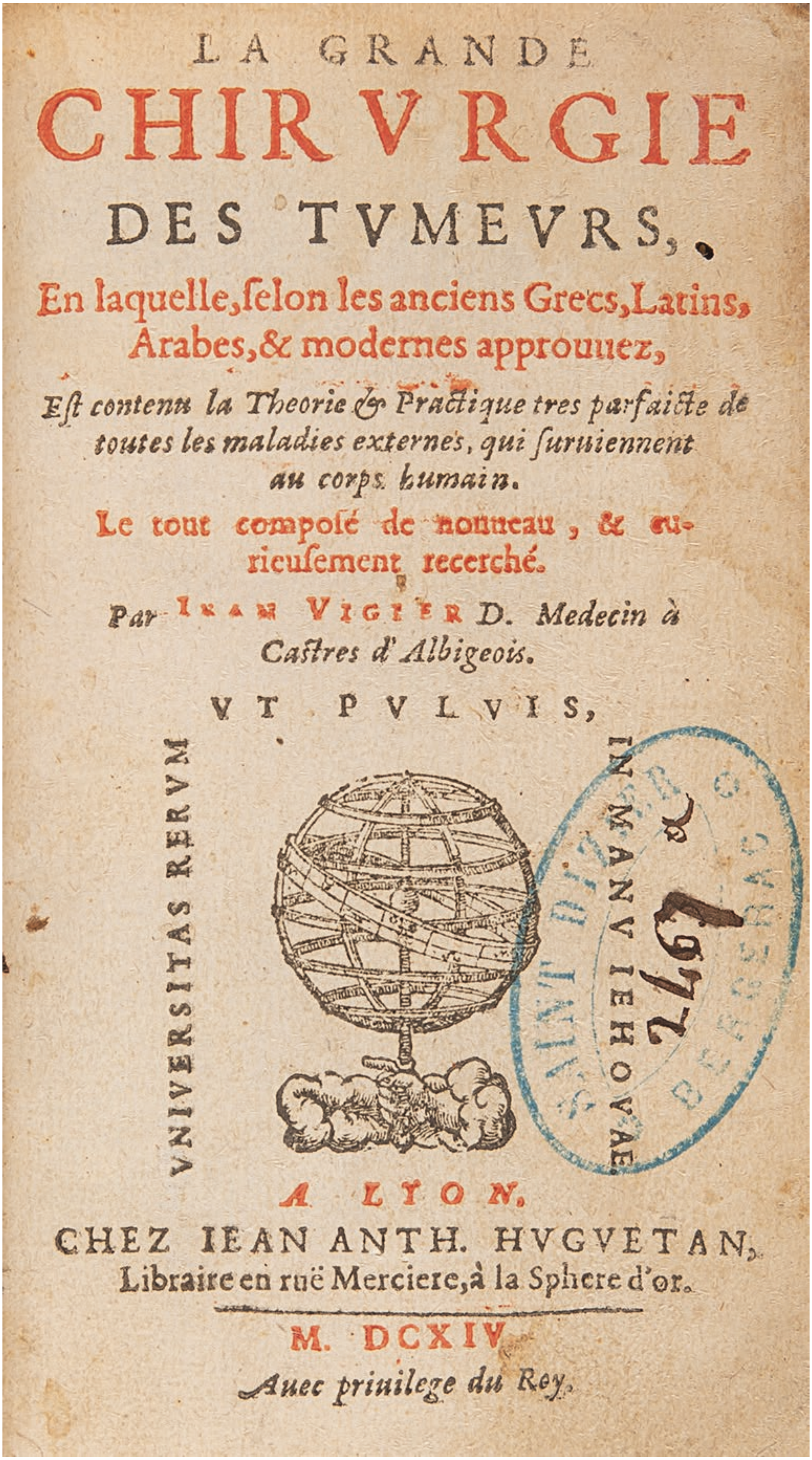


Fig. 4.9 Title page of *La Grande Chirurgie des Tumeurs* by Jean Vigier. Lyon, J.A. Huguetan, 1614

4.1.2.8 J. Baptista van Lamzweerde

In 1671, the Dutch physician **J. Baptista van Lamzweerde** (ca. 1657–1700) published *Appendix* (…) *ad Armamentarium Chirurgicum Joannis Sculteti* (Appendix to the Surgical Armamentarium of J. Scultetus) [6, 16, 17], wherein he emphasized that skin is the ideal material for nasal repair, supplemented by a series of illustrations of the arm flap technique, curiously without mentioning Tagliacozzi's name. Pre- and postoperative views of nasal reconstruction and of the instruments necessary to perform the procedure were also supplied (Fig. 4.10). Having obtained a doctorate in medicine and surgery, he established himself in Amsterdam and was admitted to the college of physicians. He was later appointed Professor of Anatomy in Köln, where he taught Anatomy until the beginning of the eighteenth century.

Fig. 4.10 Engraved illustrations of the arm flap method for nasal reconstruction, according to Tagliacozzi. Pre- and postoperative view of the patient, the bandages to maintain the arm in a stable position, the arm donor site, the application of the procedure to the nose, upper, and lower lip. (From: Lamzweerde JB. *Appendix* (…) *ad Armamentarium Chirurgicum Joannis Sculteti*. Amsterdam, Joannem van Someren, 1671)

4.1.2.9 Mattheus Purmann

Mattheus Purmann (1648–1721), a native of Lüben (Schlesien), was an army surgeon who became one of the most renowned German surgeons after J. Schultes' (*Latin:* Scultetus) (1595–1645) death. He was a supporter of the management of gunshot wounds, using simple protective dressings, although he also recommended the application of Sir K. Digby's powder of sympathy. He is regarded as the surgeon who had the greatest experience in craniotomy, having performed more than forty cases, and one of the first to have treated cancer by radical excision and, once the tumor had been removed, suggested that the wound be thoroughly cauterized [18]. He was well-known for having carried out the first blood transfusion in Germany from lamb to human in 1668 (see Sect. 4.1.7.2). He was a prolific writer, and the great majority of his publications were written in German [6, 17].

Grosser und ganz neugewundener Lorbeer-Krantz, oder Wundartzney (Large and complete Laurel Crown or Wound Surgery) first published in 1685 at Halberstadt was a very complete and scholarly written treatise on surgery that showed the different types of procedures known at the time [19]. The author gave an exhaustive account on nasal reconstruction by means of the so-called Italian method (Part One, Chapter 31, p. 232) and traced the history of the operation by quoting the Branca family, Elisio Calenzio, Alessandro Benedetti, and Tagliacozzi. He suggested that the flap, composed of skin and biceps muscle, should be outlined on the arm and severed after 4 weeks. The engraved illustration depicts the arm, with the remaining donor site wound, and the before and after surgery views of a reconstructed nose (Fig. 4.11). Purmann favored the radical excision of cancer, especially when the pathologic growth was easily detectable, as in breast carcinoma. After tumor ablation, he suggested the use of cautery for wound cleansing and sterilization. As a result of this procedure, cancer was at last removed, considered until then surgically untouchable: *noli me tangere* (do not touch me).

Fig. 4.11 Images of nasal reconstruction with the arm flap procedure: (**a**) the residual wound in the arm donor site; (**b**) pre- and postoperative profile view of the nose of the patient. (From: Purmann MG. *Grosser und ganz neugewundener Lorbeer-Krantz, oder Wundartzney*. Frankfurt u. Leipzig, Wittib und Erben, 1705)

4.1.2.10 Johannes Munnicks

Born in Utrecht (The Netherlands), **Johannes Munnicks** (1652–1711) studied medicine at Utrecht University from where he graduated in 1670 [6, 17]. In 1678, he was appointed Professor of Surgery and then Professor of Anatomy and Botany and in 1710 became the Rector of Utrecht University. In 1689, he published a textbook on surgery in Latin in Utrecht, which was translated the following year into German. *Praxis Cheirurgica* (…) (Surgical Practice) [20] is divided into five books. Book One deals with the treatment of swellings; Book Two with wounds and includes details on the management of nasal wounds; Book Three with ulcerations; Book Four with fractures; and Book Five with luxations. Regarding nasal wounds (Book Two, Chapter 18, p. 476), Munnicks explains that it is not possible to re-approximate completely separated parts of the nose. However, in the case of nasal amputation, use of noses built of silver or wood and then colored to make them more natural, represents the solution of choice. On the contrary, if a reconstruction has to be taken into consideration, it can be performed according to the Tagliacozzi procedure, using skin outlined on the arm. The work is preceded by a beautiful engraved title page which shows the allegory of surgery with the typical instruments available at that time in the foreground (Fig. 4.12).

Fig. 4.12 Engraved allegorical title page showing surgery with the typical instruments available at the time in the foreground. (From: Munnicks J. *Praxis Cheirurgica oder Wund-Artzney* (…) Ulm, Wilhelm Kühnen, 1690)

4.1.3 Tagliacozzi's Detractors: The Sympathetic Slave and the Powder of Sympathy

The greatest offense to the method of Tagliacozzi came from his detractors who spread the false information that instead of using autologous tissue, with skin outlined from the patient's own arm, it was equally possible to employ skin taken from another person's arm, a slave or a porter, for a sort of *sympathetic* relationship established between the recipient organ (*sympathetic nose*) and the man who donated the skin (*sympathetic slave*). The story continued with the belief that when the original *donor* slave died, the reconstructed nose would suffer a similar fate [6]. Tagliacozzi himself devoted an entire chapter of his *De curtorum Chirurgia* (…) (Volume One, Chapter 18) [4] to explain whether it was possible to harvest the flap from another person. In theory, he wrote, it should be possible, but in reality impracticable because of the difficulty of keeping two individuals fastened together, almost immobile, for the time necessary to establish the union between the flap and the nose.

4.1.3.1 Jean Baptiste van Helmont

The Belgian **Jean Baptiste van Helmont** (1579–1644), was born in Brussels and graduated in medicine from Leuven (Belgium). He founded the Iatrochemical School which based the treatment of diseases on employing chemical and physical remedies. He published *De magnetica vulnerum curatione* (On the magnetic healing of wounds) in 1621 [21], where he reported the following episode (Chapter 22): *A man of Brussels lost his nose in a fight and went to the surgeon Tagliacozzi of Bologna for having a new nose. Since he was afraid of having a cut on his own arm, he hired a porter for the purpose and after paying him a fee carved out a nose from his arm. Then about thirteen months after his return home, his engrafted nose grew stiff and some days later fell off. On investigation of this strange and unexpected event, it was discovered that about the same period that the nose grew stiff the porter had died*. His book, *De magnetica vulnerum curatione*, was included in his collected works, *Ortus Medicinae* (Origin of Medicine), first issued in 1648 in Amsterdam, in 1651 in Venice, and in 1682 in Frankfurt [5, 6, 21].

4.1.3.2 Athanasius Kircher

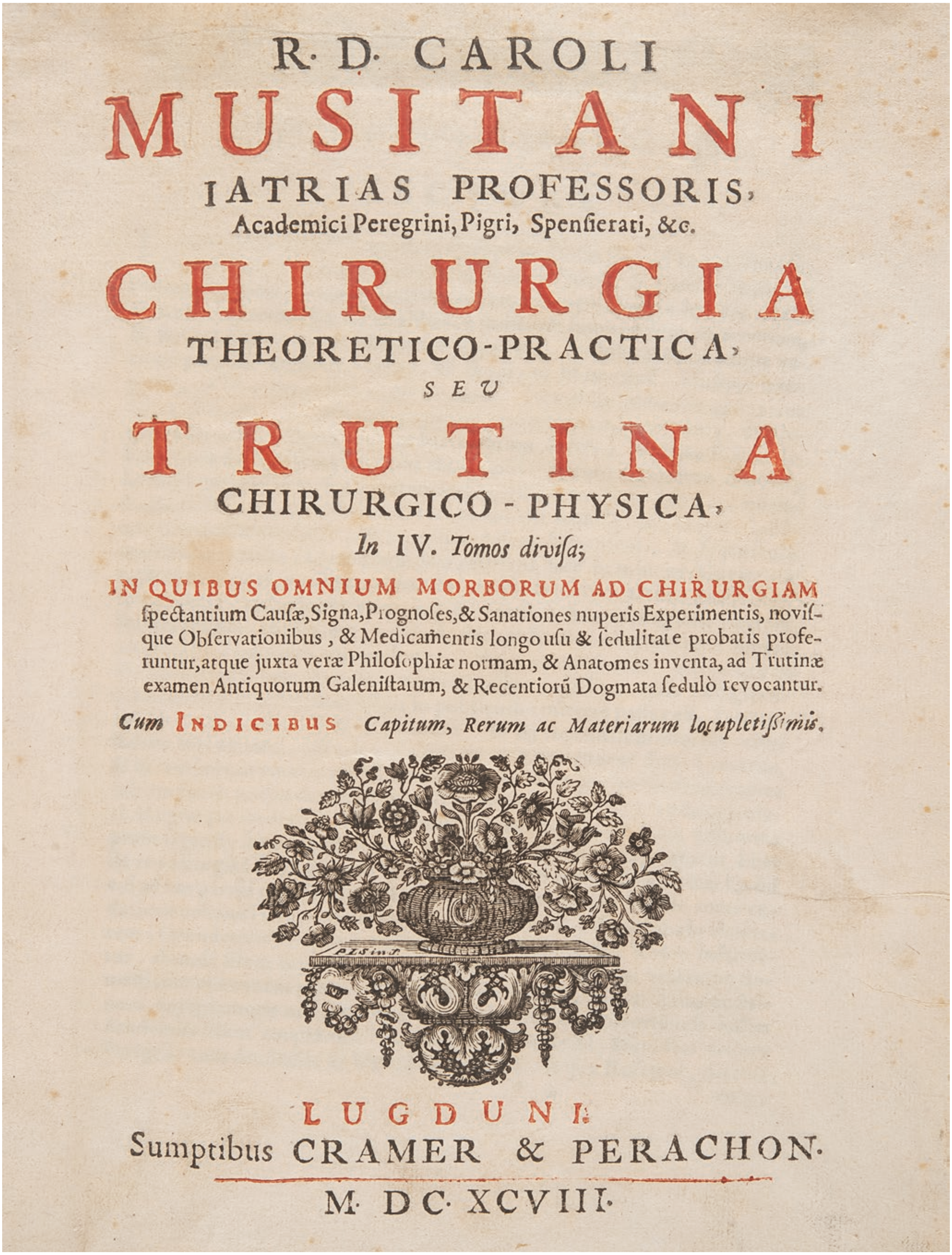
The learned Jesuit priest **Athanasius Kircher** (1554–1636), from Fulda (Germany), was a polymath, a true Renaissance man, with an enormous variety of interests, that included astronomy, geology, medicine, architecture, egyptology, music, and magnetism. In his book *Magnes sive de Arte Magnetica* (Magnetism or Magnetic art), first published in 1641 (Fig. 4.13), he cited the following slave story, although he considered it somewhat ridiculous (Book One, Chapter 3) [5, 6, 17, 22]. A gentleman, having lost his nose by some accident, consulted a surgeon to restore the missing part, according to the arm flap technique described by the Calabrian surgeons in Tropea: *Consultus itaque quidam nasorum reficiendorum peritia iamdudum celebris Chirurgus, vel ut melius dicam Rhinurgus* (…) (He consulted a renowned surgeon, better called rhinosurgeon, expert in nasal reconstruction). The gentleman had a servant, and to avoid the use of his own skin, the rhinosurgeon proposed to harvest the servant's skin instead. Thus, he incised the flesh of the servant's arm and sutured it to the stump of the gentleman's nose, in sufficient amount to build a new nose, according to a previously prepared pattern. He divided it when the union was completed. Finally, the gentleman had his cut-off nose replaced. However, when the servant died, the nose fell off.

Fig. 4.13 Engraved title page showing the double-headed eagle, symbol of the Roman/Byzantine Empire, with the city of Fulda at the bottom. (From: *Magnes sive de Arte Magnetica*, by A. Kircher. Roma, Grignani, 1641)

4.1.3.3 Carlo Musitano

For a long time, readers enjoyed these curious and peculiar stories regarding the art of nasal reconstruction. Under such circumstances, highly demonstrative is the episode reported by **Carlo Musitano** (1635–1714), in Book Three, Chapter 46, of his work *Chirurgia Theoretico-Practica; seu Trutina Chirurgico-Physica, in IV Tomos divisa* (Theoretic-practical Surgery; or Surgical-Physic Balance, divided in four Books), first published in Lyon in 1698 [17, 23] (Fig. 4.14). Dealing with nasal wounds (*De Nasi vulneribus*), Musitano says that in case of amputation for trauma, the nose can be restored by the skill of certain Calabrian surgeons: *aliqui chirurgi in nostra Calabria qui nasum amputatum efformare solent*. They can solve the problem, using skin and some flesh harvested from the arm. The Calabrian origin of the author was certainly the basis of this story. Musitano also mentioned Tagliacozzi and van Helmont. Finally, he added an anecdote, particularly unusual if one considers that nasal reconstruction was not practiced anymore at the time of Musitano, but witness of the general belief of the extreme fragility of the new nose. A man who had his nose reconstructed, using the skin taken from his own arm, was so scared to lose it, that he didn't dare sneeze, but only used the twisted corner of his handkerchief. When the surgeon noticed this, he grabbed him by the nose and pulled him around the house.

A native of Castrovillari (Calabria), priest and physician, as well as Professor of Medicine at Naples University, **Musitano** was highly respected all over Europe for his talent and capability. He was a prolific writer and appointed a member of several scientific academies. He died in Naples in 1714, aged 79 [6].



R·D· CAROLI

MUSITANI

IATRIAS PROFESSORIS,

Academici Peregrini, Pigri, Spenſierati, &c.

CHIRURGIA

THEORETICO-PRACTICA,

SEU

TRUTINA

CHIRURGICO-PHYSICA,

In IV. *Tomos diviſa;*

IN QUIBUS OMNIUM MORBORUM AD CHIRURGIAM ſpectantium Cauſæ, Signa, Prognoſes, & Sanationes nuperis Experimentis, noviſque Obſervationibus, & Medicamentis longo uſu & ſedulitate probatis proferuntur, atque juxta veræ Philoſophiæ normam, & Anatomes inventa, ad Trutinæ examen Antiquorum Galeniſtarum, & Recentiorũ Dogmata ſedulò revocantur.

Cum INDICIBUS *Capitum, Rerum ac Materiarum locupletiſſimis.*

LUGDUNI:

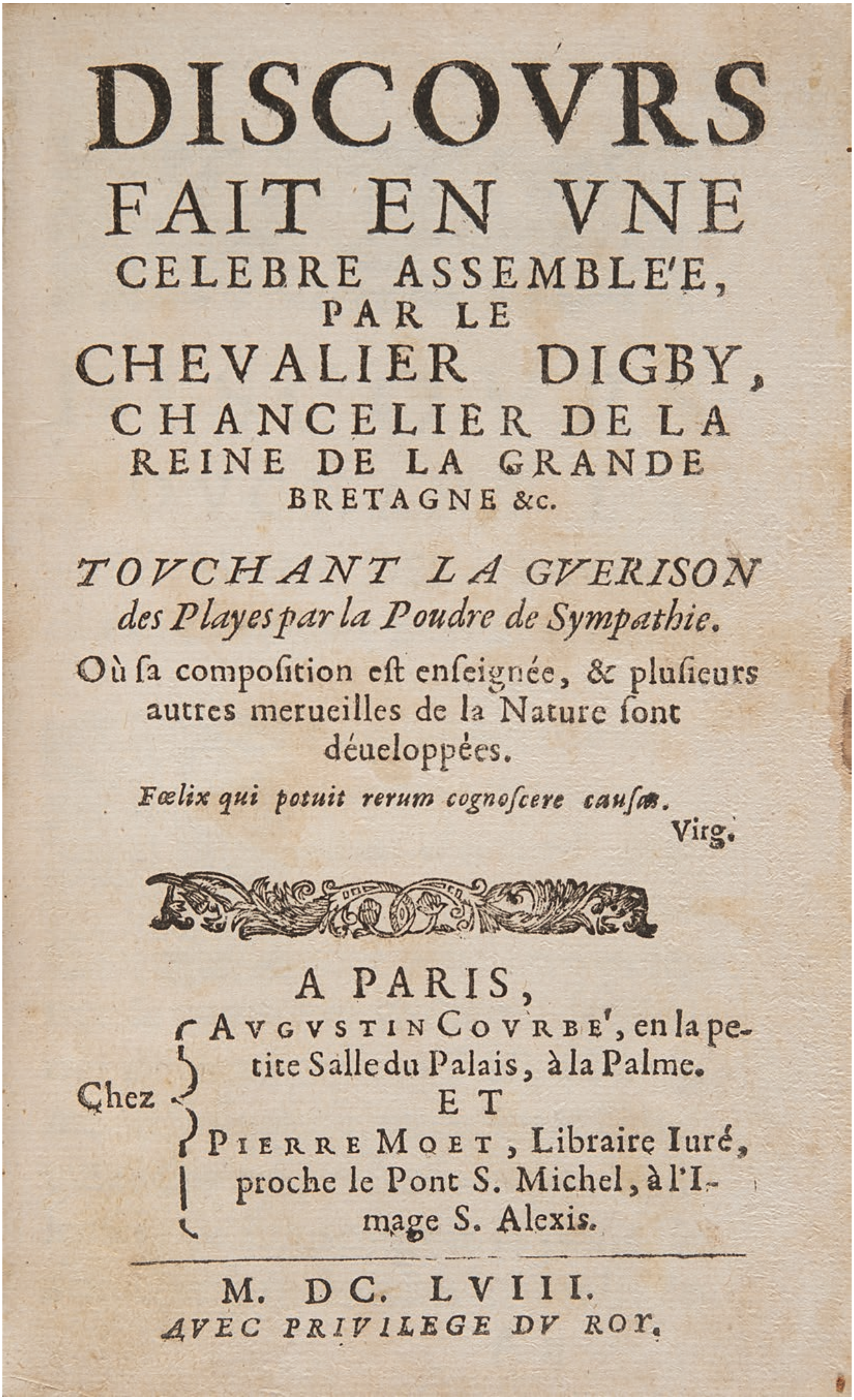
Sumptibus CRAMER & PERACHON.

M. DC. XCVIII.

Fig. 4.14 Title page of *Chirurgia Theoretico-Practica; seu Trutina Chirurgico-Physica* by Carlo Musitano. Lyon, Cramer and Perachon, 1698

4.1.3.4 Sir Kenelm Digby

Defined by Gnudi and Webster [6] as *the most extraordinary and versatile genius of the century*, **Sir Kenelm Digby** (1603–1665) was a man with widely differing interests who had a very turbulent life. He studied at Oxford, but left without a degree. At the age of 20, he was involved in a dramatic street brawl in Madrid and the following year became a successful privateer in the Mediterranean. He was then appointed as a naval administrator with lucrative trade monopolies. For political reasons, Digby left England and lived in France. He practiced medicine without formal qualifications and gained notoriety by promoting the use of *sympathetic powder*, which repaired wounds almost instantly. An experiment was done, giving it to a cock after a sword had been passed six times through its body. Miraculously, within 3 h the cock was healed! The powder of sympathy had a remarkable impact throughout the seventeenth century. It was the most famous universal cure, thanks to the brilliant mind of Sir Kenelm, who published *Discours fait en une celèbre Assemblée* (…) *touchant la Guérison des Playes par la Poudre de Sympathie* (…) first in French in 1658 [17, 24] (Fig. 4.15) and immediately translated into English: *A late discourse made in a solemne Assembly of nobles and learned men at Montpellier in France* (…) *Touching the cure of wounds by the powder of sympathy; with instructions how to make the said powder; whereby many other secrets of nature are unfolded. Rendered faithfully out of French into English*—and advertised in different countries. Soon the book, translated into German, Dutch, and Latin, was in all men's hands. At the beginning of the work, Digby explained that, as a young man in Florence, he heard from a Carmelite friar about the secrets of the healing properties of the powder, vitriol (copper sulfate), which Digby claimed possessed the miracles of the cure according to the following rules: the blood of the person had to be mixed in a basin with a solution containing the powder and then left to dry in the light, sun, and air. The sun withdrew the healing properties of the solution which, transported to the wound, could rapidly cure. The efficacy of the remedy was illustrated by several long-winded tales, among them the one of the sympathetic nose (p. 152): *I will say nothing of artificial noses that are made out of flesh of other men for to remedy the deformity of those who by an extreme excess of cold have lost their own, which new noses do putrify as soon as those persons out of whose substance they were taken come to die, as if that small parcell of flesh engrafted upon the face did live by the spirits it drew from its first root and source* (…).


DISCOVRS
FAIT EN VNE
CELEBRE ASSEMBLE'E,
PAR LE
CHEVALIER DIGBY,
CHANCELIER DE LA
REINE DE LA GRANDE
BRETAGNE &c.

TOVCHANT LA GVERISON
des Playes par la Poudre de Sympathie.

Où ſa compoſition eſt enſeignée, & pluſieurs
autres merueilles de la Nature ſont
déueloppées.

Fœlix qui potuit rerum cognoſcere cauſas.
Virg.

A PARIS,
Chez AVGVSTIN COVRBE', en la petite Salle du Palais, à la Palme.
ET
PIERRE MOET, Libraire Iuré, proche le Pont S. Michel, à l'Image S. Alexis.

M. DC. LVIII.
AVEC PRIVILEGE DV ROY.

Fig. 4.15 Title page of *Discours fait en une celèbre Assemblée* (…) *touchant la Guérison des Playes par la Poudre de Sympathie* (…) by Sir K. Digby. Paris, Augustin Courbé et Pierre Moet, 1658

4.1.3.5 Samuel Butler

The Tagliacozzi method culminated in its final peak of mockery and ridicule when it was even quoted by common writers, who used the figure of the sympathetic slave or porter as satire. This occurred in **Samuel Butler**'s (1612–1680) *Hudibras*, when the slave or porter was no longer offering his arm, but the buttock [25]:

So learned *Taliacotius* from
The brawny part of Porter's bum
Cut supplemental Noses, which
Would last as long as Parent breech:
But when the last date of *Nock* was out,
Off drop the Sympathetic Snout.

4.1.3.6 Voltaire

François-Marie Arouet, better known as **Voltaire** (1694–1778), taking inspiration from Butler's verses, made the following free translation of the text (Voltaire. *Oeuvres completes*. Vol. 41. Paris; Imprimérie Société Typographique, 1785. p. 413–414) and added a final macabre conclusion, saying that at the lender's death the nose fell off, often in the beer mug, and that the nose was eventually repositioned on the original bum:

Ainsi Tagliacotius,
Grand Esculape d'Etrurie,
Répara tous les nez perdus
Par une nouvelle industrie:
Il vous prenoit adroitement
Un morceau de cul d'un pauvre homme,
L'appliquait au nez proprement;
Enfin il arrivait qu'en somme,
Tout juste à la mort du préteur
Tombait le nez de l'emprunteur,
Et souvent dans la même bière,
Par justice et par bon accord,
On remettait au gré du mort
Le nez auprès de son derrière.

4.1.4 The Role of the Periosteum in Bone Production: The Origin of Bone Graft

For the past three centuries, surgeons have tried to induce bone formation in sites where it was congenitally or post-traumatically absent. Fundamental, exhaustive studies on the osteogenic properties of the periosteum as bone producer have been done over the years beginning with **Duhamel de Monceau** (1700–1781), continuing with the Italian **Michele Troja** (1747–1827), proceeding with **Pierre Flourens** (1794–1867), and culminating with **Louis Xavier Édouard Ollier** (1794–1867)**—**all studies that confirmed the axiom: *periosteum forms bone* when transplanted into a viable recipient site. In other terms, periosteum plays a key role in bone regeneration [26]. The role of the periosteum as bone producer will be described in detail (see Sect. 5.4).

4.1.4.1 Job Janszoon van Meekeren

We owe to the Dutch physician **Job Janszoon van Meekeren** (1611–1666) the first report of a bone graft in history. A student of Nicolaas Tulp (1593–1674), van Meekeren became a surgeon in 1635, aged 24, and practiced in Amsterdam all his life, achieving a great reputation. He died in 1666, aged 55. He published a book describing rare observations, first issued in Dutch in 1668 and translated into German in 1675 and into Latin in 1682 as *Observationes Medico-Chirurgicae* [27]. The book is an incredible mine of unusual cases. The engraved frontispiece shows a patient affected by skin and joint laxity, later named Ehlers-Danlos syndrome. On stretching the skin, it could easily reach the mouth from the shoulder (Fig. 4.16).

He also recounted the story about a bone graft from a dog to a human, told to him by the Reverend Engelbert Slot. In Moscow, a noble Russian soldier named Butterlijn received a graft of bone harvested from the skull of a dog that had been killed on purpose, corresponding in shape and size to that cut by a sword from the nobleman's head, and filled in the cranial defect, sequela of a *coup-de-sabre* on the battlefield. The graft took perfectly, and the nobleman was restored again to normal life. He joyfully recounted this miraculous event to friends and acquaintances, who in turn communicated it to the theologians and to the Bishop. They brought about his excommunication, and the nobleman was forbidden access to places where Christians met together throughout the whole of Russia, while the parts of the dog's bone remained united with the bones in the head of a Christian man. The nobleman, preferring to be counted among the members of the Church rather than remain isolated, ordered the surgeon to remove the fragments of the dog's bone. Thus, he escaped the consequences of excommunication [27] (Fig. 4.17).

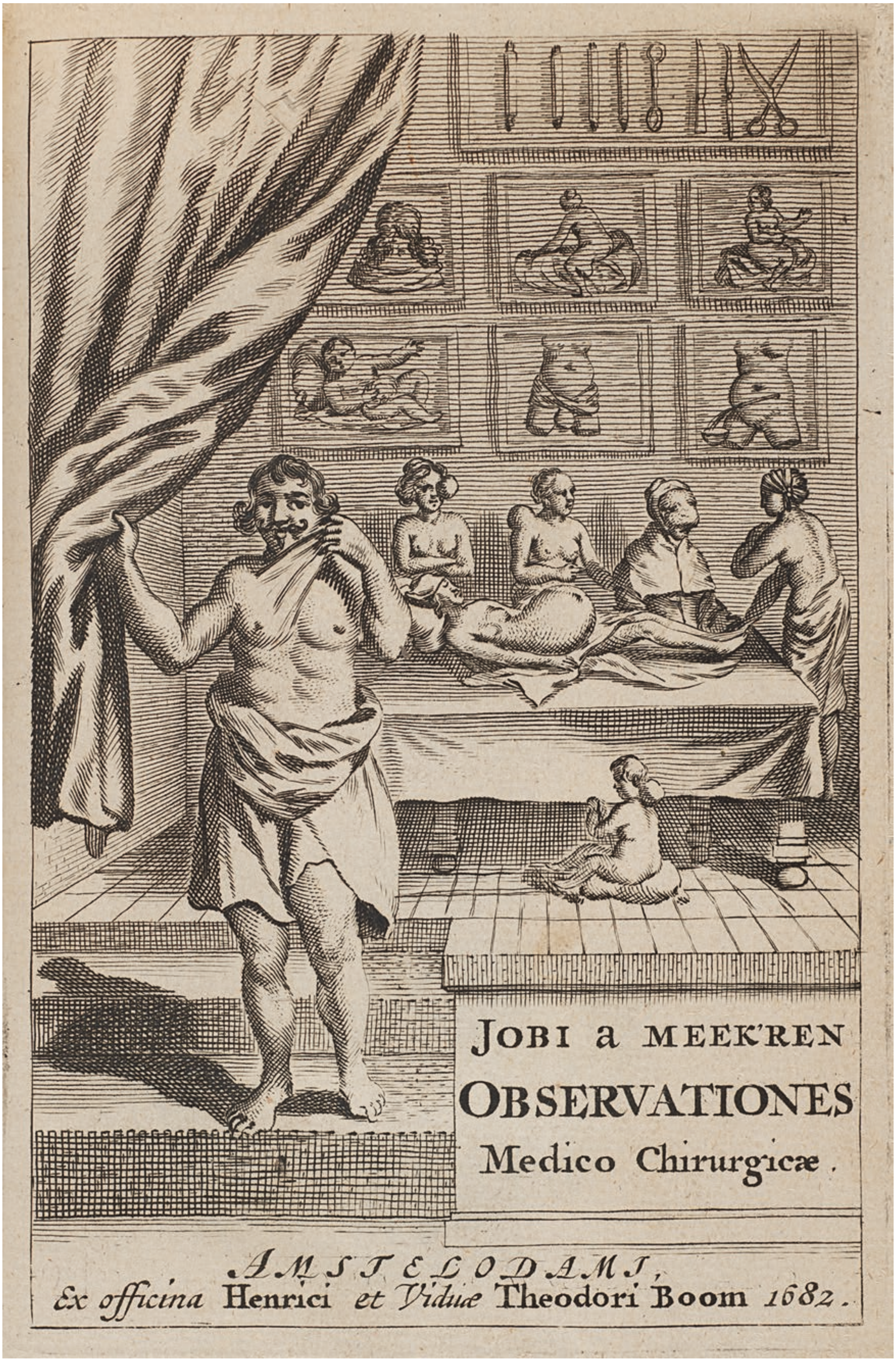


Fig. 4.16 Engraved title page showing a rare case of severe skin laxity: on stretching the skin, it could easily reach the mouth from the shoulder (Ehlers-Danlos syndrome). (From: J. van Meekeren. *Observationes Medico–Chirurgicae*. Amsterdam, Hendrik and widow of Th. Boom, 1682)

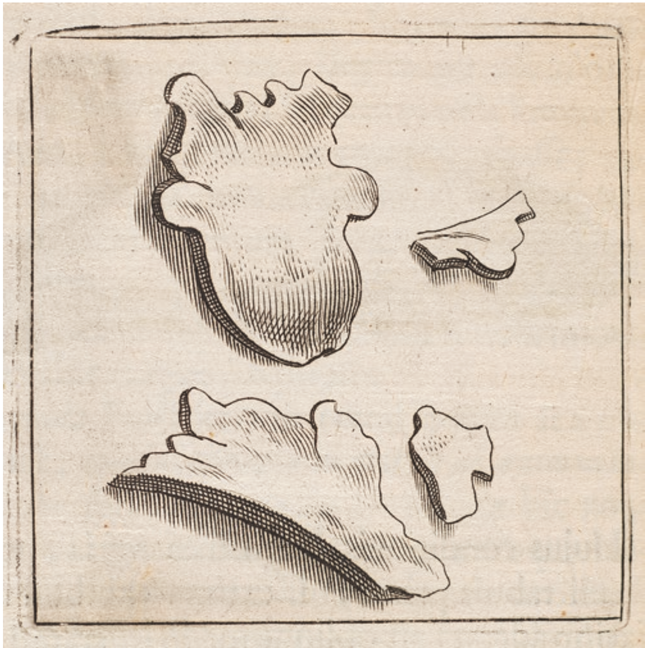


Fig. 4.17 Dog bone graft inserted in the skull of a Russian nobleman to fill in a cranial defect. First bone graft in history. (From: J. van Meekeren. *Observationes Medico–Chirurgicae*. Amsterdam, Hendrik and widow of Th. Boom, 1682)

4.1.5 The Progress of General Surgery: Italy

4.1.5.1 Hyeronimus Fabricius ab Aquapendente

The most prominent anatomist and surgeon between the Renaissance and the early seventeenth century was **Hyeronimus Fabricius ab Aquapendente** (ca. 1533–1619). He was born in Acquapendente (north of Rome) probably in 1533 [3, 18]. He concluded his medical studies at the University of Padua, receiving his degree in medicine in 1559, under the guidance of **Gabriele Falloppio**, a well-known anatomist. At Fallopio's death in 1562, Fabricius replaced him as the Chair of Anatomy and Surgery at Padua University and maintained this position for almost 50 years until 1613. During this period, he contributed significantly to the progress of anatomy and surgery teaching anatomy to students in the Anatomical Theater, designed by him for public dissections and inaugurated in 1594 (Fig. 4.18).

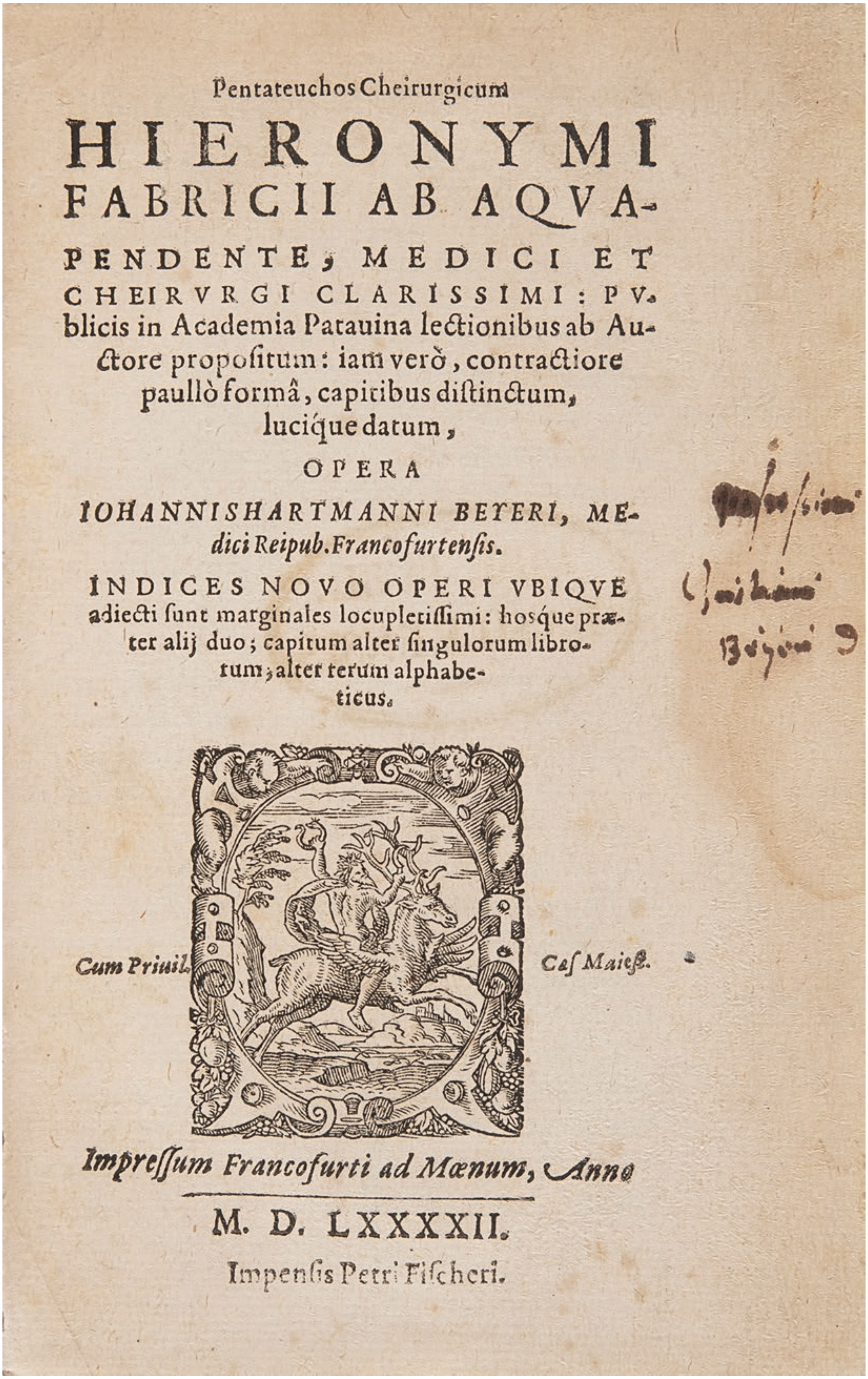
Fabricius' contributions in the field of anatomy [28] are reported in Sect. 8.5.3.

Fabricius' surgical writings were assembled in *Pentateuchos chirurgicum* (Five surgical books), first issued in Frankfurt in 1592, in an unauthorized edition [29] (Fig. 4.19) derived from notes taken by his student **J. Hartmann Beyer** (1563–1625) during Fabricius' surgical lectures at Padua University. An anecdotal report says that Fabricius was so highly concerned about this event that during his teaching the following year, he refused mentioning ulcers, as he was not aware of the contents of the book.

Opera Chirurgica in duas partes divisas (Surgical works divided in two parts) was first published officially in 1617 [30]. Part One includes the *Pentateuchos chirurgicum* (Five books of surgery) dealing with tumors, wounds, ulcers and fistulae, fractures, and dislocations and their treatment. In the appendix to Part Two devoted to facial traumas, in dealing with nasal injuries, Fabricius briefly mentioned the Calabrian surgeons and the *medicus Bononiensis* (the physician from Bologna), without reporting their names, and described the arm flap procedure for repairing a missing nose. In Part Two, entitled *Operationes chirurgicae* (Surgical Operations), Fabricius explained the management of head traumas, breast cancer, cleft lip, and omphaloceles. He made improvements in thoracentesis and in treatment of urethral strictures. The work went through numerous editions during the seventeenth and eighteenth centuries and was translated into Italian and French. It includes engraved plates of surgical instruments he had invented, among them, a famous orthopedic device for correction of deformities and contractures (Fig. 4.20).

Fabricius died in Padua in 1619, aged 86.

Fig. 4.18 Engraved plate showing the Anatomical theater in Padua designed by H. Fabricius ab Aquapendente. (From: Vesling J. *Syntagma Anatomicum*. Padova, P. Frambotti, 1647)



Pentateuchos Cheirurgicum

HIERONYMI FABRICII AB AQVA-PENDENTE, MEDICI ET CHEIRVRGI CLARISSIMI: PV-blicis in Academia Patauina lectionibus ab Au-ctore propoſitum: iam verò, contractiore paullò formâ, capitibus diſtinctum, luciq́ue datum,

OPERA

IOHANNIS HARTMANNI BEYERI, ME-dici Reipub. Francofurtenſis.

INDICES NOVO OPERI VBIQVE adiecti ſunt marginales locupletiſſimi: hosq́ue præ-ter alij duo; capitum alter ſingulorum libro-rum; alter rerum alphabe-ticus.

Cum Priuil. Cæſ Maieſt.

Impreſſum Francofurti ad Mœnum, Anno

M. D. LXXXXII.

Impenſis Petri Fiſcheri.

Fig. 4.19 Title page of *Pentateuchos Cheirurgicum* by H. Fabricius ab Aquapendente. Frankfurt, Peter Fischer, 1592

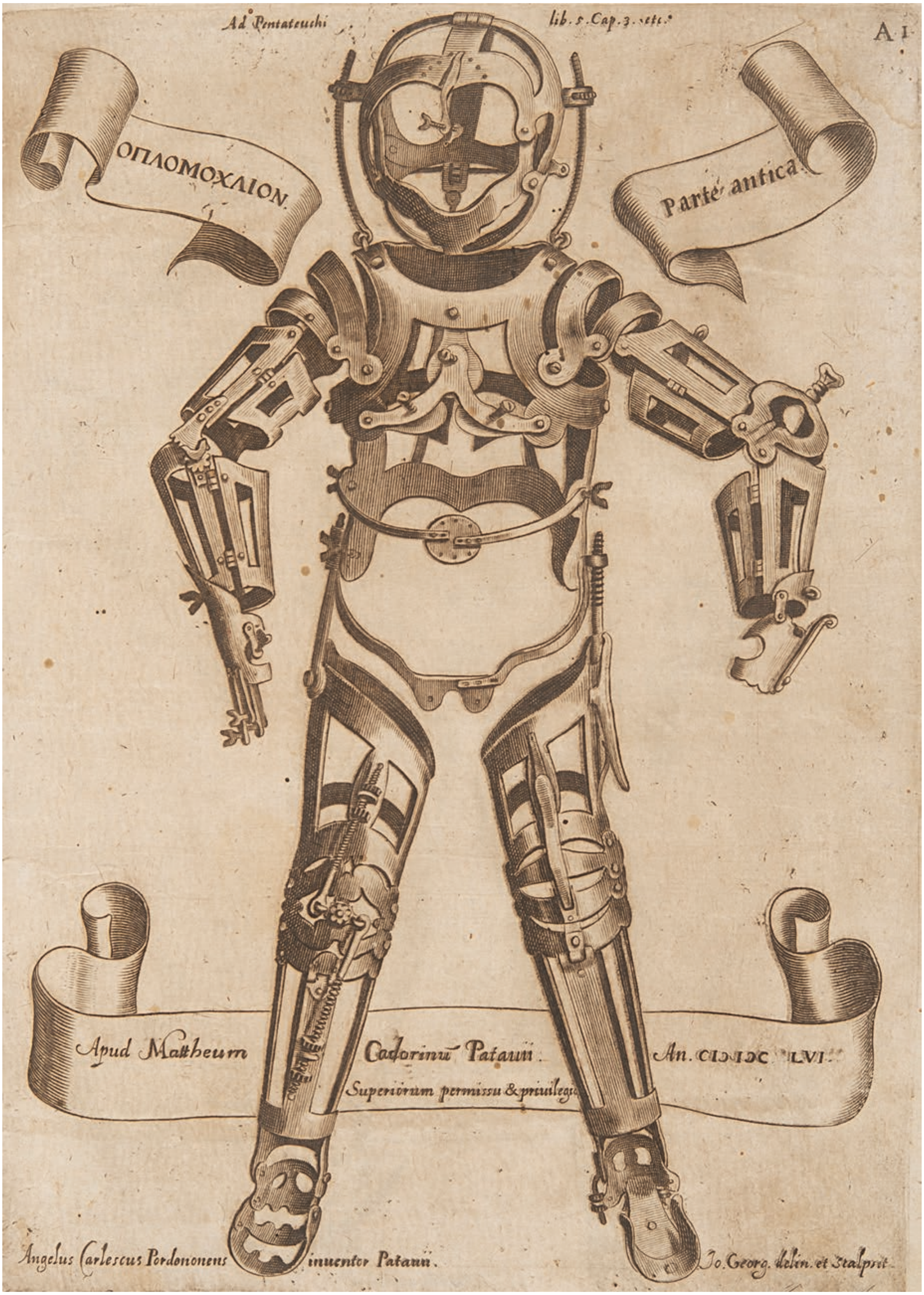


Fig. 4.20 Engraved plate showing orthopedic device for correction of deformities and contractures invented by Fabricius. (From: Fabricius ab Aquapendente H. *Opera Chirurgica.* Padova, M. Cadorino, 1666)

4.1.5.2 Giulio Casserio

Giulio Casserio (ca.1552–1616), born in Piacenza (northern Italy), studied medicine in Padua under Fabricius [31] (Fig. 4.21). His first publication was *De Vocis Auditusque Organis* (On the Organ of the Voice and Hearing), a beautiful *folio* comparative anatomical monograph with 34 engraved plates, showing the vocal and auditory apparatus of man and animals, published in 1601 [32]. It provided the first dramatic image of a tracheostomy in history, with the instruments necessary to perform it (Fig. 4.22). For other anatomical works, see Sect. 8.5.4. In 1609, he succeeded Fabricius in the Chair of Anatomy, upon his retirement [33]. He died in 1616.

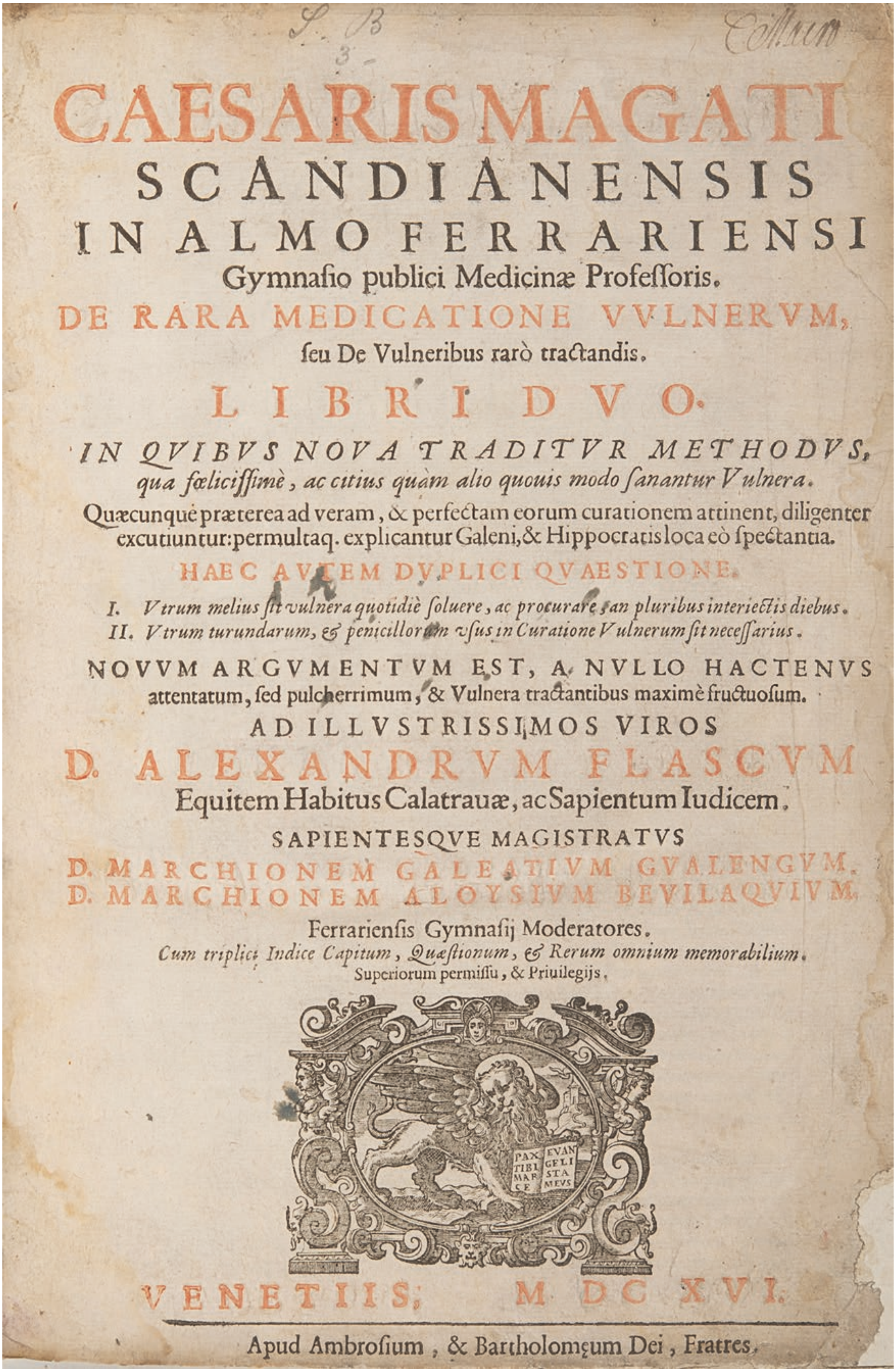
Fig. 4.21 Engraved portrait of Giulio Casserio (ca. 1552–1616) dissecting a hand. (From: Casserio G. *De Vocis Auditusque Organis*. Ferrara, Baldino, 1601)

Fig. 4.22 Dramatic image of a tracheostomy. First representation in history. (From: G. Casserio. *De Vocis Auditusque Organis*. Ferrara, Baldino, 1601)

4.1.5.3 Cesare Magati

Considered a forerunner of modern surgery for his advanced, revolutionary ideas about the management of wounds, **Cesare Magati** (1579–1647) supported the theory that wounds heal spontaneously [33, 34]. *Nature itself heals wounds*, he affirmed, *not the physician*. Thus, wounds should be cured by means of bandages moistened with plain water, and change of dressing should not be done too frequently, but rarely. In 1616, he published *De Rara Medicatione Vulnerum*, *seu de Vulneribus raro tractandis* (On rare dressing of wounds, or on rare management of injuries) [35] (Fig. 4.23). He further affirmed that: *Nature removes pus, restores flesh, repairs broken bones by means of callus, eliminates secretions. Hence, the best way to treat wounds is to supply the proper means for nature to perform its job by clearing every obstacle. Ideally, medical art should aid nature in the best possible way. Thus, leaving the injured part totally at rest we allow nature to complete its work, necessary for the repair. On the contrary, with a daily dressing, the work is much increased as we divert nature from its normal work. Moreover, complications may occur such as pain or haemorrhage. With our method leaving the wound closed and still, nature is free in its healing process, secretion is diminished, fear for haemorrhage is removed, and pain is not present* (Book One, Chapter 40, p. 69). This was Magati's leitmotiv: *The more we dress or clean a wound, the more we disturb or distract nature from its task* (Book One, Chapter 40, p. 70). He gave the following details about the appropriate management of wounds: *The physician will prepare a dressing using folded or superimposed linen. If necessary, wool or cotton may be added, so as to cover largely even the healthy part. To avoid any complication, it is essential neither to use heavy dressing, nor hard, rough or different types of linen. Soft, equally ranged linen should be used instead. It is important not to press them over the affected part with a tight dressing. Tight dressing will cause swelling and pain. Moreover, it impairs secretion drainage. On the contrary, loose dressing may move without any control. The two extremes should be avoided* (Book One, Chapter 35, p. 63). *Callus formation does not occur, unless fracture is fully stabilized* (Book Two, Chapter 6, p. 18). *In case of foreign body, it is essential to remove it as soon as possible. Its early removal is easier in absence of oedema, otherwise its extraction could be complicated* (Book Two, Appendix, p. 121). *De Rara Medicatione vulnerum* went through three editions in 1616, 1676, and 1733.

A native of Scandiano, near Reggio Emilia (northern Italy), Cesare Magati graduated in medicine and surgery from Bologna University in March 1597, aged 18 years. He established himself first at Scandiano and then, at the suggestion of the Marquis Bentivoglio, he moved to Ferrara where he was named Chair of Medicine at that university in 1613. He showed great interest in the management of wounds. In 1616, he published in Venice *De rara Medicatione Vulnerum*. Soon after, he was affected by a severe disease, and once recovered, in 1618, he entered the Order of Capuchin friars as Fra' Liberato da Scandiano. He continued his medical and surgical practice, becoming well-known throughout Italy for his skill. He treated famous patients on several occasions. On attempting to remove a stone from his bladder, he was severely injured and died of septicemia in September of 1647, aged 68 [34].



CAESARIS MAGATI
SCANDIANENSIS
IN ALMO FERRARIENSI
Gymnaſio publici Medicinæ Profeſſoris.
DE RARA MEDICATIONE VVLNERVM,
ſeu De Vulneribus rarò tractandis.
LIBRI DVO.
IN QVIBVS NOVA TRADITVR METHODVS, qua fœliciſſimè, ac citius quàm alio quouis modo ſanantur Vulnera.
Quæcunquè præterea ad veram, & perfectam eorum curationem attinent, diligenter excutiuntur: permultaq. explicantur Galeni, & Hippocratis loca eò ſpectantia.
HAEC AVTEM DVPLICI QVAESTIONE.
I. Vtrum melius ſit vulnera quotidiè ſoluere, ac procurare, an pluribus interiectis diebus.
II. Vtrum turundarum, & penicillorum vſus in Curatione Vulnerum ſit neceſſarius.
NOVVM ARGVMENTVM EST, A NVLLO HACTENVS attentatum, ſed pulcherrimum, & Vulnera tractantibus maximè fructuoſum.
AD ILLVSTRISSIMOS VIROS
D. ALEXANDRVM FLASCVM
Equitem Habitus Calatrauæ, ac Sapientum Iudicem.
SAPIENTESQVE MAGISTRATVS
D. MARCHIONEM GALEATIVM GVALENGVM.
D. MARCHIONEM ALOYSIVM BEVILAQVIVM.
Ferrarienſis Gymnaſij Moderatores.
Cum triplici Indice Capitum, Quæſtionum, & Rerum omnium memorabilium.
Superiorum permiſſu, & Priuilegijs.

PAX TIBI MARCE EVANGELISTA MEVS

VENETIIS, M DC XVI.
Apud Ambroſium, & Bartholomęum Dei, Fratres.

Fig. 4.23 Title page of *De Rara Medicatione Vulnerum*, by C. Magati. Venezia, Ambrosius and Bartholomeus Dei, 1616

4.1.5.4 Auguste Belloste

Magati's theories were followed by the French surgeon **Auguste Belloste** (1654–1730) who published a very successful work, *Le Chirurgien d'Hôpital*, in 1696, 80 years after *De rara Medicatione Vulnerum* [36]. The work went through numerous editions and translations. However, Belloste gave little credit to Magati quoting his name (incorrectly spelled as Caesar Manatus) in the preface only.

4.1.5.5 Marco Aurelio Severino

Marco Aurelio Severino (1580–1656), a native of Tarsia in Calabria, studied philosophy and medicine and received his degree at Salerno in 1606. In 1610, he moved to Naples where he became the Chair of Anatomy and Surgery at the university and was appointed Head Surgeon at the Hospital of the Incurabili (*Hospital of Incurables*). His great success was the envy of his detractors who accused him of heresy. Condemned to jail, he was later rehabilitated and reinstated in his former position. He died of plague aged 76.

He is regarded as one of the most innovative surgeons of the seventeenth century. His lectures were well attended by local as well as foreign students. Among them, mention should be made of **Thomas Bartholin** (see Sect. 8.7.2.2).

Severino published a few works on surgery, notably *De recondita Abscessuum Natura* (On the secret Nature of Swellings) [37], first issued in 1632 (Fig. 4.24) and reprinted several times, and *De efficaci medicina* (On effective medicine) [38].

Garrison [3] considered *De recondita Abscessuum Natura* as "the first textbook on surgical pathology." Under the heading, *Abscessus*, Severino included any kind of swelling, congenital or acquired, caused by inflammation or by pathological growth. He described tumors of the breast (Chapter 9); tumors of the bones (Chapter 3); herpes zoster (Chapter 10); omphaloceles (Chapter 21); elephantiasis of the leg (Chapter 22); elephantiasis of the scrotum (Chapter 4); hydrocephalus (Chapter 2); and massive arteriovenous malformation of the dorsum that he named *Abscessus sanguisfluis* (considered the first illustration of an aneurysm, or arteriovenous malformation) (Chapter 7) (Fig. 4.25). Severino provided a description of the most likely surgical treatment for some of these conditions. He also classified breast tumors in four categories: strumae, glandular, scirrhous, and gangrenous.

De Efficaci Medicina, usually issued with **Fabry von Hilden's** (1560–1634) collected works, and rarely found separately [38], deals with surgery, phlebotomy, paracentesis, and cautery. Severino gave detailed accounts of the surgical management of uncommon clinical cases, such as ectropion (p. 100), cleft lip (p. 128), cancer of the nose (p. 269), and burns (p. 163). Numerous woodcuts showing surgical instruments accompany the text. The allegorical engraved title page, present in this edition only, includes a portrait of the author aged 65 years and medical and surgical scenes with the physician at the bedside for consultation and a leg amputation (Fig. 4.26).

Fig. 4.24 Engraved allegorical title page of *De recondita Abscessuum Natura* by M.A. Severino. Napoli, O. Beltrano, 1632

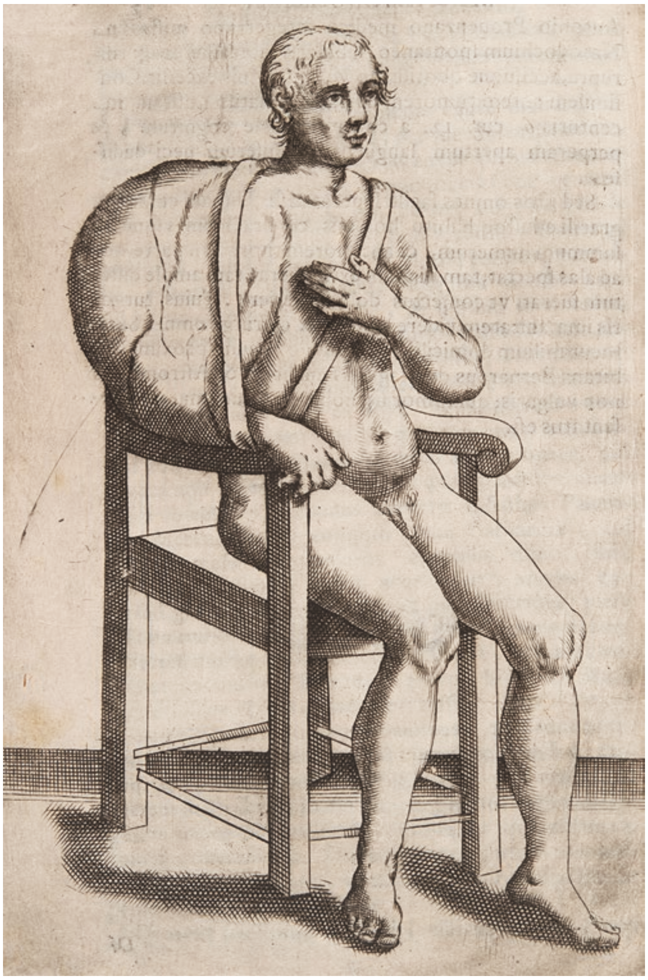


Fig. 4.25 Massive arteriovenous malformation of the dorsum. First illustration in history. (From: M.A. Severino. *De recondita Abscessuum Natura*. Napoli, O. Beltrano, 1632)

Fig. 4.26 Engraved allegorical title page. Above, the portrait of Severino, aged 65. Below, the physician at the bedside for consultation and a leg amputation. (From: M.A. Severino. *De efficaci medicina*. Frankfurt, J. Beyer, 1646)

4.1.5.6 Filippo Masiero

Filippo Masiero (1652–ca. 1725), surgeon at San Francesco Hospital in Padua, published *La Chirurgia Compendiata, overo Istruzioni per il Chirurgo in Pratica* (Abridged surgery, or Instructions for the Surgeon in Training) [39]. First issued in 1688, it was a handbook for the young surgeon, written in the form of a dialogue, where the author summarized what to do and what not to do. For example, he recommended that cancer of the face should not to be touched surgically, but that the use of local ointments instead is preferable. Regarding facial wounds, Masiero recommended plasters rather than stitches, to avoid unpleasant scars (Fig. 4.27).

Fig. 4.27 Facial wound, approximated by means of plasters. (From: F. Masiero. *La Chirurgia Compendiata, overo Istruzioni per il Chirurgo in Pratica*. Venezia, Curti, 1690)

4.1.5.7 Antonio Filippo Ciucci

A witness to the reduced interest in reconstructive surgical procedures was **Antonio Filippo Ciucci** (mid-seventeenth century–ca. 1710). Born in Arezzo (Tuscany), he was appointed First Surgeon at the Hospital of Macerata as well as Professor of Anatomy and Forensic Medicine at Macerata University (central Italy). He died in Macerata about 1710. In his *Promptuarium Chirurgicum* (Surgical Handbook) [40], first published in 1679–1680, in addition to a description of nasal reconstruction, using the arm flap procedure, without mentioning Tagliacozzi's name, Ciucci gives an account of how to avoid drooling by closing a lower lip defect. Instead of advocating a plastic surgical procedure, he recommends a lead device maintained in position by two laces around the head (Fig. 4.28).

Fig. 4.28 Closure of a lower lip defect provided by a lead device, maintained in position by two laces. (From: AF. Ciucci. *Promptuarium Chirurgicum*. Macerata, Giuseppe Piccini, 1679–1680)

4.1.6 The Progress of General Surgery: Germany

4.1.6.1 W. Fabry von Hilden

The leading surgeon of the period was **W. Fabry von Hilden** (or **G. Fabricius Hildanus**) (1560–1634), with the same name as the leading Italian surgeon, **H. Fabricius ab Aquapendente**, but completely different in terms of education and training. One was more practically trained, based on continuous apprenticeship with skilled and experienced wound and barber surgeons. The other was more formally trained following the official course of studies in the leading university of the period for medicine—Padua. Nevertheless, they were two giants in their own field [3, 18].

Fabry was born at Hilden (northwest Germany). His school studies suddenly stopped, for family reasons, when he was 13. As he couldn't afford formal training in medicine, at 16 he started working as an assistant to a surgeon in Neuss and later to C. Slotano, a student of Vesalius, in Düsseldorf. At his teacher's death in 1585, he started travelling to various countries and practiced both in Germany and Switzerland. He was very successful in his activity and kept detailed records, not only of the cases observed and treated but also of the letters he received from prominent physicians and colleagues, in which he discusses different clinical problems. He arranged his case reports in series of 100, named *centuriae*, and published them in six accurately illustrated monographs entitled *Observationen, oder Wahrnemungen in der Wundartzney* (Observations or Perceptions in Wound Surgery), for a total of 600 [41]. In 1614, he was appointed surgeon to the city of Berne and remained there until his death in 1634, aged 74.

His works were posthumously assembled in a single *folio* edition, called *Opera quae extant Omnia* (Collected surviving works), first issued in 1646 [42] and reissued in 1682. It is one of the most extraordinary medical textbooks of the seventeenth century which includes 13 of Fabry's works, the great majority of them with their own title page. It was ready for printing in 1633, but the Thirty Years' War delayed the publication considerably, until 1646, 12 years after Fabry's death. Initially scheduled with all the illustrations engraved, to reduce the costs, it was finally printed with 200 woodcuts and 20 engravings by Matthäus Merian (1593–1650), a well-known Swiss-born engraver working in Frankfurt.

Opera Omnia's title page is within an architectural border with Fabry's portrait aged 73 at the top, the statues of Dioscorides and Hippocrates at the sides, and at the bottom three scenes of medical interest (the interior of a hospital, surgical instruments, and a consultation between two physicians) (Fig. 4.29). The text opens with *Observationum & Curationum Chirurgicarum Centuriae* (100 observations and surgical treatments), probably Fabry's most important work, spanning 634 pages. *Observationum*, in six books, is a collection of his 600 case reports, gathered from Fabry's personal experiences, observations, and detailed notes and from information supplied by physicians and surgeons with whom he corresponded over the 35-year period from 1606 to 1641. The cases cover the entire field of surgery and demonstrate how Fabry was an unsurpassed practitioner and a skillful and inventive surgeon. Among these cases, mention should be made of scar contracture of the hand after a burn and the device to maintain the hand straight, avoiding recurrence (p. 60) (Fig. 4.30), cranial bone depression (p. 84), breast cancer and axillary lymph node excision (p. 150 and 346), tongue carcinoma (p. 263), removal of an iron splinter from the eye using a magnet (p. 297), upper arm lymphoedema (p. 342) (Fig. 4.31), limb fracture in children (p. 475), ankyloblepharon (p. 503), encephalocele (p. 512), and talipes (p. 618).

Observationum & Curationum Chirurgicarum Centuriae also includes (p. 214) the story of nasal reconstruction, *Nasus abscissus, quomodo restitutus?* (Nose excised, how replaced?); Fabry reports a case that occurred in 1590 in Geneva, when a girl called Susanna had her nose cut off by some soldiers. Two years later, in 1592, she was treated in Lausanne by the surgeon **Jean Griffon**, who restored her nose with an excellent result. *I myself saw and noted this many times, for up to the year 1611 she was living at Lausanne.* (…) *But in winter when it is very cold, the tip of the nose turns a bit livid* (…) writes Fabry, and adds: *The original inventor of this operation was Caspar Tagliacozzi, by far the most distinguished and learned professor of medicine at the University of Bologna* (…) *Dr. Griffon received in the first place a few details from an Italian who was passing through Lausanne, and had been treated by Dr. Tagliacozzi* (see Sect. 3.3.4.1). Thus, Jean Griffon performed nasal reconstruction 5 years earlier than the publication of *De curtorum Chirurgia* (1597). However, the letter to Mercuriale, with the details of the procedure, had already been issued in Frankfurt in 1587. This may explain Griffon's source of information about the operation.

In 1603, he wrote a letter to Jean Griffon to congratulate him on the successful outcome of nasal reconstruction (see above) and to get information about the instruments he used. The letter is reported in *Epistolarum ad Amicos* (…) *centuria* (One hundred letters written to his friend) (p. 1005–1006) also part of the *Opera Omnia* [42] (see Sect. 3.3.4.2).

Fabry was a very prolific writer and published numerous accounts and essays on various topics, all of them included in *Opera Omnia*. Among them, two are particularly relevant for plastic surgery: *De Combustionibus* (On burns) and *De Gangrena & Sphacelo* (On Gangrene & Deterioration). *De Combustionibus* (p. 917–934), first printed in Basel in 1607, constitutes the first systematic tract on burns, introducing the three degrees of classification depending on the burn's depth and showing the dramatic deformities resulting from healing by secondary intention (Fig. 4.30 *left*) and the different devices used to contrast scar contracture recurrence (Fig. 4.30 *right*). *De Gangrena & Sphacelo* describes the possible causes of gangrene and tissue deterioration. When amputation was necessary, he emphasizes the importance of performing it in healthy tissue, above the level of necrosis. The tract depicts a dramatic surgical scene of limb amputation and the surgical instruments, most of them invented and designed by Fabry himself, to limit gangrene and tissue deterioration. Instruments reflect the style of the period, when decoration was considered an important factor for changing an anonymous piece of iron into a work of art. The ornate cutting saw reproduced in the text (p. 809–811) is an example.

Fabry's *Opera* remained the standard surgical textbook in Germany and in Europe for almost 80 years until the second decade of the eighteenth century when it was replaced by **Lorenz Heister's** (1683–1758) *Chirurgia*.

As we have anticipated, annexed to Fabry's *Opera Omnia*, with a separate title page and different pagination, is *De Efficaci Medicina* (On Effective Medicine) by **Marco Aurelio Severino** (1580–1656) (see description above Sect. 4.1.5.5). Only the first edition (1646), not the second, has an engraved title page.

Fig. 4.29 Engraved title of Fabry von Hilden's *Opera Omnia*. The architectural border shows Fabry's portrait aged 73 at the top, the statues of Dioscorides and Hippocrates at the sides, and at the bottom three scenes of medical interest (the interior of a hospital, surgical instruments, and a consultation between two physicians). (From: W. Fabry von Hilden. *Opera Omnia*. Frankfurt am Main, Joahann Beyer, 1646)

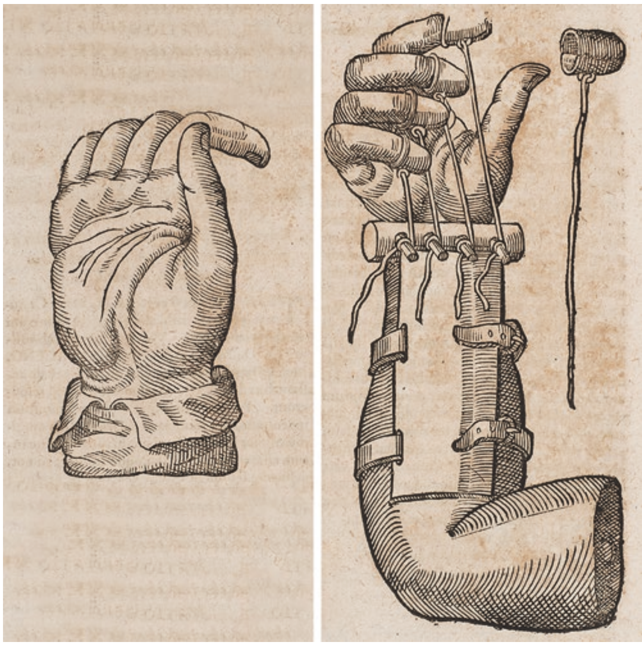


Fig. 4.30 *Left*: Hand scar retraction sequelae of burns. *Right*: the device to contrast the retraction. (From: W. Fabry von Hilden. *Opera Omnia*. Frankfurt am Main, Joahann Beyer, 1646)

Fig. 4.31 Severe upper arm lymphoedema. (From: W. Fabry von Hilden. *Opera Omnia*. Frankfurt am Main, Joahann Beyer, 1646)

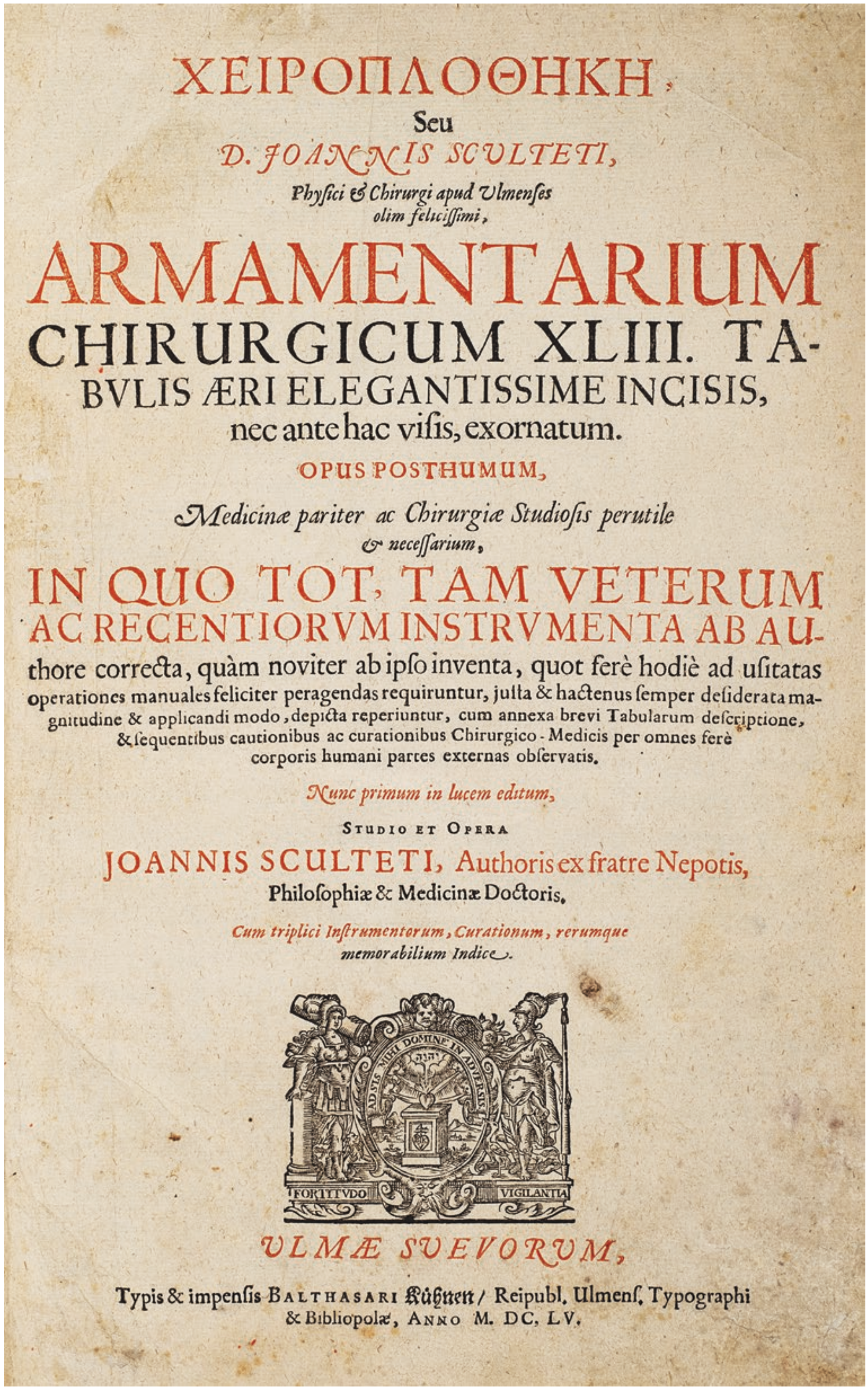
4.1.6.2 Johannes Schultes

Johannes Schultes (Scultetus) (1595–1645) was a contemporary of Fabry von Hilden. The son of a poor sailor, Schultes was born in Ulm (Germany) on October 12, 1595 [18]. At the age of 15, he went to Padua to study medicine. He served as a prosector in the renowned Anatomical School of Fabricius of Acquapendente, becoming a student of **Adriaan van der Spieghel** (1578–1625), the celebrated Belgian surgeon and anatomist, successor of Fabricius as the Chair of Anatomy. In 1621, Schultes graduated in medicine and surgery, and at the age of 30, he returned to Ulm, where he worked as a city physician until his death in Stuttgart in 1645, aged 50.

Schultes' *Armamentarium Chirurgicum* (Surgical Armamentarium) was the most influential and successful textbook of surgery of the seventeenth century. It was posthumously published by the author's nephew, Johannes Schultes the younger, 10 years after the author's death and went through dozens of editions and translations, all of them *in-4to* or *in-8to*, apart from the first edition, the only one *in-folio* [43] (Fig. 4.32).

The book is divided into two parts. <u>Part One</u> (p. 1–67) contains 43 full-page engraved illustrations. From Table 1 through Table 20, the author shows the armamentarium, an almost complete catalogue of the different types of surgical instruments known at that time, saws, trephines, forceps, needles, cannulas, whereas Plates 21 through 42 show the different clinical applications. One of these plates summarizes the most common surgical procedures of the epoch on a standing man: compression devices for preventing arterial hemorrhage, stabilization of fractures, cancer of the lip excision, arrow removal, and thoracic bandages (Fig. 4.33). Many images are of plastic surgery interest: cranioplasty (Plates 31 and 32), eyelid tumor removal (Plate 33), tracheostomy (Plate 34), eyelid ptosis, cleft lip (Plate 35), teeth removal, palatal perforation, mandibular anchyloses, jaw fracture, ankyloglossia (Plate 36), breast excision for cancer (Plate 38) (Fig. 4.34), and catheter application (Plates 39 and 40). <u>Part Two</u> (from p. 67 to 131) includes a series of case reports with their treatment, demonstrating Schultes' surgical courage, capability, and skill. A comprehensive and detailed index is included.

Fig. 4.32 Title page of the first edition of *Armamentarium Chirurgicum* by Johannes Schultes (Scultetus), posthumously published in 1655



ΧΕΙΡΟΠΛΟΘΗΚΗ,
Seu
D. JOANNIS SCULTETI,
Physici & Chirurgi apud Ulmenses olim felicissimi,
ARMAMENTARIUM
CHIRURGICUM XLIII. TABULIS ÆRI ELEGANTISSIME INCISIS,
nec ante hac visis, exornatum.
OPUS POSTHUMUM,
Medicinæ pariter ac Chirurgiæ Studiosis perutile & necessarium,
IN QUO TOT, TAM VETERUM AC RECENTIORUM INSTRUMENTA AB AUthore correcta, quàm noviter ab ipso inventa, quot ferè hodiè ad usitatas operationes manuales feliciter peragendas requiruntur, justa & hactenus semper desiderata magnitudine & applicandi modo, depicta reperiuntur, cum annexa brevi Tabularum descriptione, & sequentibus cautionibus ac curationibus Chirurgico-Medicis per omnes ferè corporis humani partes externas observatis.
Nunc primum in lucem editum,
STUDIO ET OPERA
JOANNIS SCULTETI, Authoris ex fratre Nepotis,
Philosophiæ & Medicinæ Doctoris.
Cum triplici Instrumentorum, Curationum, rerumque memorabilium Indice.

FORTITUDO VIGILANTIA

ULMÆ SUEVORUM,
Typis & impensis BALTHASARI Kühnen / Reipubl. Ulmens. Typographi & Bibliopolæ, ANNO M. DC. LV.

Fig. 4.33 Schultes summarizes the most common surgical procedures known at the time on a standing man: compression devices for preventing arterial hemorrhage, stabilization of fractures, cancer of the lip, arrow removal, and thoracic bandages. (From: J. Schultes. *Armamentarium Chirurgicum*. Ulm, Balthasar Kühnen 1655)

4.1.7 Intravenous Injection of Drugs or *Chirurgia Infusoria*. Blood Transfusion Possible, or *Chirurgia Transfusoria*

The new knowledge about blood circulation provided by **William Harvey** in 1628 prompted physicians and scientists to try to inject drugs into the bloodstream to carry them directly to various parts of the body, thus favoring the healing of wounds, curing diseases, and improving the quality of life. The first experiments with intravenous injections were done in 1656 by **Christopher Wren** (1632–1723), an astronomer, mathematician, and architect in Oxford (England), assisted by **Robert Boyle**, a chemist, and **John Wilkins**, a writer with a group of scientists who injected different medications into the veins of dogs. The first books on the applications of intravenous infusions in humans were published in Germany by **J.D. Major** (1634–1693) *Chirurgia Infusoria* (Injecting surgery) in 1667 [44] and by **Johann Sigismund Elsholtz** (1623–1688) *Clysmatica Nova* (New Clyster) in 1667 [45]. Bladders of animals, quills, or enema syringes were used as instruments. Because of lethal accidents, the *Chirurgia Infusoria* soon fell from favor.

However, *Chirurgia Transfusoria* had a different impact. Indication was mainly to improve the strength of patients, to heal wounds, and to rejuvenate the spirit. The first attempt of human blood transfusion is attributed to **Francesco Folli** (ca. 1624–1685) [3], an Italian physician practicing in Florence who, in 1654, conceived the idea of performing transfusions for ailing bodies, recovering from sickness and favoring wound healing [46]. He presented this challenging project to the Grand Duke of Tuscany, Cosimo III, whom he served as personal physician. The Grand Duke supported the plan, but

Fig. 4.34 Breast excision for cancer. *Left*, delimitation of the tumor with stitches; *center*, tumor excision; *right*, cauterization of the wound to staunch blood and to prevent cancerous cells from entering the blood flow. Probably the first representation of breast cancer excision in history. (From: J. Schultes. *Armamentarium Chirurgicum*. Ulm, Balthasar Kühnen 1655)

due to complications related to its practical execution, Folli was unable to fulfill the task [47, 48].

4.1.7.1 Blood Transfusion in Animals

In the meantime, the newly established ***Royal Society of London***, in 1661, decided to conduct research on blood transfusion, considering it a panacea for life-saving therapy. Among the several persons involved in this project was **Richard Lower** (1631–1691), a British physician, who demonstrated that it was possible to transfuse blood from animal to animal, with potential later application for human beings. In February 1665, Lower successfully transfused blood between two dogs before the members of the society. At that time, it was common practice that experiments should first be conducted in front of colleagues and peers and then written down and published. Lower used a silver tube to connect the carotid artery of one dog to the jugular vein of another. The recipient animal survived. Experiments were repeated on different creatures, mixing the blood of lambs and dogs. Details of the operation were reported in *Philosophical Transactions*, the official journal of the society [49].

4.1.7.2 Blood Transfusion in Man

France

Jean-Baptiste Denis (ca. 1640–1704), an eminent physician and member of the team appointed to oversee the health of King Louis XIV, having read of Lower's experiments, initiated his own trials, performing numerous dog-to-dog transfusions, in association with a surgeon, **Paul Emmerez**. On June 15, 1667, Denis was asked to take care of a feverish 15-year-old boy, who had been bled by his physician numerous times, (…) *to lessen the excessive heat*. In his *Lettre* (…) *touchant une nouvelle manière de guérir plusieurs maladies par la transfusion du sang, confirmée par deux expériences faites sur des homes* (Letter (…) describing a new method to heal many diseases by blood transfusion witnessed by two experiments in men) published in Paris in 1667 [50], Denis said: *Before the disease, the youth had not been noticed to be of a depressed character, his memory was happy enough, and he seemed cheerful and active; but since the aggressiveness of the fever, his smartness seemed completely ruined, his memory totally lost, and his body so apathetic and lazy that he was unable or fit for anything*. Thus, the poor fellow was bled another time to the extent of about 3 oz and received in exchange 9 oz of blood from the carotid artery of a lamb. The improvement that ensued was described as *amazing*, and immediately the young patient was showing (…) *a clear and smiling expression*, whereas previously he was living (…) *in an incredible apathy*. The patient referred to (…) *a very great heat along his arm,* something similar to what is regarded as a transfusion reaction nowadays. Apparently, no further side effect was reported.

One month later, Denis carried out another animal-to-man transfusion on a 45-year-old man. Ten ounces of blood were drawn from one arm, whereas 20 oz of lamb's blood were infused into the other. On completion of the treatment, the man said he was feeling stronger than before.

On November 23, 1667, the Royal Society organized an important event: a blood transfusion from lamb to man before its members. The aim of the procedure was relieving pain, ensuring longevity, and introducing a youthful, healthy spirit into an old individual. Lamb's blood was chosen because it was thought that blood from a docile animal might quiet the tempestuous spirit of an agitated person. Lower introduced at various times 12 oz of lamb's blood into the bloodstream of the patient, a certain Arthur Coga, a poor, old clergyman, without any inconvenience to him. *The man after this operation, as well as in it, found himself very well, and has given his own narrative under his own hand* (…) *He urged to have the experiment repeated upon him within three or four days after this; but it was thought advisable to put it off somewhat longer* (…) [51]. The second experiment took place the following month. No complication occurred, apart from a little headache. Once the treatment was over, Arthur Coga said he felt better.

It is clear that, though Lower was the first to initiate preliminary transfusion experiments in animals, Denis could justly claim performing the first blood transfusion on a human being, from lamb to man, for therapeutic purposes, in 1667. This procedure was named *chirurgia transfusoria* (transfusory surgery), a technique which became quite popular in England, France, and Italy about 1667–1668. It should be remembered that these experiments were carried out at a time when the medical treatment used by doctors to cure different illnesses was mainly bloodletting, i.e., bleeding the patients, instead of transfusing them.

Germany

Mattheus Gottfried Purmann (1648–1721) reported his first blood transfusion from lamb to human in 1668 in Frankfurt/Oder in a male patient, in Part Three, Chapter 31, p. 284, of *Grosser und ganz neugewundener Lorbeer-Krantz oder Wundartzney* (Large and complete Laurel Crown or Surgical Wound Treatment) [19]. Having taken a certain amount of blood from the *Vena Mediana* of the arm, as the strength of the patient permitted, he replaced the same quantity transferred from the jugular vein of a lamb. In 3 months, the patient completely recovered from his symptoms that had included convulsions, muscular contractures, and mandibular stricture. On the contrary, the procedure was not successful in two other patients. The adopted technique was the same. A cannula, surrounded by a linen cover, connected the arm of the patient to the animal (lamb, sheep, or ox). A strong fillet, tied around the arm and neck of the animal, was necessary to facilitate the transfusion. A metallic device was placed around the cannula to allow warm water to circulate, avoiding possible blood coagulation and clot formation. The animal was tied firmly so that it had no possibility to move. An engraved illustration shows the process (Fig. 4.35). Purmann named this procedure *Chirurgia transfusoria*, in contrast to *Chirurgia infusoria*, as reported by Ettmüller, which indicated injection of drugs into the vein of a human being.

Fig. 4.35 Blood transfusion (*Chirurgia transfusoria*) from animal to man. One end of the cannula is inserted into the arm and the other into the jugular vein of the lamb, firmly tied to avoid the possibility of moving. (From: Purmann MG. *Grosser und ganz neugewundener Lorbeer-Krantz, oder Wundartzney*. Frankfurt u. Leipzig, in Verlegung Michael Rohrlachs seel., Wittib und Erben, 1705)

Italy

In Italy, blood transfusion was introduced by **Paolo Manfredi** (1640–1716), Professor of Medicine at La Sapienza University in Rome, in 1667. In cooperation with the Dutch physician **Johannes Camay** and the Italian **Bartolommeo Simoncelli**, Manfredi transfused blood from the carotid artery of a dog into the jugular vein of another, according to Denis' French model. On January 2, 1668, Manfredi successfully infused blood from the carotid artery of a lamb into a vein in the arm of a certain Angelo, a feverish man from northern Italy. He reported his experiments in a very rare 32-page essay *De nova et inaudita Medico-Chyrurgica Operatione Sanguinem transfundente de individuo ad individuum* (On the new and unheard-of medico-surgical operation transfusing blood from individual to individual), issued in Rome in 1668 [52] (Fig. 4.36), where he described the advantages and the safety of the procedure. To support his theory, he emphasized the continuous exchanges of blood occurring between the mother and the fetus.

Neither Denis' *Lettre* nor any other paper published by him or by Lower on the subject of blood transfusion in 1667 or 1668 was illustrated. Thus, the work by Manfredi, having the earliest images of the operation, is therefore extremely important in the history of medicine. Plates included in his essay show the technique of transfusion from dog to dog (Fig. 4.37 *top left*), the instruments necessary for the operation, how to prepare the human vein (Fig. 4.37 *lower left* and *top right*), and the transfusion from the jugular vein of a ram into the arm of a human (Fig. 4.37 *lower right*).

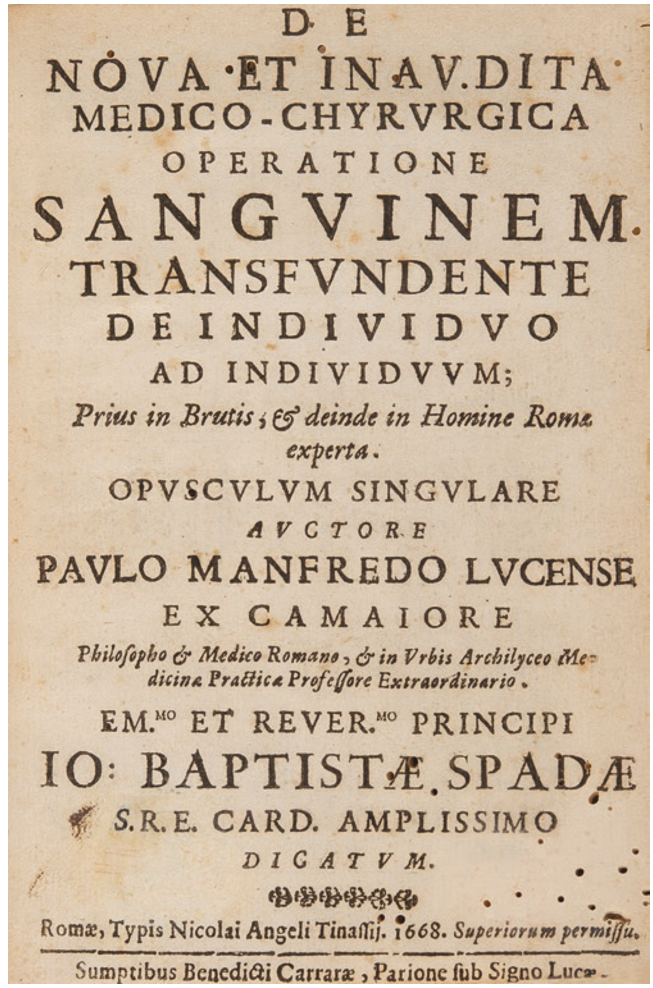

DE
NOVA ET INAVDITA
MEDICO-CHYRVRGICA
OPERATIONE
SANGVINEM
TRANSFVNDENTE
DE INDIVIDVO
AD INDIVIDVVM;
Prius in Brutis, & deinde in Homine Romæ experta.
OPVSCVLVM SINGVLARE
AVCTORE
PAVLO MANFREDO LVCENSE
EX CAMAIORE
Philosopho & Medico Romano, & in Vrbis Archilyceo Medicinæ Practicæ Professore Extraordinario.
EM.^MO ET REVER.^MO PRINCIPI
IO: BAPTISTÆ SPADÆ
S.R.E. CARD. AMPLISSIMO
DICATVM.
Romæ, Typis Nicolai Angeli Tinassij. 1668. *Superiorum permissu.*
Sumptibus Benedicti Carraræ, Parione sub Signo Lucæ.

Fig. 4.36 Title page of P. Manfredi essay on blood transfusion. Roma, Tinassi, 1668

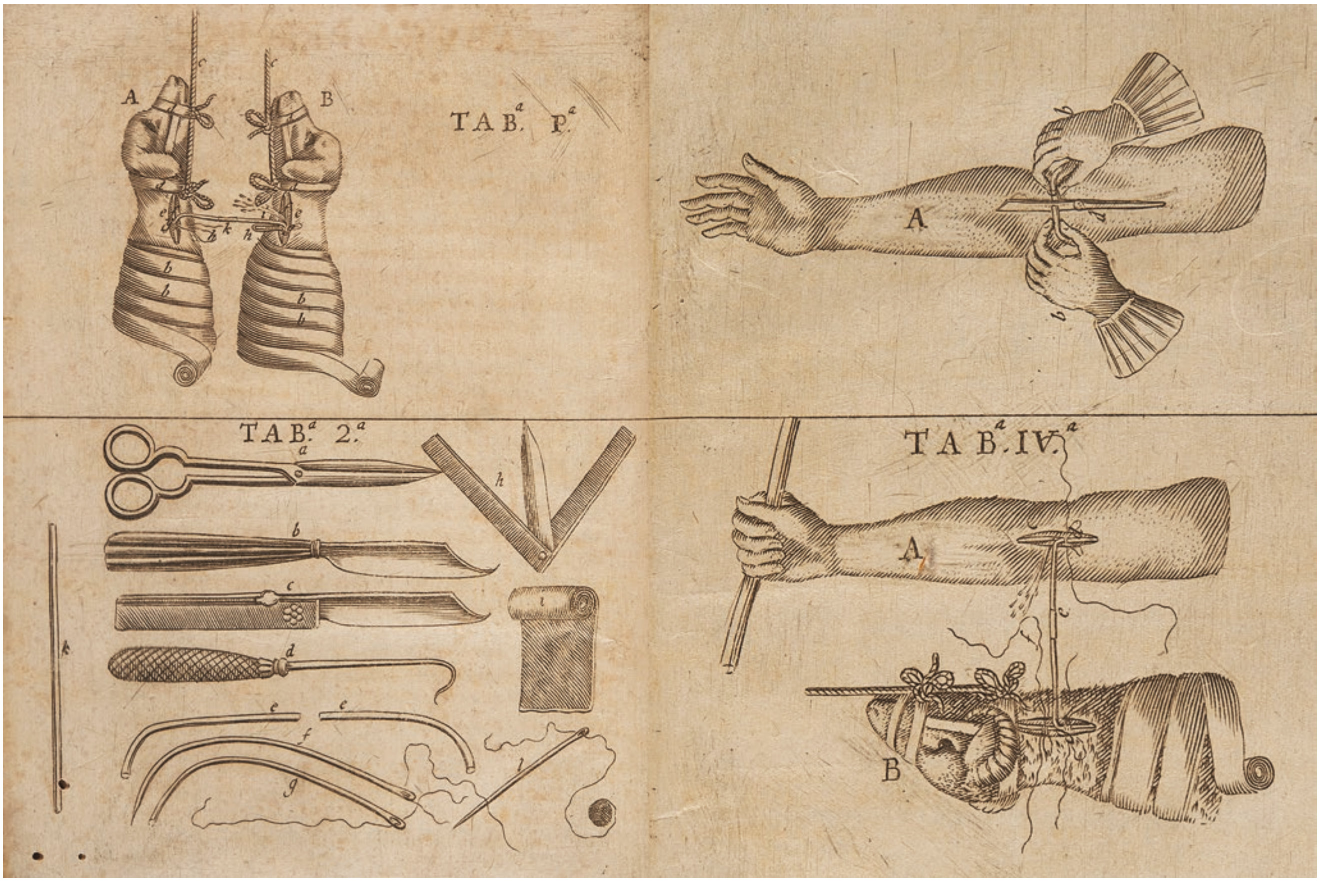


Fig. 4.37 Technique of blood transfusion. *Top left*, from dog to dog; *top right*, preparation of the human *vein*; *lower left*, the instruments for the procedure; *lower right*, from the jugular vein of the ram to the vein in the patient's arm. (From: P. Manfredi P. *De nova et inaudita Medico-Chyrurgica Operatione Sanguinem transfundente de individuo ad individuum.* Roma, Tinassi, 1668)

4.1.7.3 The Drama

Denis' experiments continued. He infused blood into the Swedish Baron Gustaf Bonde, who was in such a bad state in Paris that he had been abandoned by his physicians. Having heard of Denis' miraculous remedy, the family asked for a transfusion, as a final hope. After the first procedure, Bonde felt better and began to speak. However, during the second transfusion, Bonde died. Soon afterward, Denis took care of Antoine Mauroy, a 34-year-old man suffering from long-term severe frenzies during which he used to beat his wife. One day, the man escaped through the streets of Paris completely naked. After two transfusions, Mauroy became calm and quiet. But, shortly after the second procedure he developed what is now recognized as a hemolytic transfusion response. Here is Denis' report of the events following the second transfusion: *As soon as the blood entered his veins, he felt the heat along his arm. His pulse rose and abundant sweat all over his face was observed. His pulse varied extremely, he complained of great pains in his kidneys, and he didn't feel well in his stomach. He was made to lie down and fell asleep, and slept all night without awakening until morning. When he awakened, he made a great glass full of urine, of a color as black as if it had been mixed with the soot of chimneys.*

Denis said that the following morning Mauroy had further hemoglobinuria and epistaxis. However, by the third day, his urine had cleared up and his mental state apparently improved, so the man returned to his wife completely recovered. Denis attributed the color of the urine to a *black choler* which had been retained in the body. Several months later, Antoine Mauroy became aggressive again, and his wife persuaded Denis to repeat the procedure. By the end of January 1668, a third transfusion was undertaken. Regrettably, Mauroy died during the procedure. Denis' detractors persuaded Mauroy's widow to accuse Denis of murder. He replied that she had poisoned her husband with arsenic. After a prolonged legal battle, Denis was exonerated.

4.1.7.4 Blood Transfusion Forbidden

Based on the results of the clinical trials, the Paris medical faculty issued a decree, which forbade any procedure of transfusion without its permission. Since the faculty was strongly opposed to blood transfusion, this permission was never granted and the practice of transfusion rapidly fell from favor.

The decision provoked a heated controversy in London where the Royal Society prohibited the procedure as well. Finally, in 1679 the church also announced a ban on the technique. As a result, interest in transfusion rapidly waned, and for 150 years no one dared to transfuse blood.

4.1.7.5 Blood Transfusion Resumed

The beginning of modern therapeutic transfusion has an official date: December 22, 1818. On that occasion, the British obstetrician **James Blundell** (1791–1878) infused human blood into a patient for treatment of postpartum hemorrhage [53]. Eighty years later, **Karl Landsteiner** (1868–1943), an Austrian physician, discovered the blood group system [54] and the Rh factor [55], creating the basis for a safer use of the procedure. For this epochal accomplishment, Karl Landsteiner was awarded the Nobel Prize for medicine in 1930.

4.2 The Eighteenth Century

4.2.1 Tagliacozzi's Influence

Three important events characterized the increasing interest in plastic and reconstructive surgery during the eighteenth century: the reprint in full of *De Curtorum Chirurgia* in Manget's *Bibliotheca Chirurgica* (1721) and the publication of two dissertations on nasal reconstruction, discussed in Uppsala and Paris in 1742.

4.2.1.1 Tagliacozzi's *De Curtorum Chirurgia* Reissued

Jean-Jacques Manget (1652–1742), physician and scholar of the Geneva Republic, successfully practiced medicine in Geneva [6] where he was dean of the medical faculty. In 1699, he became the first physician to the Elector of Brandenburg, later the King of Prussia. He was a great compiler and issued *Bibliotheca Anatomica* (Anatomical Library), a two-volume illustrated encyclopedia on anatomy, and *Bibliotheca Chirurgica* (Surgical Library), a four-volume illustrated encyclopedia on surgery, alphabetically arranged according to the disease, first published in 1721, which offers a selection of the most significant procedures from the early Renaissance to the beginning of the eighteenth century, including a huge number of quotations. It should be regarded as an inexhaustible mine of information on the surgical techniques of previous times [56] (Fig. 4.38). Volume One, p. 377–485, contains the sole reprint of the full text of Tagliacozzi's *De Curtorum Chirurgia per insitionem* issued between 1598 (Frankfurt edition) and 1831 (Troschel edition) (see Sect. 3.3.5.2). At the end of the text of *De Curtorum Chirurgia* (p. 485), Manget quotes the episode reported by Fabry von Hilden in his *Observationum & Curationum Chirurgicarum Centuriae* (Surgical Observations) [42], that in 1592, in Lausanne, the surgeon Jean Griffon (see Sect. 3.3.4.1) restored an amputated nose to a young girl, using the arm flap technique, 5 years before the publication of Tagliacozzi's work, apparently with a successful outcome.

Two dissertations on nasal reconstruction were discussed in 1742: one in Uppsala (Sweden) and another in Paris. The first one, *De Chirurgiae Curtorum Possibilitate* (On the Possibilities of Surgery of Injuries), presented at Uppsala University by **Isaac Fritz**, under the presidency of **Nils Rosén von Rosenstein** (1706–1773) is witness to the interest in the plastic surgery discipline that had arisen in northern European countries [57] (Fig. 4.39). The work was mainly a historical review of the arm flap method and emphasized the advantages of the art of restoring the nose using autologous tissue, rather than an evaluation on the outcomes of previously operated cases. It featured three woodcut plates, two of them showing the steps of the arm flap procedure, whereas the third one illustrated the different views of nasal prostheses. The thesis drew attention to a specialty almost completely neglected after Tagliacozzi's death.

The second one, *Quaestio Medico-Chirurgica*: *an curtae nares ex brachio reficiendae*? (Medico-Surgical question: can defective noses be reconstructed from the arm?) [58] (Fig. 4.40), was presented in Paris by **Urbain de Vandenesse** before the medical faculty, under the presidency of **Jean-Baptiste Dubois** (end of seventeenth century–1759), surgeon and professor at the Royal College.

Although its contents didn't add much to well-known descriptions of nasal repair by the arm flap procedure, the thesis played a key role in the history of plastic surgery because in a period of almost complete decline of reconstructive surgical procedures, the author affirmed that the operation of nasal reconstruction was possible. For severed noses, *it is better to attempt to re-attach them*, he said, *even though it is not always successful. Should the unfavourable situation of skin necrosis happen, the arm flap procedure is the treatment of choice.*

If you have no nose, de Vandenesse concluded, *why be afraid? Why delay? Severed noses can be reconstructed from the arm*. However, these considerations were time-consuming because the medical faculty was very cold on accepting Dubois' and Vandenesse's proposals. Although the definitive answer of the faculty was positive, nobody took notice of the provoking message. The thesis had no success among physicians and surgeons, and replacement of the missing nose continued using silver or wood prostheses, demonstrating the decline of reconstructive procedures. Garrison reported that the medical faculty interdicted facial repair after that [3]. Gnudi and Webster [6] believe that Garrison's statement was incorrect (see p. 306–307). In 2010, we personally asked the curator of the Paris BIUM Library (Bibliothèque Inter-Universitaire de Médecine). She affirmed that Garrison's statement did not correspond to the truth. A similar event never occurred in the history of the medical faculty of Paris [59].

Apart from the three works mentioned above, almost no reference to any plastic surgical procedure was reported during the eighteenth century, witness of a decreased interest in nasal reconstruction, in Tagliacozzi's method, or in reconstructive surgery in general. The publication of the famous letter to the editor in *The Gentleman's Magazine* about the Indian forehead rhinoplasty in October of 1794 changed the trend of current thinking [60].

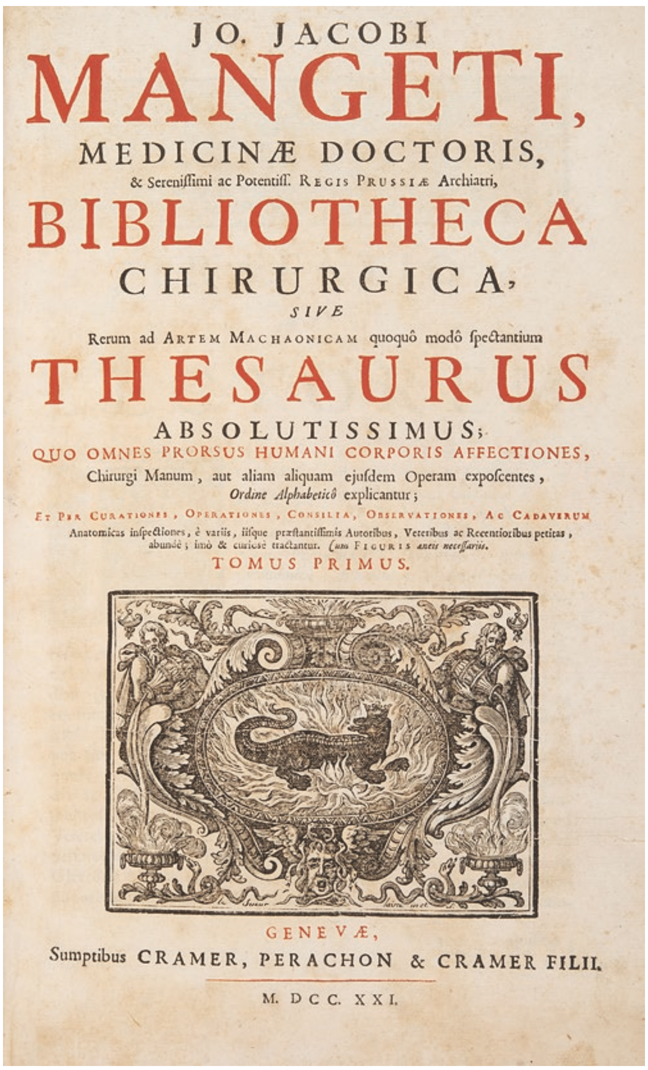

JO. JACOBI
MANGETI,
MEDICINÆ DOCTORIS,
& Sereniſſimi ac Potentiſſ. Regis Prussiæ Archiatri,
BIBLIOTHECA
CHIRURGICA,
SIVE
Rerum ad Artem Machaonicam quoquô modô ſpectantium
THESAURUS
ABSOLUTISSIMUS;
QUO OMNES PRORSUS HUMANI CORPORIS AFFECTIONES,
Chirurgi Manum, aut aliam aliquam ejuſdem Operam expoſcentes,
Ordine Alphabeticô explicantur;
Et Per Curationes, Operationes, Consilia, Observationes, Ac Cadaverum
Anatomicas inſpectiones, è variis, iiſque præſtantiſſimis Autoribus, Veteribus ac Recentioribus petitas, abundè; imò & curiosè tractantur. Cum Figuris aeneis necessariis.
TOMUS PRIMUS.
GENEVÆ,
Sumptibus CRAMER, PERACHON & CRAMER FILII.
M. DCC. XXI.

Fig. 4.38 Title page of Jean-Jacques Manget (1652–1742) *Bibliotheca Chirurgica*, first published in Geneva in 1721


— 11 —
Q. F. F. Q. S.
DISSERTATIO MEDICO-CHIRURGICA
DE
CHIRURGIÆ
CURTORUM
POSSIBILITATE,
QUAM,
Suffrag. & Conſenſ. Experientiſſ. Facult. Med.
In Reg. Acad. Upſal.
Sub PRÆSIDIO
Celeberrimi & Experientiſſimi VIRI,
Dn. Doct. NICOLAI
ROSÉN,
S:æ R:æ M:tis Med. & Med. PROFESS. Ordin.
Publico bonorum examini ſubmittit
ISAAC FRITZ,
STOCKHOLMENSIS.
In Auditor. Carol. Majori, ad diem 10 Octobr.
Ann. MDCCXLII.
Horis ante meridiem ſolitis.
UPSALIÆ impreſſa.

Fig. 4.39 Title page of the thesis on the arm flap nasal reconstruction discussed at Uppsala (Sweden) in 1742, under the presidency of Nils Rosén von Rosenstein (1706–1773)

DEO OPTIMO MAX.
UNI ET TRINO,
VIRGINI DEIPARÆ, ET S. LUCÆ,
Orthodoxorum Medicorum Patrono.

QUÆSTIO MEDICO-CHIRURGICA,
QUODLIBETARIIS DISPUTATIONIBUS,
manè discutienda, in Scholis Medicorum, die Jovis, decimâ-nonâ Aprilis, Anno M. DCC. XLII.

M. JOANNE-BAPTISTA DUBOIS, Professore Regio, Doctore Medico, Præside.

An curtæ nares ex brachio reficiendæ?

I.

HUMANI corporis humores coge, dilue: motus eorum excita, compesce: fibras tende, laxa, stimula, demulce. Cerebrum sternutatoriis, stomachum vomitoriis, purgantibus alvum sollicita. Urinam, sudorem, sputa, menses move. Remediis mille specificis utere. Abundè, parcè nutri. Cæde venas lanceolâ, hirudinibus emunge. Cucurbitulis, emplastris cutem in vesicas attolle. Dissolutione, suppuratione, resectione, tumorem dele. Vulnus claude; ulcus deterge: luxata restitue; fracta compone. Sarci, sue, liga, unge, frica, punge, ure, seca. Quodcunque istorum egeris, puta demptum aliquid, vel additum corpori. Desunt in eo multa, redundant plura. Hinc & indè scatebra morborum. *(a)* Adjice, detrahe, in utroque modum serva; Medicus es. Cùmque in his duobus versentur salutaris artis illæ partes, quæ medicamentis & victu prospiciunt valetudini; tùm maximè pars ea, quæ manu curat. Quocircà mirum est in eo consentire plerosque de Chirurgiâ Scriptores, ut à generali divisione Chirurgicarum operationum exulet πρόσθεσις, quæ totius Chirurgiæ dimidium est. Quin & altera dimidia pars ἐξαίρεσις, vel ἀφαίρεσις, quasi novatoribus patrocinante spretæ sororis exemplo, jamjam proscribitur, lege quidem eò molestiori, quò recentior est *(b)* Legislatoris auctoritas. Quid ergo superest? Σύνθεσις & διαίρεσις, ad quas placet ἐξαίρεσιν & πρόσθεσιν, ministrarum nomine, revocari. At si tantum compendiariæ methodi studium est, quidni potiùs, famularum titulo, σύνθεσις & διαίρεσις ad ἐξαίρεσιν & πρόσθεσιν, tanquam ad magistras referantur? His quippe illæ subserviunt, venustum, utilem, necessarium nexum addendo; indecorum, noxium, lethalem auferendo. Obiter hæc: properemus ad metam. Curtorum incommoda medicam postulant atque admittunt manum. Crus ex ligno, ex argento manus, oculus

(a) Ad mentem *Hippocratis*, lib. de Flat. *(b)* Vid. *Junck.* Consp Chir. tab. I.

A

Fig. 4.40 Title page of the thesis on the possibility of reconstructing noses using the arm flap technique discussed in Paris in 1742, under the presidency of Jean-Baptiste Dubois (end of seventeenth century–1759)

4.2.2 Surgical Achievements in Europe

Surgery made considerable progress in Europe during the eighteenth century, particularly in France where the foundation of the ***Académie Royale de Chirurgie*** (Royal Academy of Surgery) significantly contributed to surgical education.

4.2.2.1 France

Pierre Dionis

Pierre Dionis (1643–1718), a Parisian surgeon of great repute, well-known anatomist, and a student of **Guichard Joseph Duverney** (1648–1730), substantially advanced the teaching of surgery. In 1672, he was appointed surgeon to Louis XIV, with the specific task of teaching anatomy, according to the principles of blood circulation, published in 1628 by **William Harvey** (1578–1657), but until now not well received by the Paris medical faculty. He became first surgeon to the Madame la Dauphine and to Queen Maria Theresa of Austria [3, 6, 18].

In 1707, he published *Cours des Operations de Chirurgie, démontrées au Jardin Royal* (Courses of Surgical Operations, demonstrated at the Royal Garden) [61], a very successful book which went through numerous editions, was translated into different languages, and remained a classic in eighteenth-century surgical literature. The book is a synopsis of the lectures on anatomy and surgery held by Dionis at the *Jardin Royal* (Royal Garden) of Paris and scholarly presented. The work is divided into ten surgical demonstrations of the most common procedures known at that time, including aneurysm, anal fistula, cleft lip, stone removal, hernias, and limb amputations. Plastic surgery is barely mentioned. On p. 403, Dionis explains how it is possible to reconstruct an amputated nose using the skin taken from the arm [61]. However, Tagliacozzi's name is not mentioned. Each chapter opens with an image of the operating table, accurately arranged with the surgical instruments necessary to perform that specific procedure (Fig. 4.41). Technical details about the surgery follow. The engraved plates at the beginning of the text depict the Royal Garden (Fig. 4.42) and the Saint-Côme Anatomical Theatre, venue of the dissection's courses, with Pierre Dionis, the course director, wearing a wig, teaching in front of his trainees (Fig. 4.43).

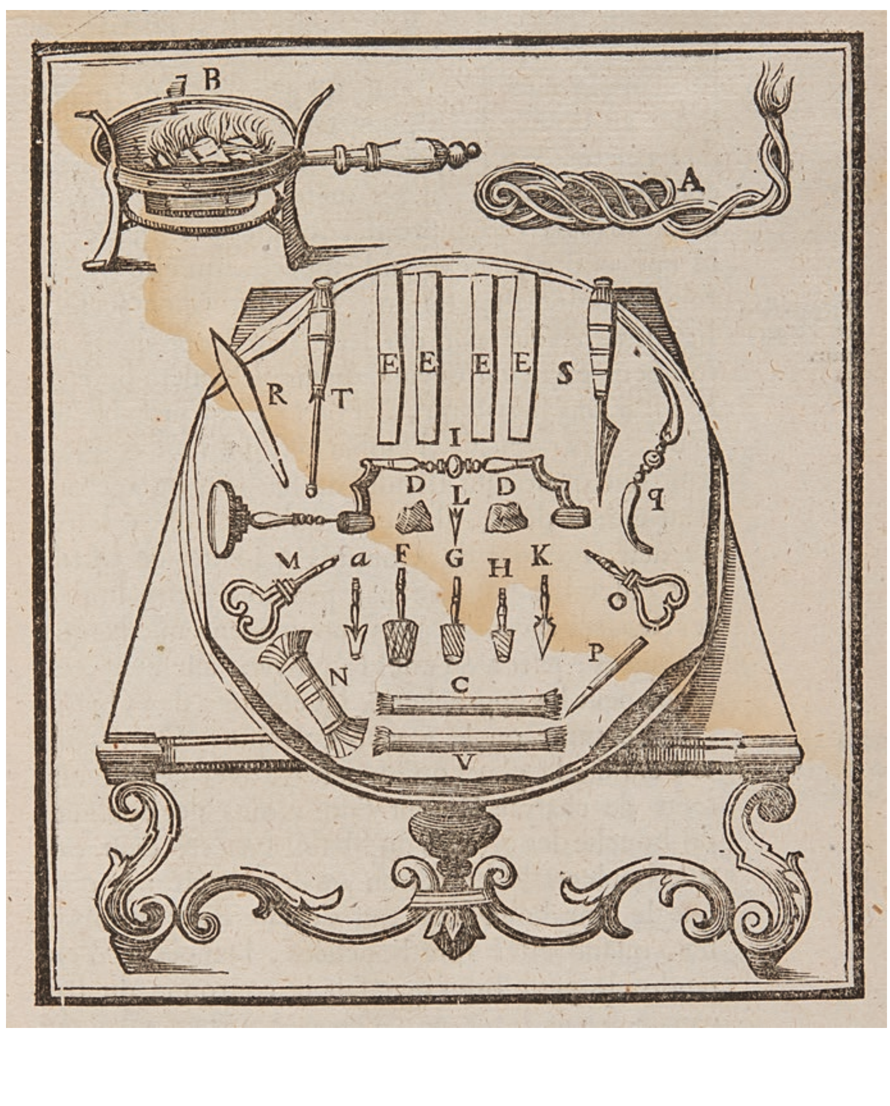


Fig. 4.41 Preparation of the operating table, arranged with the instruments necessary to perform a craniotomy. (From: Dionis P. *Cours des Operations de Chirurgie, démontrées au Jardin Royal*. Paris, Laurent d'Houry, 1707)

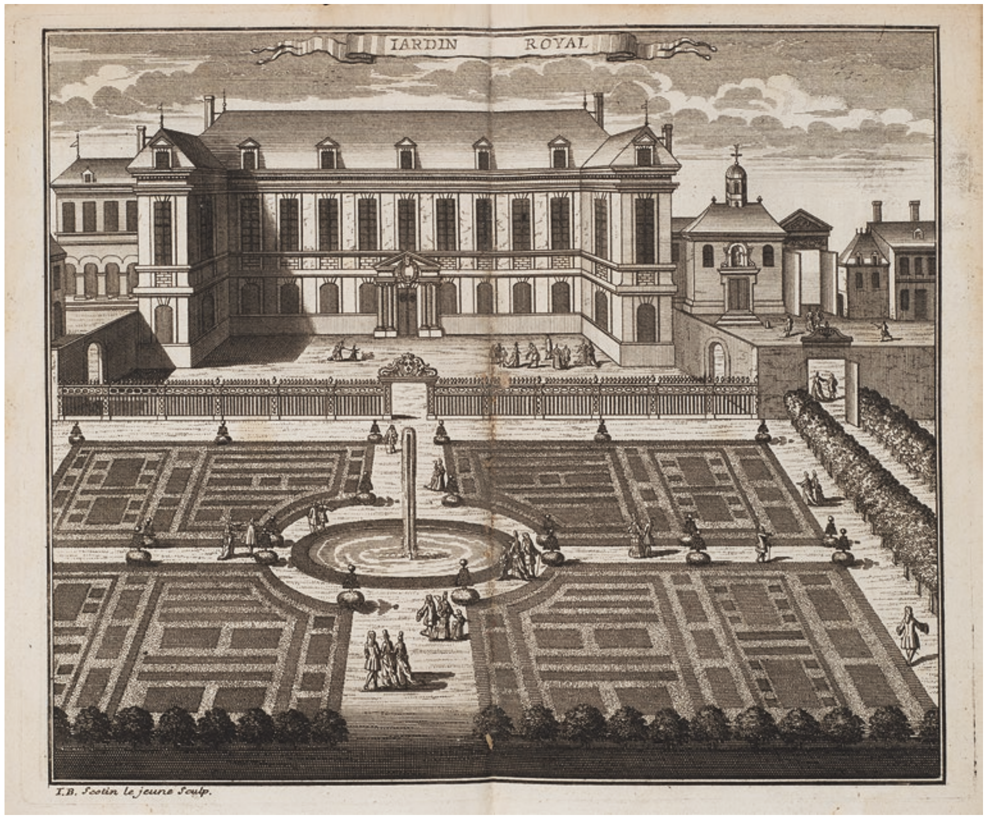
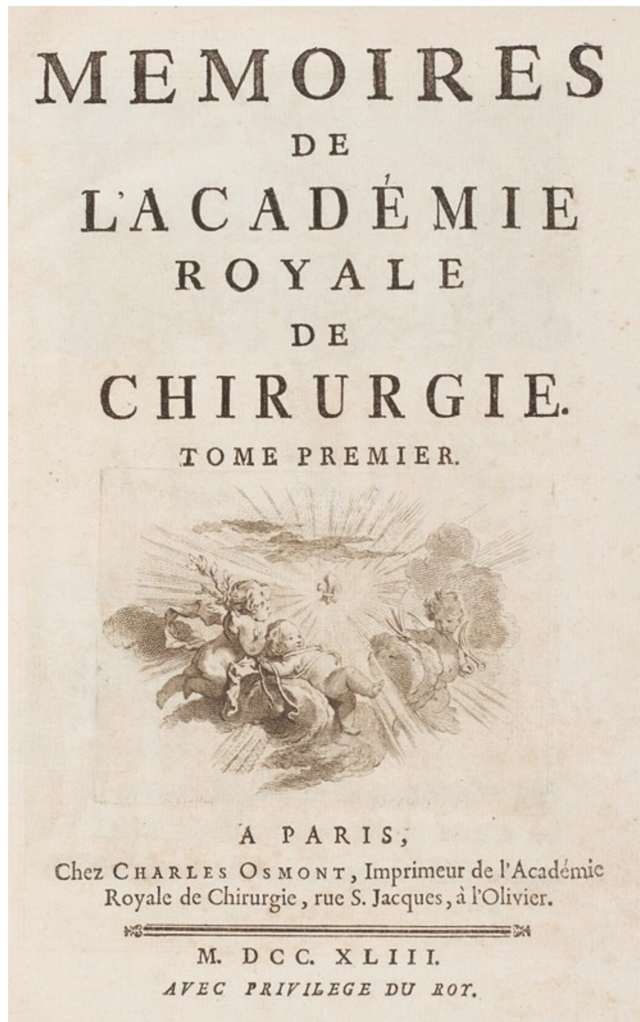


Fig. 4.42 Engraved plate, depicting the Royal Garden, venue of the dissection's courses. (From: Dionis P. *Cours des Operations de Chirurgie, démontrées au Jardin Royal*. Paris, Laurent d'Houry, 1707)

Fig. 4.43 Engraved plate, showing the Saint-Côme Anatomical theatre, venue of the dissection's courses, with Pierre Dionis, the course director, wearing a wig, teaching in front of his trainees. (From: Dionis P. *Cours des Operations de Chirurgie, démontrées au Jardin Royal*. Paris, Laurent d'Houry, 1707)

The Académie Royale de Chirurgie

In 1731, at the suggestion of **Georges Mareschal** (1658–1736), first surgeon to King Louis XV, and of **François de la Peyronie** (1678–1747), surgeon to the King, the ***Académie Royale de Chirurgie*** (Royal Academy of Surgery) was established in Paris, superseding the historic brotherhood of Saint-Côme, with the purpose of elevating the level of French surgery. Mareschal was appointed the first president, replaced after his death by de la Peyronie. The Academy's motto, *Consilioque manuque,* means use of intelligence and capability for achieving the goal. Initially, meetings were held in the Saint-Côme Anatomical Theatre, but in 1776, the academy moved into a new neo-classical building. The academy's official publication was *Mémoires de l'Académie Royale de Chirurgie* (Proceedings of the Royal Academy of Surgery), a sumptuous series of volumes, *in-4to*, with numerous engraved illustrations, dedicated to King Louis XV, where members published their own studies and observations. The first volume was issued in 1743 [62] (Fig. 4.44). The academy issued a special award annually for the best study or research in the field of surgery. Papers were collected in a series of volumes, first issued in 1753 [63]. The academy lasted until 1793, when it was suppressed by the French revolution.



MEMOIRES
DE
L'ACADÉMIE
ROYALE
DE
CHIRURGIE.
TOME PREMIER.

A PARIS,
Chez CHARLES OSMONT, Imprimeur de l'Académie Royale de Chirurgie, rue S. Jacques, à l'Olivier.

M. DCC. XLIII.
AVEC PRIVILEGE DU ROY.

Fig. 4.44 Title page of *Mémoires de l'Académie Royale de Chirurgie*, first issued in 1743

René Jacques Croissant de Garengeot

René Jacques Croissant de Garengeot (1688–1759), the son of a surgeon, was born in Vitré (Brittany) in 1688. He studied medicine at the Hospital of Angers. At 23, he moved to Paris becoming a student of the most renowned surgeons of the period, **Georges Mareschal**, **Jacob Winslow**, and **Jean Louis Petit**. He had a brilliant career in Paris and, in 1729, was appointed a member of the newly established ***Royal Academy of Surgery*** (Académie Royale de Chirurgie). He died in Köln in 1759, aged 71, as a consequence of a vascular stroke. A prolific writer, he published the *Traité des Opérations de Chirurgie* (Treatise of Surgical Operations), which went through numerous editions and was translated into English and German, and several works on anatomy, lithotomy, and surgical instruments.

Traité des Opérations de Chirurgie, first issued in 1720 without illustrations, was reprinted in 1731 with beautiful engraved plates [64]. The work describes the most common surgical procedures known at the author's time. The engraved plates show elegantly dressed surgeons either in consultation or performing operations at the patient's bedside, such as amputations, cleft lip management, polyp removal, craniotomy (Fig. 4.45), lithotomy, anal fistulae, and lachrymal fistulae. The environment of the epoch is well represented. In Volume Three, p. 55, Garengeot relates a story that during a fight, a soldier had his nose, including the cartilage, bitten off. His adversary spat the piece of flesh into a nearby gutter. The soldier picked up the rest of his nose and threw it into a nearby shop before running after his adversary. Upon his return, the soldier collected the piece of nose, which was in the meantime carefully washed by the shop owner, and put it back in its natural position. It was maintained stable with the aid of plasters and dressing. The following day, the approximation seemed favorable, and after 4 days the union remained intact. The story was reported by **Carpue** (1816) [65] and in *The Lancet* (1823) [66].

Fig. 4.45 Engraved illustration of the surgeon and his assistant, elegantly dressed, performing a craniotomy. (From: R.J. Garengeot. *Traité des Opérations de Chirurgie*. Paris, Huart, 1731)

Jean Louis Petit

Jean Louis Petit (1674–1750) was a highly respected surgeon and one of the leading scientific personalities in Paris in the first half of the eighteenth century (Fig. 4.46). Born in Paris in 1674, Petit began his medical studies at 7 years of age with **Alexis Littré** (1654–1725), a French anatomist, who followed him until he obtained his medical degree. Initially, Petit dedicated himself to anatomy and later to surgery, becoming a student of **Charles George Mareschal** (1658–1736). In 1700, he was appointed surgeon and in 1715 became a member of the ***Royal Academy of Sciences***. In 1731, when the ***Royal Academy of Surgery*** (Académie Royale de Chirurgie) was established in Paris, Petit was nominated the director and then the secretary. He was a talented surgeon and requested all over Europe for consultations. In 1705, he published *Traité des Maladies des Os* (Treatise on Bone Diseases), the only book that appeared during his lifetime. He died in 1750, aged 76 [3, 18].

He worked on his *Traité des Maladies Chirurgicales et des Opérations qui leur conviennent* (Treatise on Surgical Diseases and of the Operations to treat them), for over 12 years, personally taking care of the text and of all the illustrations of instruments so *useful to young surgeons*, as stated in the foreword. Regrettably, due to Petit's sudden death, the work was interrupted. It was posthumously issued 24 years later in 1774 by **François Dominique Lesne** (1722–1800) [67]. The three-volume text begins with management of wounds and how to suture them (Volume One, p. 1–42). It continues with the treatment of tumors, amputations, and hernias. In Volume One, Chapter 7, p. 223–230, Petit deals with mammary tumors. He was one of the pioneers in emphasizing the importance of the concurrent ablation of tumors, pectoralis muscle, and axillary lymph nodes. He reported the first successful operation for mastoiditis (Volume One, p. 153–160), addressed lachrymal fistula (Volume One, p. 289–376) and management of lumbar hernia (Volume Two, p. 256–258), and wrote a description of the lumbar hernia triangle between the iliac crest and the margins of the external oblique and latissimus dorsi muscle, which was eponymously named after him. The numerous engraved plates show surgical instruments, among them the screw tourniquet for controlling bleeding after limb amputation (Fig. 4.47).

Fig. 4.46 Portrait of J.L. Petit (1674–1750). (From: J.L. Petit. *Traité des Maladies Chirurgicales et des Opérations qui leur conviennent*. Paris, P. Fr. Didot le Jeune, 1774)

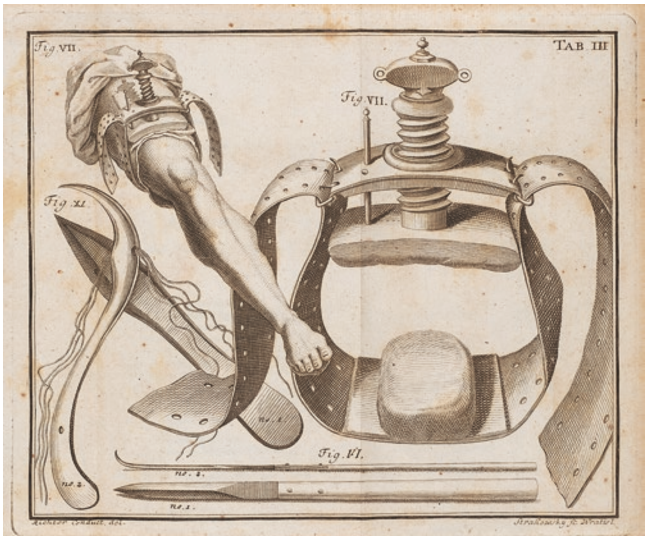


Fig. 4.47 The screw tourniquet for controlling bleeding after limb amputation invented by J.L. Petit. (From: J.Z. Platner *Institutiones Chirurgiae Rationalis*. Venezia, G.B. Albrizzi, 1747)

Dionis Georges de la Faye

Dionis Georges de La Faye (1699–1781) was a member of the ***Royal Academy of Surgery*** (Académie Royale de Chirurgie) and appointed its director in 1754 and in 1772. In 1738, he published *de Chirurgie* (Principles of Surgery), a very successful and scholarly written textbook, anonymously issued, which was translated into different languages [68]. He contributed to the first volume of *Mémoires de l'Académie Royale de Chirurgie* with *Observations sur les Becs-de-Lièvre venus de Naissance* (Observations on Congenital Cleft Lips) [69], one of the few essays on the treatment of cleft lip patients published after **Pierre Franco** (ca. 1500–1561)—200 years earlier (see Sect. 9.1.3.5).

Henry-François Le Dran

Henry-François Le Dran (1685–1773) was an army surgeon and a member of the ***Académie Royale de Chirurgie***. In 1742, he issued *Traité des Opérations de Chirurgie* (Treatise on Surgical Operations) [70], a very popular work with a large section devoted to lithotomy, treatment of cancer, and management of head traumas. Le Dran was in favor of trephination in cases of crushed wound of the skull so as to reduce the risk of meningeal suppuration. According to him, any fracture of the skull required exposure of the dura by elevation of bone and by removing the bony fragments. The text was translated into English and first published in London in 1749. The English anatomist and surgeon **William Cheselden** (1688–1752) added his own *Observations* with 22 engraved plates [71].

Sauveur François Morand

Sauveur François Morand (1697–1773) was considered a very talented surgeon. He was appointed secretary and also director of the ***Académie Royale de Chirurgie***. He issued *Opuscules de Chirurgie* (Accounts on Surgery) in 1768–1772 [72] where he reported the first successful operation in history of the evacuation of a brain abscess located in the temporo-sphenoidal region in a 51-year-old monk. After trephining the carious bone, Morand inserted a silver tube into the cavity to secure a successful outcome of the operation. After 4 years, the patient was still alive.

Pierre-Joseph Desault

Pierre-Joseph Desault (1744–1795) (Fig. 4.48) obtained his medical education directly at the military Hospital of Belfort where he remained for 3 years treating gunshot wounds. In 1764, aged 20, he moved to Paris where he dedicated himself to anatomy and opened an anatomical school that soon became well attended, causing jealousy among some university professors. In 1782, he was appointed surgeon at La Charité Hospital, and in 1786, he became chief surgeon at Hôtel-Dieu. His fame grew rapidly. He was considered the most famous surgeon of that period in France. At Hôtel-Dieu, he established a clinical school introducing bedside teaching rounds which attracted numerous students and physicians from all over the country and from abroad. **Dominique Jean Larrey** (1768–1842), future surgeon to Napoleon, was Desault's student at Hôtel-Dieu. Desault is best remembered for bandaging clavicle fractures (Fig. 4.49) and for the idea of wound debridement, the basis of reparative surgery. Wound cleansing, by excising dead tissue and removing foreign material, was already advocated by **Leonardo Botallo** (ca. 1519–1587), in 1560 [73] (see Sect. 3.1.2.5).

In 1791, Desault founded the *Journal de Chirurgie*, with articles coming from his experience at Hôtel-Dieu. It was edited by his students and represented an invaluable source of information for the possible diseases of surgical interest seen at that time [74]. However, after his death, the journal ceased publication. In 1793, during the French revolution, Desault was arrested while lecturing and imprisoned. He was soon released and permitted to resume his functions. He died in Paris in June of 1795, aged 51, of a malignant fever. During his short lifetime, he wrote very few works: *Traité des maladies chirurgicales* (Treatise of surgical diseases) in cooperation with his friend and colleague **François Chopart** (1743–1795) [75], a member of the ***Royal Academy of Surgery*** (Académie Royale de Chirurgie) and Professor of Surgery, and *Oeuvres chirurgicales*, posthumously assembled and issued, thanks to his student **Xavier Bichat** (1771–1802) [76].

Volume One of *Traité des maladies chirurgicales* is of primary interest for plastic surgery, as it discusses wound healing (p. 10), management of microtia and atresia auris (p. 118), nasal reconstruction (p. 182), and treatment of uni- and bilateral cleft lip (p. 198) and cancer of the lip (p. 205). Regarding microtia, the authors suggested that its correction should be delayed until the period of adolescence using local flaps. Desault revived the Tagliacozzi procedure for nasal reconstruction. For cancer of the lip, the wedge excision with approximation of the margins was advocated.

Fig. 4.48 Portrait of Pierre-Joseph Desault (1744–1795). (From: P.J. Desault. *Œuvres Chirurgicales*. Paris, Méquignon l'ainé, 1801–1803)

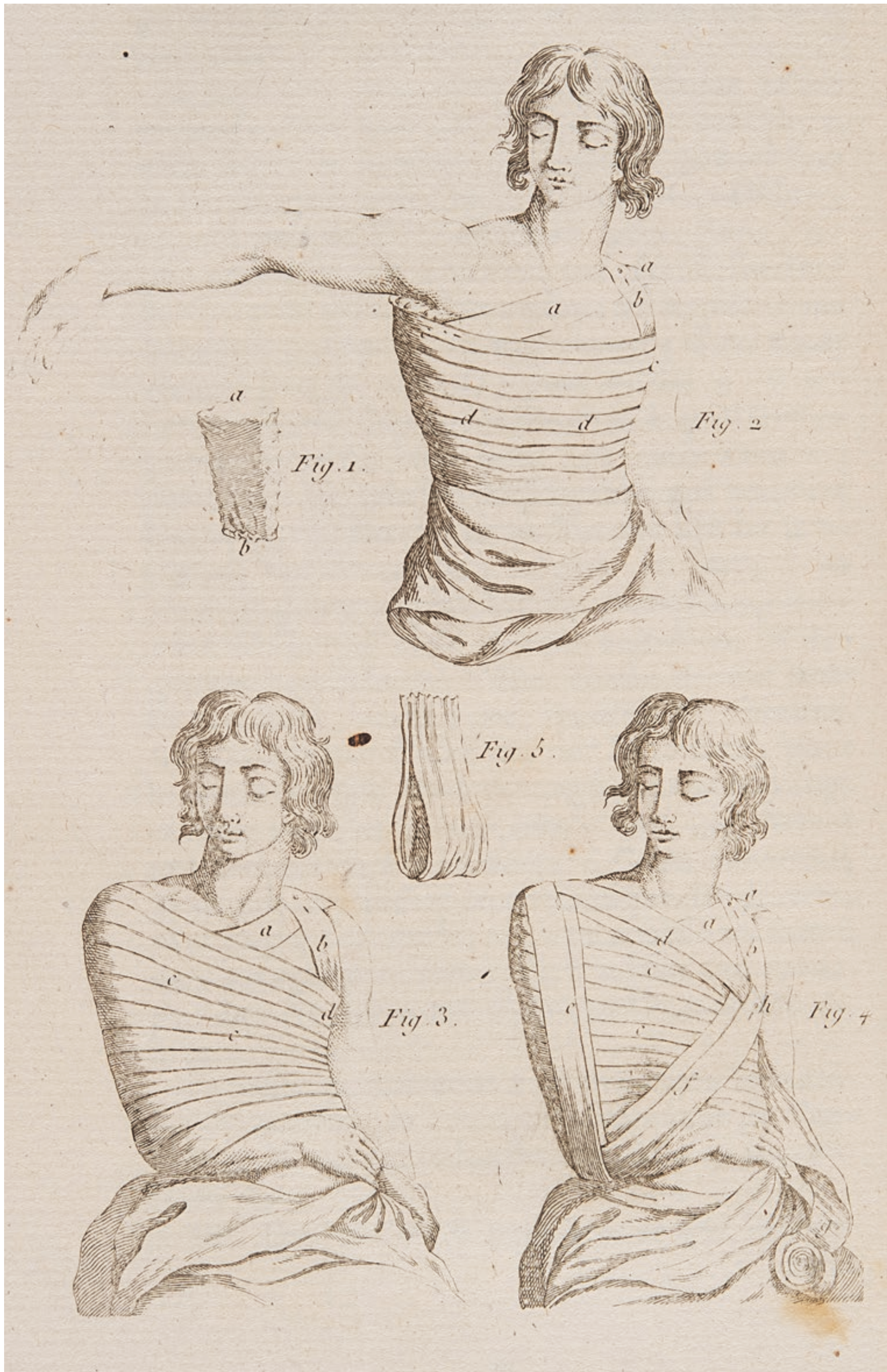


Fig. 4.49 Management of clavicle fracture, using a bandage which eponymically bears Desault's name. (From: P.J. Desault. *Œuvres Chirurgicales*. Paris, Méquignon l'ainé, 1801–1803)

4.2.2.2 England

During the eighteenth century, English surgery experienced a particularly favorable moment. Outstanding names included **Percival Pott** (1714–1789), **John Hunter** (1728–1793), **Samuel Sharp** (1709–1778), **William Cheselden** (1688–1752), and **Benjamin Bell** (1749–1806). They contributed in turn to make Great Britain the reference point of surgery in the world. A number of surgeons of this period of time are of particular interest for plastic surgery.

William Cheselden

William Cheselden (1688–1752), probably the greatest English anatomist and surgeon of the period, learned surgery through an apprenticeship with a surgeon at St. Thomas Hospital and anatomy from **William Cowper**. In 1711, he was admitted to the guild of barber-surgeons. From that date onward, for more than 25 years, he was the most respected teacher of anatomy in the city. In 1718, he was appointed physician and surgeon at St. Thomas Hospital in London, and as one of the greatest lithotomists, his reputation grew worldwide. He was also a member of the ***Royal Academy of Surgery*** (Académie Royale de Chirurgie) of Paris. In 1737, he was appointed chief surgeon at the Royal Hospital in Chelsea. His major work was *Osteographia*, a large *folio* atlas on bones published in 1733 and illustrated with amazing, striking drawings (see Sect. 8.7.7.5). The only surgical text he issued was a commentary added to the English translation of *The Operations in Surgery* by **Henry-François Le Dran**, accompanied by 21 engraved plates, where he discussed cranial fractures, lachrymal fistulae, cleft lip, talipe, and breast cancer [71] (Fig. 4.50).

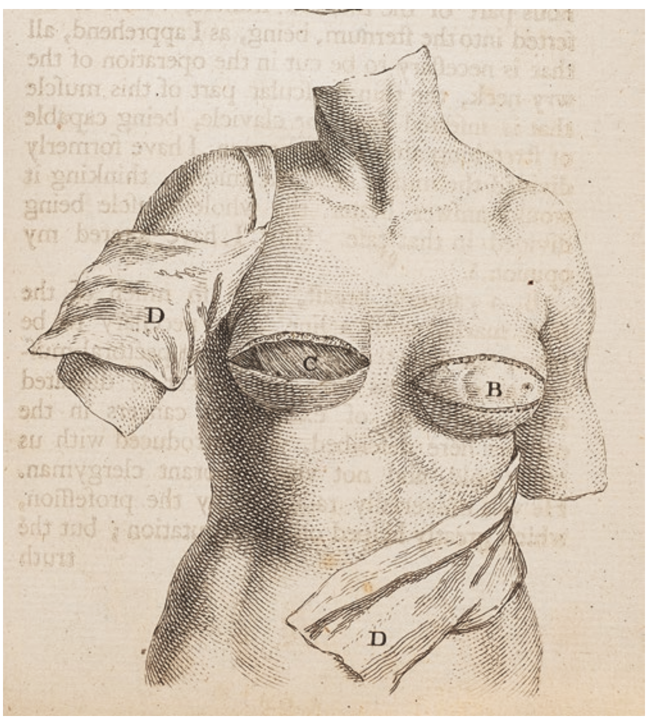


Fig. 4.50 Mastectomy for breast carcinoma; skin excision along with the mammary gland; the pectoralis muscle after the tumor has been removed. (From: W. Cheselden. *Observations on H. F. Le Dran. Operations in Surgery.* London, C. Hitch and R. Dodsley, 1749. p. 454)

Samuel Sharp

Samuel Sharp (1709–1778), a student of William Cheselden, was head surgeon at Guy's Hospital from 1733 to 1757. *A Treatise on the Operations of Surgery*, first issued in London in 1739 [77], deals with the management of the most common diseases of the period suitable for surgical treatment, including wounds, abscesses, hernias, phymosis, stones, breast cancer, polyps, hare lip, and aneurysm. The engraved illustrations show surgical instruments. The work, one of the most popular surgical textbooks of the period, went through 11 editions and was translated into numerous languages.

Benjamin Bell

Benjamin Bell (1749–1806), born in Dumfries, Scotland, in 1749, studied medicine at the University of Edinburgh under the famous **Alexander Monro *secundus*** (1733–1817). At the completion of his studies, he visited London and Paris, meeting the most notable surgeons of the period. Upon his return to Edinburgh, he established a flourishing surgical practice.

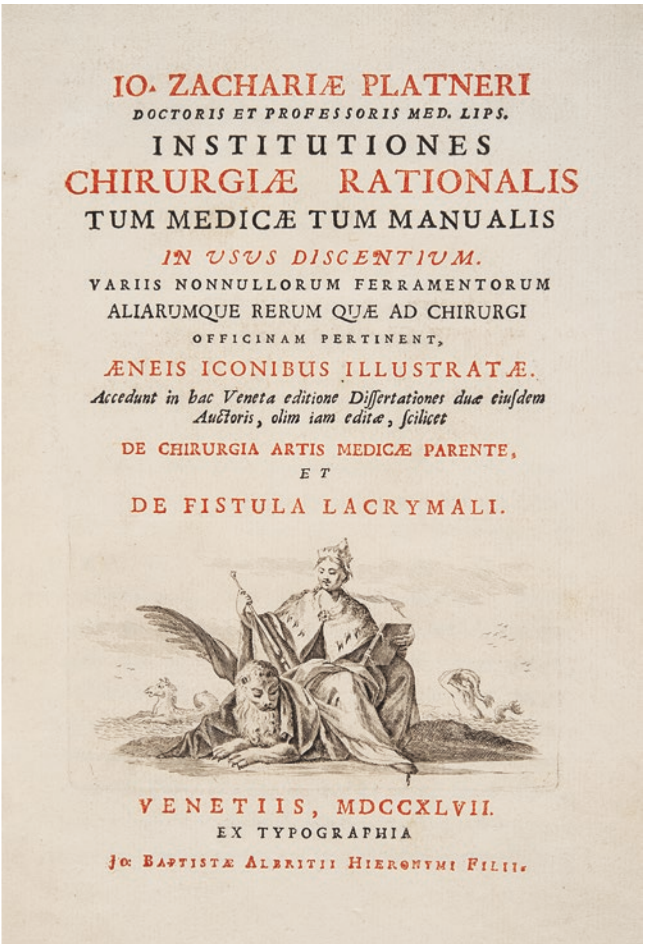
In 1783, he was among the founding members of the ***Royal Society of Edinburgh***. He contributed to surgery with two important textbooks: *A Treatise on the Theory and Management of Ulcers*, issued in Edinburgh in 1778 [78], in which he classified the different types of ulcers and established guidelines to treat them, and *A System of Surgery*, published in six volumes between 1783 and 1788 [79], translated into several languages, covering the entire subject of surgery known at that time.

4.2.2.3 Germany

Johann Zacharian Platner

Johann Zacharian Platner (1694–1747), Professor of Anatomy and Surgery at Leipzig University, issued *Institutiones Chirurgiae Rationalis* (…) (Treatise on Rational Surgery) in 1745 [80], a scholarly written treatise on surgery and surgical pathology that covered the whole field of surgery including sections on the management of cancer, wounds, traumas, sores, fistulae, luxations, and fractures. Paragraphs 576–605 deal with different types of facial wounds, eyelids, cheeks, ears, lips, and the tongue. In describing nasal wounds (Paragraphs 592–593), Platner traces the history of nasal reconstruction with the arm flap technique, quoting Benedetti, Tagliacozzi, Cortesi, Molinetti, Vianeo, and many others. The book was very successful and went through numerous editions. It was the most common text used in European universities during the eighteenth century. A second edition, *in-4to*, was printed in Venice in 1747 [81] in a luxurious edition with an engraved frontispiece drawn by the Venetian painter G.B. Piazzetta (1683–1754) (Figs. 4.51 and 4.52). The engraved plates show surgical instruments.

Fig. 4.51 Engraved frontispiece representing a fainting patient cured by a physician. (From: J.Z. Platner *Institutiones Chirurgiae Rationalis*. Venezia; G.B. Albrizzi, 1747)



IO. ZACHARIÆ PLATNERI
DOCTORIS ET PROFESSORIS MED. LIPS.
INSTITUTIONES
CHIRURGIÆ RATIONALIS
TUM MEDICÆ TUM MANUALIS
IN USUS DISCENTIUM.
VARIIS NONNULLORUM FERRAMENTORUM
ALIARUMQUE RERUM QUÆ AD CHIRURGI
OFFICINAM PERTINENT,
ÆNEIS ICONIBUS ILLUSTRATÆ.
Accedunt in hac Veneta editione Dissertationes duæ eiusdem Auctoris, olim iam editæ, scilicet
DE CHIRURGIA ARTIS MEDICÆ PARENTE,
ET
DE FISTULA LACRYMALI.
VENETIIS, MDCCXLVII.
EX TYPOGRAPHIA
Jo. BAPTISTÆ ALBRITII HIERONYMI FILII.

Fig. 4.52 Title page of *Institutiones Chirurgiae Rationalis*. by J.Z. Platner. Venezia, G.B. Albrizzi, 1747

Lorenz Heister

The leading surgeon of the period was **Lorenz Heister** (1683–1758) (Fig. 4.53). In contrast to the uneducated German practitioners who preceded him, Heister was a fully trained student of medicine who had pursued an official course of studies in the leading universities of the period. Born in Frankfurt am Main, Heister attended the Universities of Giessen and Leiden under Albinus and Boerhaave. In 1708, he graduated from Hardewyk (The Netherlands) under Ruysch and was appointed Chief Surgeon of the Dutch army. At the beginning of 1710, he was hired by the city of Nürnberg to teach anatomy and surgery and became a professor at the University of Altdorf where he remained for 11 years. During this period, he issued his well-known textbook *Chirurgie* (On Surgery) in 1718. After its publication, he was called to the University of Helmstadt (Brunswick) to assume the Chair of Anatomy and Surgery and later of Botany. He remained at Helmstadt for 38 years, until his death in 1758, aged 75. He wrote several books on anatomy, surgery, and botany and is considered the founder of modern scientific surgery [3, 18].

Chirurgie by Lorenz Heister is one of the most important surgical tracts of the eighteenth century as it reflects the different operations performed at that time. The second edition, dated 1724 [82] (Fig. 4.54), was considerably expanded compared to the first one of 1718 and is richly illustrated with engraved plates showing instruments, diseases, and surgical procedures. It is divided into three parts. Part One includes the basis of surgery, the different types of wounds and their location, fractures, luxations, swellings, and sores. Part Two deals with surgical procedures, according to the different areas of the body. Regarding nasal reconstruction (Chapter 70, p. 548), Heister briefly mentions Tagliacozzi's operation, saying: *up to now it is considered impossible and impracticable. When this part of the body is lost, one must replace it with an artificial nose made of wood or silver, painted to be lifelike, and adapted to the defect by springs and screws, so as to render the accident and deformity unnoticeable.* Chapter 72 (p. 550) is devoted to cleft lip and to the treatment of facial wounds. The illustration shows a facial wound approximation with adhesive strips and a cleft lip suture (Fig. 4.55). Chapter 99 includes tracheostomy, and Plate 15 shows the instruments necessary to perform it. Chapter 104 is dedicated to breast tumors, with breast excision using a special guillotine (Fig. 4.56). Part Three explains the different types of bandages and stabilization devices applied in all the operations and limb disorders. The book was very successful and remained the standard text of surgery for more than a century—it was still in use in Vienna as late as 1838. It went through numerous editions (seven in Germany alone) and translations into Latin, Italian, Spanish, French, and Dutch. There were ten editions in English, the first one in 1743.

Fig. 4.53 Portrait of Lorenz Heister (1683–1758). (From: L. Heister. *Chirurgie, in welcher alles was zur Wund-Artzney gehoeret*. Nürnberg, Heirs of Johann Hoffmann, 1724)

D. LAVRENTII Heisters,
Anatom. Chirurg. ac Physiolog. Profes. Publ.
auf der Kön. und Hertzogl. Julius Universit. Helmstad,
der Kaiserl. und Königl. Preus. Societät Mitglied,
CHIRURGIE,
In welcher Alles,
was zur
Wund-Artzney
gehöret,
Nach der neuesten und besten Art/ gründlich abgehandelt/
und
In vielen Kupffer-Tafeln
die neu-erfundene und dienlichste
Instrumenten/
Nebst den bequemsten Handgriffen der Chirurgischen
Operationen und Bandagen
deutlich vorgestellet werden.
Zweyte Auflage/ viel vermehrt und verbessert.
Mit allergnädigsten Privileg.
Nürnberg, bey Johann Hoffmanns seel. Erben.
Gedruckt bey Lorentz Bieling, Anno 1724.

J. G. Kornmann.
Anno 1728.

Fig. 4.54 Title page of L. Heister. *Chirurgie, in welcher alles was zur Wund-Artzney gehoeret*. Nürnberg, Heirs of Johann Hoffmann, 1724

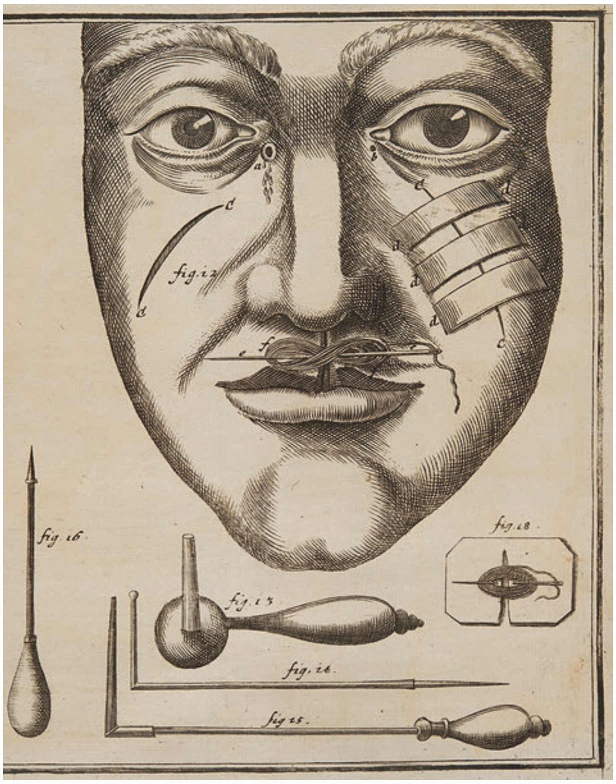


Fig. 4.55 Engraved illustration showing facial wound approximation with adhesive strips and cleft lip suture. (From: L. Heister *Chirurgie, in welcher alles was zur Wund-Artzney gehoeret*. Nürnberg, Heirs of Johann Hoffmann, 1724)

4.2.2.4 Austria

Giovanni Alessandro Brambilla

The Italian **Giovanni Alessandro Brambilla** (1728–1800), born in S. Zenone Po (Pavia) to a noble family, studied medicine at Pavia University, at that time under Austro-Hungarian Empire domination. In 1752, he moved to Vienna where he became the personal physician to the Emperor Joseph II of Asburg. In 1778, he was appointed first surgeon of the defense state and the following year sole superintendent of the military health service. In 1784, in Vienna, he established the ***Imperial and Royal Medical and Surgical Academy*** for the training of doctors and surgeons for the army, named *Josephinum* as a tribute to the Emperor.

In 1781, he published the *Instrumentarium chirurgicum Viennense* [83] (Fig. 4.57), the most complete and detailed text on surgical instruments ever issued with 65 engraved plates, in the German language, far superior to the *Armamentarium Chirurgicum* by Johannes Schultes (1655). He classified and illustrated all the instruments used by the Austrian army with great accuracy and reproduced them in actual size. In 1782, the work was translated into Latin as *Instrumentarium Chirurgicum Militare*, with 67 engraved plates. **Ferdinand Landerer** (1730–1795) was the official engraver for both editions.

Brambilla greatly contributed to promoting surgery vs. medicine. For anatomical training, he acquired 1190 pieces

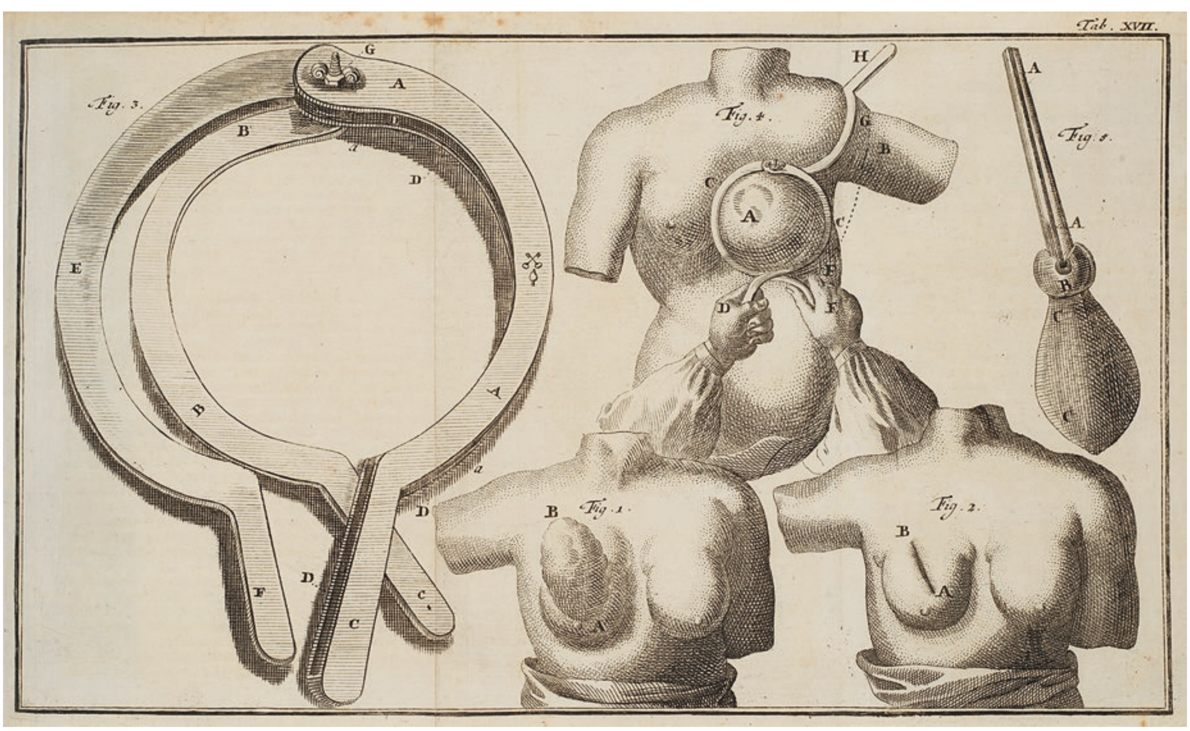


Fig. 4.56 Mastectomy for breast tumor performed using a special guillotine invented by L. Heister. (From: L. Heister. *Chirurgie, in welcher alles was zur Wund-Artzney gehoeret*. Nürnberg, Heirs of Johann Hoffmann, 1724)

of anatomical wax models prepared in Florence by **Clemente Susini** (1754–1814) and his school and brought them to Vienna.

Clemente Susini was a famous eighteenth-century bronze sculptor in Florence. He was a great anatomist and created a school of artistic anatomy, where he prepared superb life-size reproductions of the different parts and organs of the human body in wax (see Sect. 8.7.4.5 on "The Wax Modelers of the Grand Duchy of Tuscany"). These wax models were sold to different anatomical institutes for teaching purposes avoiding cadaveric dissections, costly and complicated to organize. Brambilla acquired wax models of the different organs of the human body for his students in surgery in Vienna.

Brambilla advanced Pavia University Medical School with substantial reforms to the study plan. In 1790, at the death of the Emperor, Brambilla gradually lost his power and returned to Pavia. He died suddenly in Padua in 1800, on his way back to Vienna, at the age of 72.

Fig. 4.57 Architectural engraved title page of *Instrumentarium chirurgicum Viennense* by G.A. Brambilla. Wien, M.A. Schmidt, 1781

4.2.2.5 Italy

The division of Italy into many different relatively small states significantly affected the development of medicine and surgery in the eighteenth century. Exception is made regarding the Vatican State, where physicians and surgeons of first rank practiced.

A surgeon of great repute of the period was **Giuseppe Flajani** (1739–1808). He studied medicine at La Sapienza University in Rome, from where he graduated in 1761. He was appointed head surgeon at Santo Spirito Hospital and, in 1775, became the personal physician of Pope Pius VI. He died in 1808 at the age of 69. His most important work was a four-volume collection of unusual case reports, *Collezione d'Osservazioni, e Riflessioni di Chirurgia* (Collection of Observations and Considerations of Surgery), published in Rome in 1798–1803 [84]. Among them were treatment of cleft lip, lip cancer, breast carcinoma, and eyelid carcinoma. However, Flajani's name is associated with the first description of the classic symptoms of the goiter, Volume Three, p. 270–273, hypertrophy of the thyroid gland, and tachycardia, although no mention of the exophthalmos was given. The condition was later reported in detail by **Robert Graves** in 1835 and by **Carl von Basedow** in 1840. It is now eponymously named *Flajani-Basedow-Graves disease* [85].

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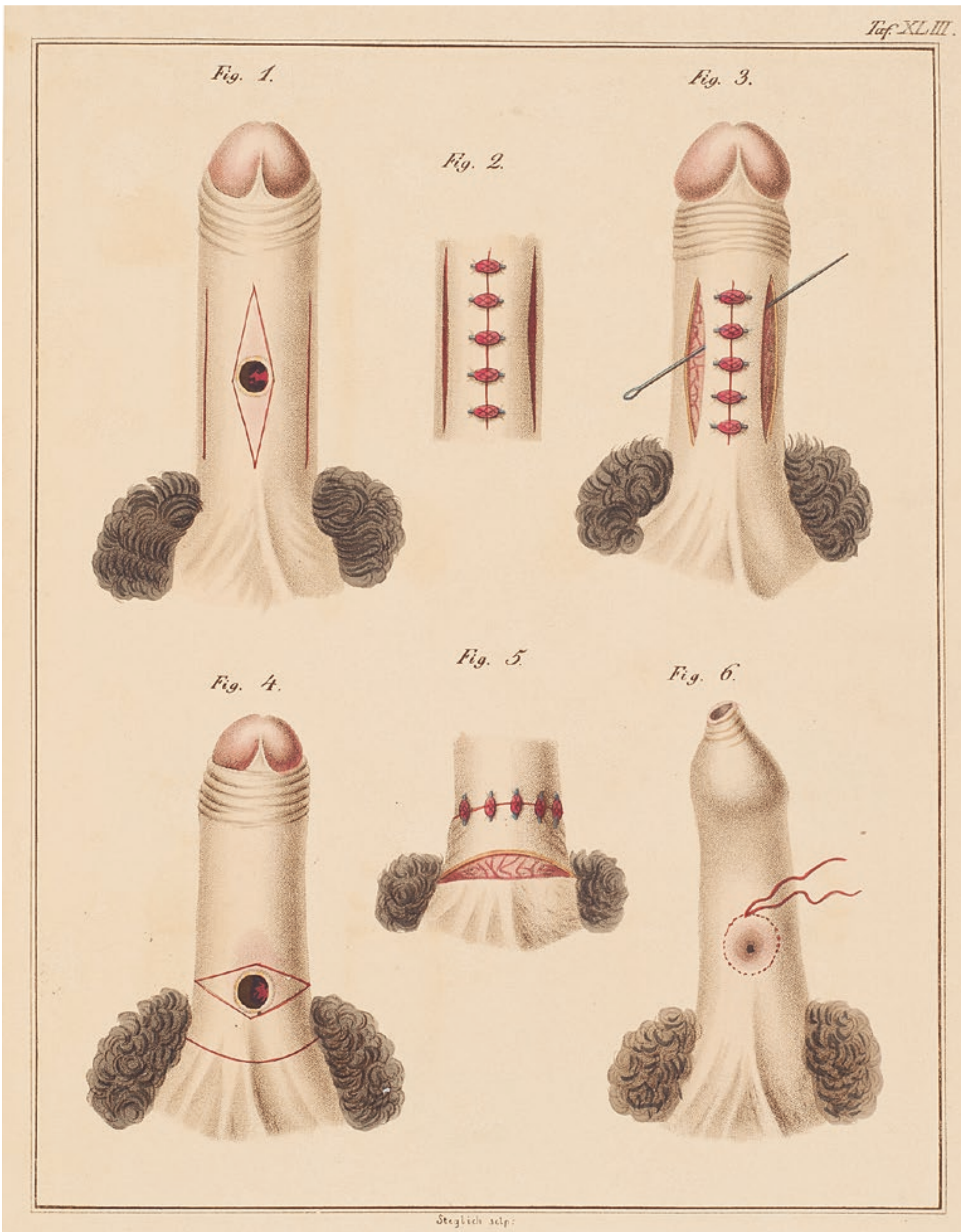
5 The Nineteenth Century: The Rebirth of Plastic Surgery in the Western World



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The Nineteenth Century: Salient Events in Surgery and Plastic Surgery

- After two centuries of oblivion, the rebirth of plastic surgery begins with a letter to the editor of a popular English monthly journal, *The Gentleman's Magazine*. The letter details the forehead flap technique for nasal reconstruction, as practiced in India but unknown in Europe, stimulating the interest of the English surgeon Joseph C. Carpue to perform forehead nasal reconstruction. Carpue's account contributes to the resurrection and spread of plastic surgery in England, Germany, and France and later in other countries.
- New flaps are reported mainly for the repair of facial defects. To facilitate flap advancement, von Burow removes a triangular piece of skin lateral to the flap, mathematically calculating the required amount. The method is now eponymously named von Burow's triangle skin excision.
- Priority of cleft palate closure is shared between Carl Ferdinand von Gräfe and Philibert Joseph Roux. Von Gräfe performs cleft palate closure in 1816, but publishes it as a short note in a local German journal, and the operation is unsuccessful. Roux performs a successful cleft palate closure 3 years later; thus, he claims the priority of palatoplasty.
- Free skin graft is developed and systematized: experimental in 1804 by Giuseppe Baronio; epidermic in man in 1869 by Jacques Louis Reverdin; full-thickness in 1870 by George Lawson; split-thickness in 1872 by Louis Ollier; and split-thickness and systematization of the technique in 1874 by Carl Thiersch.
- The introduction of anesthesia for pain control by William Thomas Green Morton at Massachusetts General Hospital in Boston in 1846 is a crucial event in medicine that completely changes the course of surgical operations.
- The discovery of antisepsis by Lister in 1865 brings a dramatic reduction of infections.

5.1 The Impact of *The Gentleman's Magazine* on the Resurrection of Plastic Surgery: Joseph C. Carpue

The resurrection of plastic surgery is associated with the publication of a letter in the October 1794 issue of *The Gentleman's Magazine*, a popular English monthly journal (Fig. 5.1). Signed simply B. L., recently identified as the English engraver **Barak Longmate** (1768–1836), the letter was addressed to the Editor-in-Chief of the journal and contained a detailed description of the Indian forehead rhinoplasty [1, 2]: *Mr. Urban, a friend of mine has transmitted to me, from the East Indies, the following very curious and, in Europe, I believe unknown chirurgical operation, which has long been practiced in India with success; namely, affixing a new nose on a man's face* (Fig. 5.2).

Accompanied by an engraved plate showing the details of the procedure (Fig. 5.3), the contents had a profound impact not only on the public but unexpectedly in London surgical circles, which stimulated the English surgeon **Joseph C. Carpue** (1764–1846) to perform the forehead flap operation.

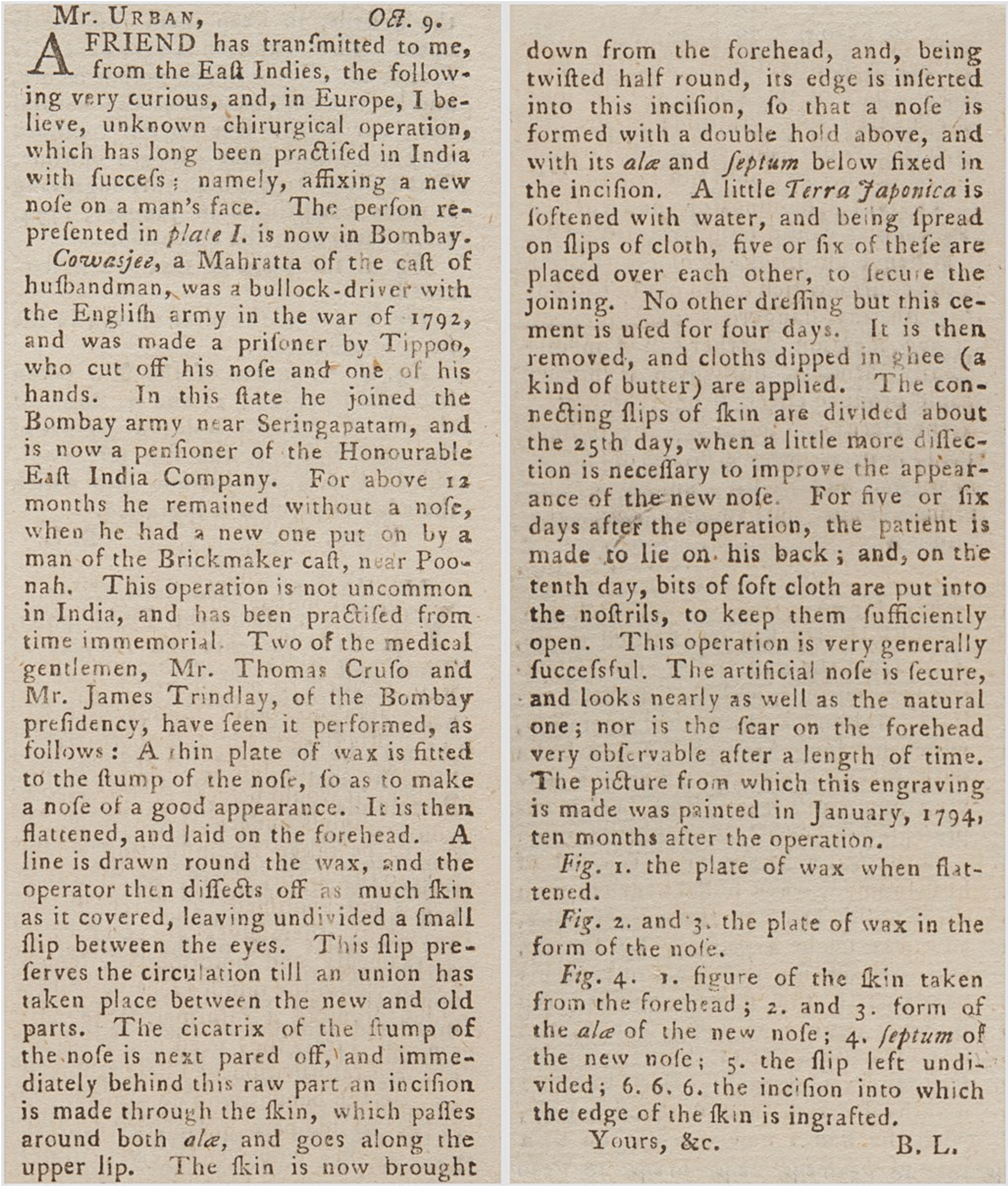
Joseph Carpue was born in 1764 in a suburb of London to a rather wealthy family. He was educated at the Jesuit's College of Douai (France) and began his surgical studies in 1796 at St. George's Hospital as a student of **Sir Everard Home** (1756–1832) and **George Pearson** (1751–1828). Two years later he became a member of the *Corporation of Surgeons*, and in 1799 he was appointed to the surgical staff of York Hospital where he started his career as an anatomical tutor and demonstrator. His lectures rapidly gained in popularity, and Carpue's fame spread over the next years. In 1801, he published *Description of the Muscles of the Human Body*. He developed an outstanding surgical practice, and, due to his profound knowledge of the literature, he became interested in various procedures, among them the Indian method of nasal reconstruction.

While waiting for the appropriate opportunity to try it, Carpue taught its principles to his students for more than 15 years. In the meantime, he practiced on cadavers. Finally, the occasion arrived, and Carpue carried out the forehead flap nasal reconstruction on an officer of His Majesty's Army, with a missing septum, tip, and alae—*the consequence of excessive use of mercury* (Fig. 5.4 *left*). In 1814, he performed the procedure at St. Bartholomew's Hospital, London. The operation lasted 37 min: *it was no child's play—extremely painful—but it was no use complaining*, the officer said. But at the end, he exclaimed: *my God, there is a nose!* (Fig. 5.4 *middle*). The postoperative course was uneventful apart from considerable edema. The patient left the hospital on Day 20.

After 4 months, Carpue *made the dissection of the integuments on the bridge of the nose*, sectioning the vascular pedicle. He documented the final result with an illustration shown on Plate 4 (Fig. 5.4 *right*). In 1815, he performed the second case on an officer in His Majesty's Army who had his nose amputated by a *coup-de-sabre* during a battle in Spain. The adopted technique was similar to the first one, with the same uneventful postoperative course. After 4 months, he followed with the second stage, sectioning the pedicle. With these two successful outcomes, Carpue prepared the description of the first forehead nasal reconstruction in the western world. The text was preceded by a detailed historical review about the origin of the procedure over the centuries. In December of 1815, he sent the manuscript to the printer, having commissioned the illustrations to **Charles Turner**

(1774–1857), the most outstanding mezzotint engraver of his day. In 1816, *An Account of two successful Operations for Restoring a lost nose from the Integuments of the forehead* (…), dedicated to His Royal Highness George IV, Prince of Wales, Regent of the United Kingdom, was issued and represented the zenith of Carpue's career [3, 4] (Fig. 5.5). For this, he was elected as a member of the *Royal Society*. *An account* (…) was well received throughout Great Britain and the continent—a prelude to the birth of modern plastic surgery. The following year, in 1817, the text was translated into German and published in Berlin, with a foreword by the German surgeon **Carl Ferdinand von Gräfe** (1787–1840) [5], who promptly initiated the use of the forehead flap. Carpue died in 1846, aged 78.

Fig. 5.1 Frontispiece of the October issue of the *Gentleman's Magazine* containing the letter about the Indian forehead rhinoplasty. (From: Gent's Mag 1794; 64: 891–892)



Mr. URBAN, Oct. 9.

A FRIEND has tranſmitted to me, from the Eaſt Indies, the following very curious, and, in Europe, I believe, unknown chirurgical operation, which has long been practiſed in India with ſucceſs; namely, affixing a new noſe on a man's face. The perſon repreſented in *plate I.* is now in Bombay.

Cowasjee, a Mahratta of the caſt of huſbandman, was a bullock-driver with the Engliſh army in the war of 1792, and was made a priſoner by Tippoo, who cut off his noſe and one of his hands. In this ſtate he joined the Bombay army near Seringapatam, and is now a penſioner of the Honourable Eaſt India Company. For above 12 months he remained without a noſe, when he had a new one put on by a man of the Brickmaker caſt, near Poonah. This operation is not uncommon in India, and has been practiſed from time immemorial. Two of the medical gentlemen, Mr. Thomas Cruſo and Mr. James Trindlay, of the Bombay preſidency, have ſeen it performed, as follows: A thin plate of wax is fitted to the ſtump of the noſe, ſo as to make a noſe of a good appearance. It is then flattened, and laid on the forehead. A line is drawn round the wax, and the operator then diſſects off as much ſkin as it covered, leaving undivided a ſmall ſlip between the eyes. This ſlip preſerves the circulation till an union has taken place between the new and old parts. The cicatrix of the ſtump of the noſe is next pared off, and immediately behind this raw part an inciſion is made through the ſkin, which paſſes around both *alæ*, and goes along the upper lip. The ſkin is now brought down from the forehead, and, being twiſted half round, its edge is inſerted into this inciſion, ſo that a noſe is formed with a double hold above, and with its *alæ* and *ſeptum* below fixed in the inciſion. A little *Terra Japonica* is ſoftened with water, and being ſpread on ſlips of cloth, five or ſix of theſe are placed over each other, to ſecure the joining. No other dreſſing but this cement is uſed for four days. It is then removed, and cloths dipped in ghee (a kind of butter) are applied. The connecting ſlips of ſkin are divided about the 25th day, when a little more diſſection is neceſſary to improve the appearance of the new noſe. For five or ſix days after the operation, the patient is made to lie on his back; and, on the tenth day, bits of ſoft cloth are put into the noſtrils, to keep them ſufficiently open. This operation is very generally ſucceſsful. The artificial noſe is ſecure, and looks nearly as well as the natural one; nor is the ſcar on the forehead very obſervable after a length of time. The picture from which this engraving is made was painted in January, 1794, ten months after the operation.

Fig. 1. the plate of wax when flattened.

Fig. 2. and 3. the plate of wax in the form of the noſe.

Fig. 4. 1. figure of the ſkin taken from the forehead; 2. and 3. form of the *alæ* of the new noſe; 4. *ſeptum* of the new noſe; 5. the ſlip left undivided; 6. 6. 6. the inciſion into which the edge of the ſkin is ingrafted.

Yours, &c. B. L.

Fig. 5.2 Text of the letter to Mr. Urban, Editor-in-Chief of the *Gentleman's Magazine.* (From: Gent's Mag 1794; 64: 891–892)

Fig. 5.3 Engraved illustration showing reconstruction of the nose using the forehead flap. At the bottom, the details of the procedure and the template used for evaluating the flap size. (From: Gent's Mag 1794; 64: 891–892)

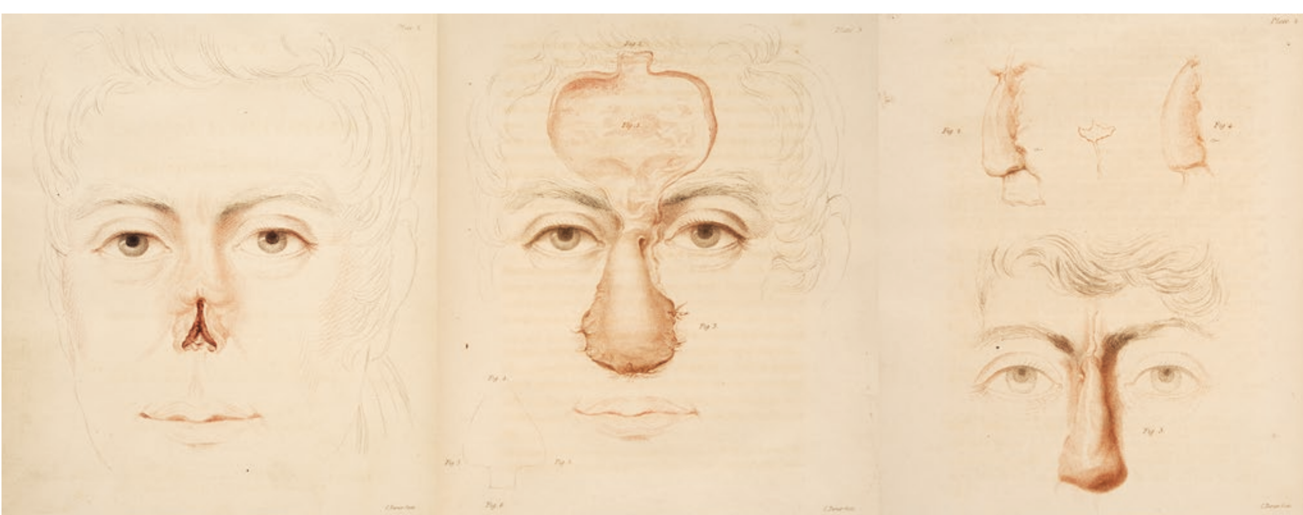
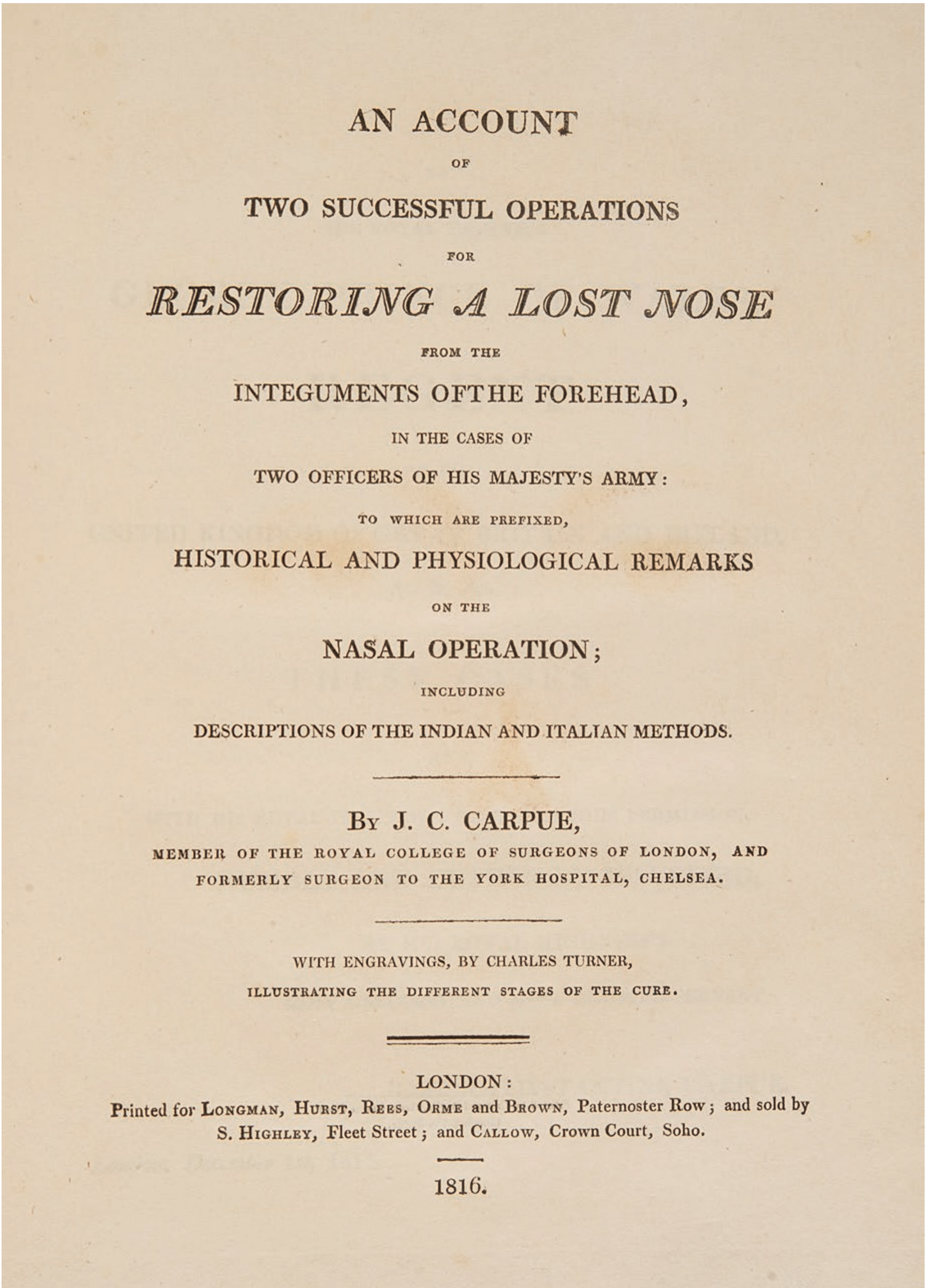


Fig. 5.4 Nasal reconstruction with forehead flap. *Left*: preoperative view of the patient. *Middle*: the forehead flap in position. *Right*: final result. (From: J.C. Carpue. *An Account of two successful Operations for Restoring a lost Nose from integuments of the forehead.* London, Cox and Baylis, et al., 1816)



AN ACCOUNT

OF

TWO SUCCESSFUL OPERATIONS

FOR

RESTORING A LOST NOSE

FROM THE

INTEGUMENTS OFTHE FOREHEAD,

IN THE CASES OF

TWO OFFICERS OF HIS MAJESTY'S ARMY:

TO WHICH ARE PREFIXED,

HISTORICAL AND PHYSIOLOGICAL REMARKS

ON THE

NASAL OPERATION;

INCLUDING

DESCRIPTIONS OF THE INDIAN AND ITALIAN METHODS.

BY J. C. CARPUE,

MEMBER OF THE ROYAL COLLEGE OF SURGEONS OF LONDON, AND
FORMERLY SURGEON TO THE YORK HOSPITAL, CHELSEA.

WITH ENGRAVINGS, BY CHARLES TURNER,

ILLUSTRATING THE DIFFERENT STAGES OF THE CURE.

LONDON:
Printed for LONGMAN, HURST, REES, ORME and BROWN, Paternoster Row; and sold by
S. HIGHLEY, Fleet Street; and CALLOW, Crown Court, Soho.

1816.

Fig. 5.5 Title page of J.C. Carpue (1764–1846) account on the forehead nasal reconstruction, the first published in the western world on this topic (1816)

5.2 The *Golden Age* of Plastic Surgery

Germany and France, with their outstanding surgeons, schools, and relevant scientific publications, share the supremacy of the rediscovered specialty during the nineteenth century, contributing to name this unique epoch the *golden age* of plastic surgery. We can affirm, without any doubt, that almost all the reconstructive procedures and the so-called new flaps, or new techniques, used in modern clinical practice were created, described, and systematized during this period.

Gnudi and Webster [6] affirmed that *to relate in detail the widening sweep of plastic surgery during the nineteenth century would require a volume in itself and is not properly contained in the scope of the present work*. Descriptions of operations, new procedures, variations of techniques, as well as reports of single cases filled not only the scientific journals of Germany, France, Italy, England, and the United States but also numerous treatises, demonstrating the achievements obtained by this promising branch of surgery. Extensive contributions on this subject also found a place in important surgical textbooks of the period.

In the foreword of his *Oeuvres completes d'Hippocrate* (Complete Works of Hippocrates), the French physician and philosopher **Émile Littré** (1801–1881) wrote the following phrase: *There is no development, even the most advanced of contemporary medicine, which is not found in embryo in the medicine of the past* [7].

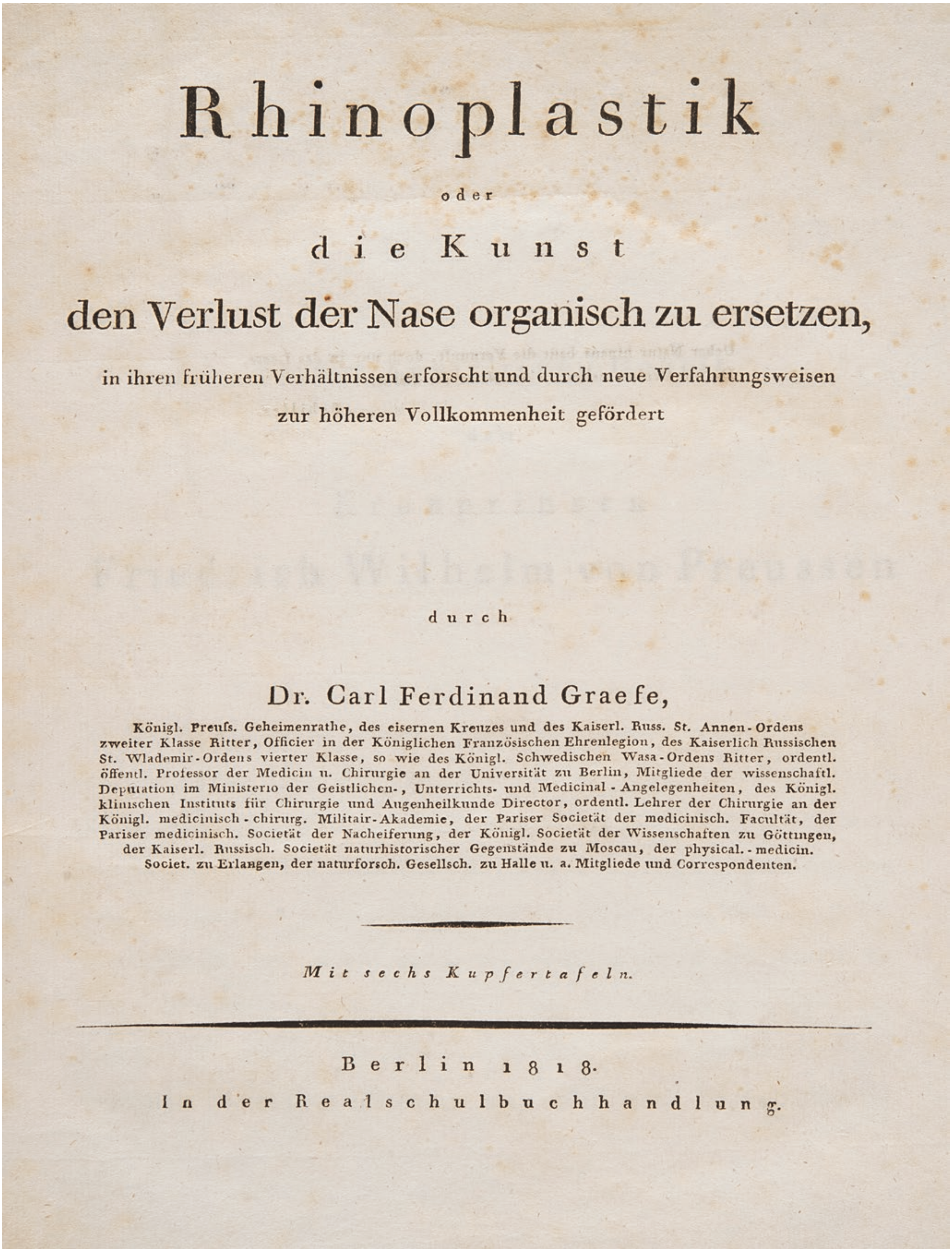
5.2.1 Germany

5.2.1.1 Carl Ferdinand von Gräfe

In 1818, **Carl Ferdinand von Gräfe** (1787–1840), Professor of Surgery at Berlin University, published *Rhinoplastik: oder die Kunst den Verlust der Nase organisch zu ersetzen* (Rhinoplasty: or the Art of replacing the Loss of the Nose organically) [8] (Fig. 5.6), dedicated to Friedrich Wilhelm III, King of Prussia. After discussing the origin and general principles of nasal reconstruction, he reported three successful cases. The first was a typical "Italian" method, the second a typical "Indian" forehead flap technique, and the third was a modified arm flap procedure. Alae, dorsum, and columella were prefabricated on the arm after a wax template and then immediately sutured to the nasal stump (Fig. 5.7). The advantage was a shorter immobilization period. He named this variation the *German method*. Finally, he compared the results obtained by the Italian (Fig. 5.8 *upper left* and *right*) and Indian procedures (Fig. 5.8 *lower left* and *right*). He favored the upper arm flap technique because he was unhappy with the donor site scar morbidity on the forehead [6]. *Rhinoplastik*, translated into Latin the same year [9], *stands as the first great treatise on plastic surgery after Tagliacozzi and Carpue* [6]. In 1821, von Gräfe published a report on the successful repair of full-thickness facial defect involving the cheek, lower eyelid, and upper third of the nose, by transposition of the Indian forehead flap [10] (Fig. 5.9).

Von Gräfe, regarded by Gnudi and Webster and by Garrison as the founder of modern plastic surgery [6, 11], was born in Warsaw in 1787 into a noble family. He studied medicine in Dresden, Halle, and Leipzig, from where he graduated in 1807 at the age of 20 by defending a thesis on lip hemangiomas, *De Notione et cura angiectaseos Labiorum* (On the Knowledge and treatment of Lip hemangiomas), where he described the characteristics of a lower lip nevus and its excision and diagnosis as a vascular tumor [12]. In 1810, at the age of 23, he was appointed Professor of Surgery and Director of the Surgical Ophthalmological Clinic at the newly established Berlin University, founded in the same year. In 1813, he attended the Leipzig battle (*The Battle of the Nations*) against Napoleon, as the Surgeon General to the troops of the Prussian army. When the war was over, he resumed his professorship at the surgical clinic of Berlin University. Von Gräfe showed great interest in reconstructive procedures, when surgery was mainly confined to limb amputations. In 1814, at the age of 27, he visited Paris where he was awarded the Legion of Honor and met famous surgeons. In 1816, he reported the first cleft palate closure, sharing with **Philibert Roux** the priority of the procedure (see Sect. 9.2.2.2), and in 1818 he published the first account of nasal reconstruction (*Rhinoplastik*) in the German literature. He was one of the most prominent and successful surgeons of the period, consulted by famous patients and royal families all over Europe. He died in Hannover in 1840, aged 53, having acquired a great fortune in his practice. A detailed biography of von Gräfe was written by Blair O. Rogers in 1977 [13].

Carpue and von Gräfe, with their cornerstone works, significantly contributed to the resurrection and spread of plastic surgery. A flood of followers subsequently published a series of papers and books on nasal reconstruction and facial repair in general, not only in Europe, but also in the United States—witness to the new interest in reconstructive plastic surgery [6].



Rhinoplastik

oder

die Kunst

den Verlust der Nase organisch zu ersetzen,

in ihren früheren Verhältnissen erforscht und durch neue Verfahrungsweisen
zur höheren Vollkommenheit gefördert

durch

Dr. Carl Ferdinand Graefe,

Königl. Preufs. Geheimenrathe, des eisernen Kreuzes und des Kaiserl. Russ. St. Annen-Ordens zweiter Klasse Ritter, Officier in der Königlichen Französischen Ehrenlegion, des Kaiserlich Russischen St. Wlademir-Ordens vierter Klasse, so wie des Königl. Schwedischen Wasa-Ordens Ritter, ordentl. öffentl. Professor der Medicin u. Chirurgie an der Universität zu Berlin, Mitgliede der wissenschaftl. Deputation im Ministerio der Geistlichen-, Unterrichts- und Medicinal-Angelegenheiten, des Königl. klinischen Instituts für Chirurgie und Augenheilkunde Director, ordentl. Lehrer der Chirurgie an der Königl. medicinisch-chirurg. Militair-Akademie, der Pariser Societät der medicinisch. Facultät, der Pariser medicinisch. Societät der Nacheiferung, der Königl. Societät der Wissenschaften zu Göttingen, der Kaiserl. Russisch. Societät naturhistorischer Gegenstände zu Moscau, der physical.-medicin. Societ. zu Erlangen, der naturforsch. Gesellsch. zu Halle u. a. Mitgliede und Correspondenten.

Mit sechs Kupfertafeln.

Berlin 1818.

In der Realschulbuchhandlung.

Fig. 5.6 Title page of *Rhinoplastik* by CF. von Gräfe (1787–1840), the first account on the nasal reconstruction, published in Germany on this topic (1818)

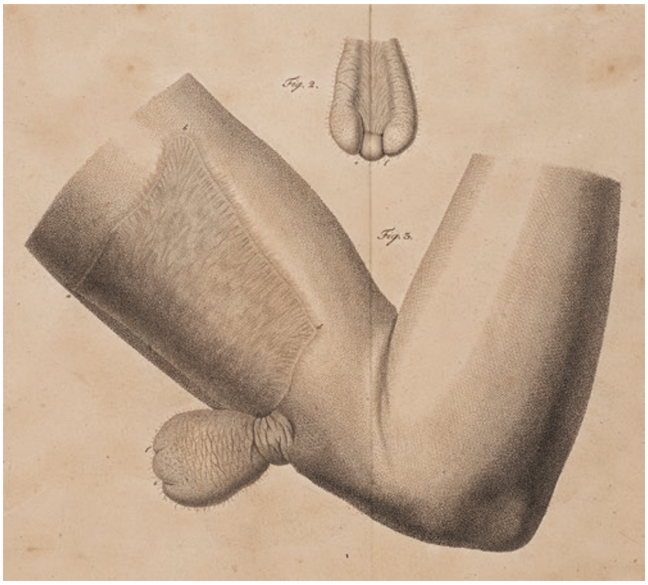


Fig. 5.7 The German method of nasal reconstruction. Prefabrication of dorsum, alae, and columella on the arm, before transferring the whole unit to the remaining nasal stump. (From: CF. von Gräfe. *Rhinoplastik*. Berlin, Realschulbuchandlung, 1818)

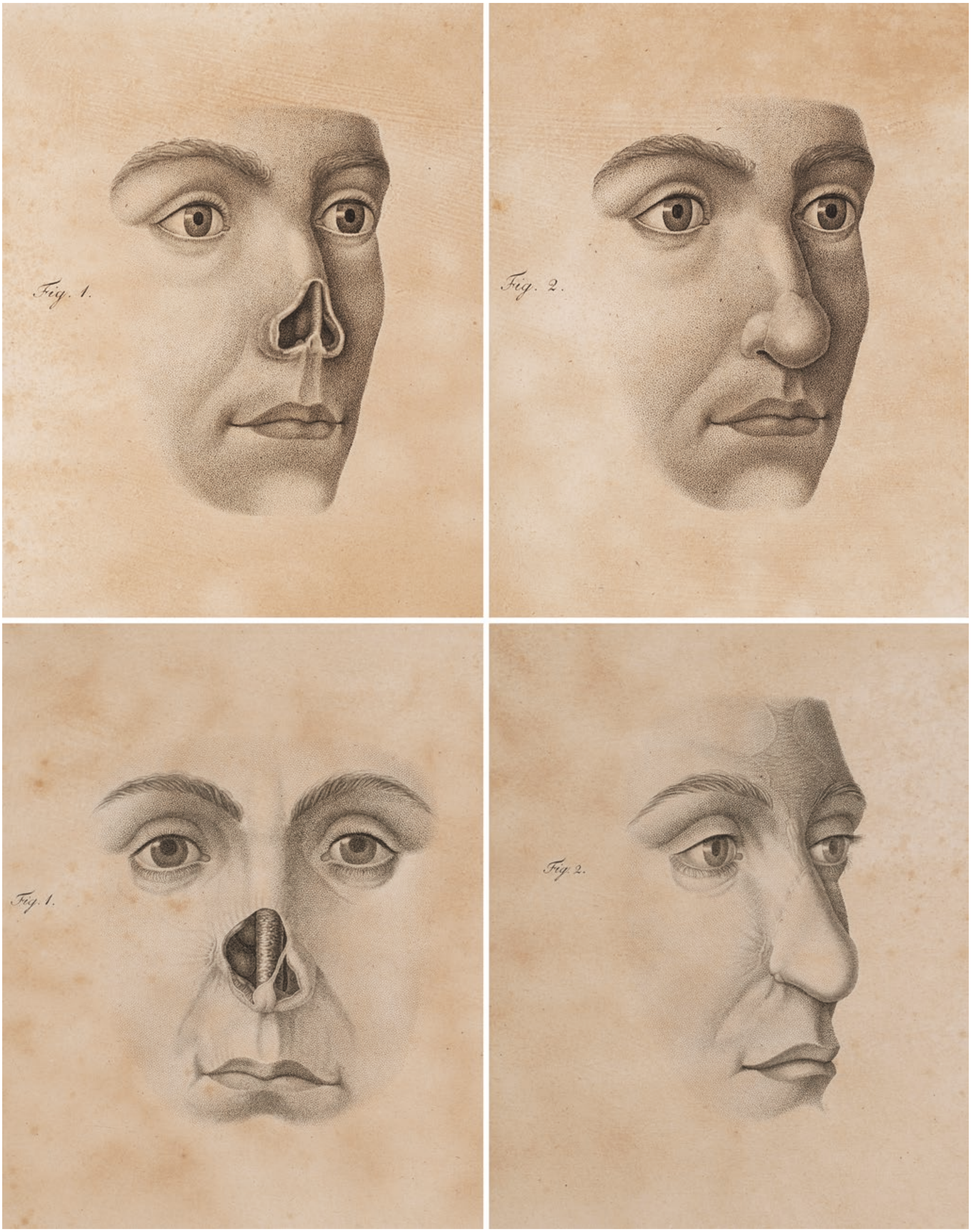


Fig. 5.8 Comparison of Italian and Indian methods for nasal reconstruction. *Upper left*: Preoperative nasal defect. *Upper right*: Postoperative view of the reconstruction with the arm flap procedure. *Lower left*: Preoperative nasal defect. *Lower right*: Postoperative view of nasal reconstruction with forehead flap. The forehead scar is noticeable. (From: CF. von Gräfe. *Rhinoplastik*. Berlin, Realschulbuchandlung, 1818)

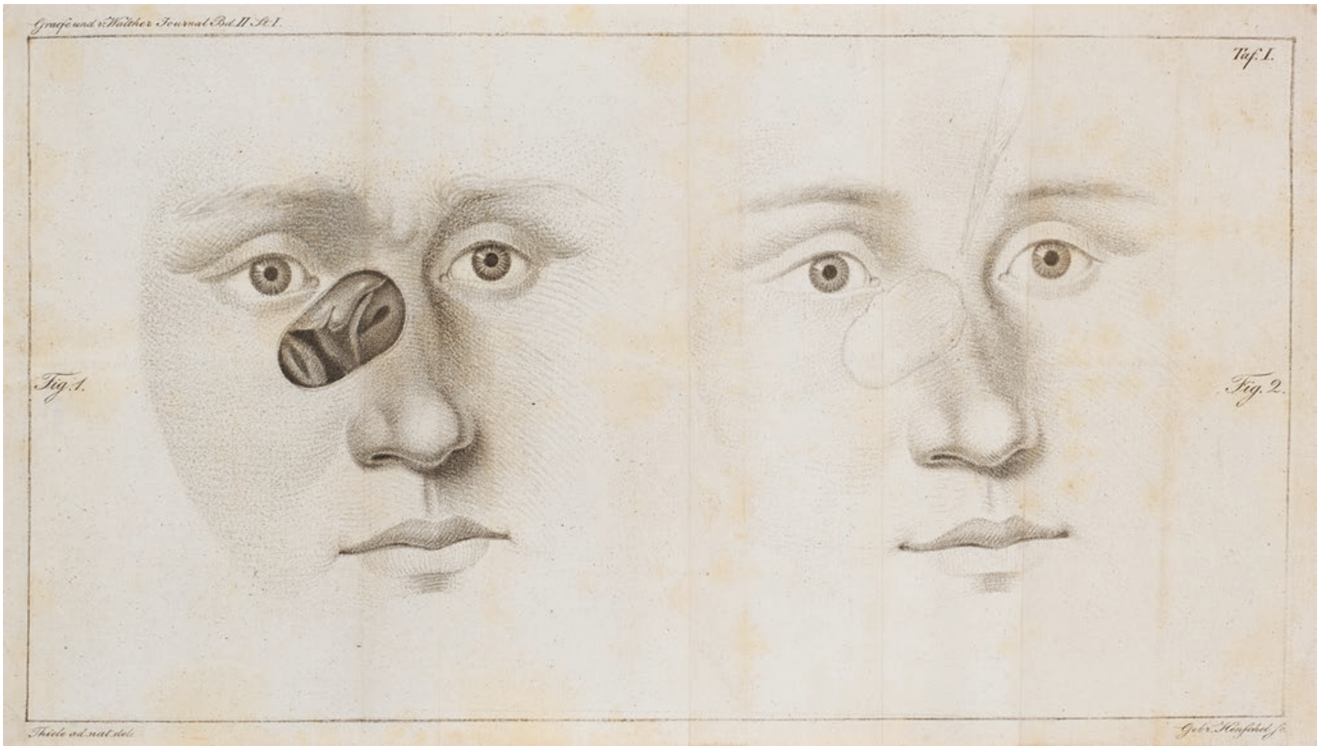


Fig. 5.9 *Left*: Full-thickness facial defect involving cheek, lower eyelid, upper third of the nose. *Right*: repair by transposition of the Indian forehead flap. (From: CF. von Gräfe. *Neue Beiträge zur Kunst, Theile des Angesichts organisch zu ersetzen*. Journ Chir Augenheilk. 1821; 2: 1–35)

5.2.1.2 Johann Friedrich Dieffenbach

A further important step in the development of the discipline came from the contribution of a surgeon of outstanding talent, **Johann Friedrich Dieffenbach** (1794–1847) (Fig. 5.10).

Born in Königsberg in 1794, Dieffenbach studied medicine initially in Königsberg and then in Bonn, becoming a student of **Philipp von Walther** (1782–1849), Professor of Surgery. To improve his surgical knowledge, in 1821, he went to Paris, where he visited Boyer, Larrey, Magendie, and Dupuytren, and to Montpellier, where he spent a few months with Jacques Delpech, orthopedist and reconstructive surgeon. In 1822, he returned to Germany and graduated from Würzburg defending a thesis *Nonnulla de Regeneratione et Transplantatione* (On Tissue Regeneration and Transplantation) [14], in which he tried to experimentally demonstrate the possibility of transplantation and regeneration of hairs and feathers. In 1823, after graduation, he settled in Berlin and dedicated himself to surgery, particularly to reconstructive problems. He treated cleft lip, cleft palate, ectropion by applying a sort of V-Y technique, auricle and nasal defects, congenital malformations, torticollis and clubfoot with myotomy and tenotomy, hypospadias, eyelid tumors, cheek defects, and lip carcinomas with immediate closure of the defect. He also performed the genioglossus, styloglossus, and hyoglossus myotomy from the tongue basis for correction of stuttering [15].

Dieffenbach was a prolific writer, publishing numerous papers and two books: *Chirurgische Erfahrungen* (Surgical Experiences) (1829–1834) [16] and *Die operative Chirurgie* (Operative Surgery) (1845–1848) [17]. He won recognition as a leading plastic surgeon with a great reputation, treating patients regarded as incurable from the whole of Germany and from abroad. He contributed to the revival of interest in reconstructive procedures, in contrast to the general trend of the period, mainly oriented toward performing tissue excision. He was particularly interested in nasal surgery, at which he was very skilled, always seeking excellence. He favored the forehead reconstruction which he regarded as a better choice for tissue texture and color match. He fostered the fourth edition of *De Curtorum Chirurgia* by Tagliacozzi issued in 1831 in Berlin, dedicated to him by his co-worker **Maximilian Tröschel** [18] (see Sect. 3.3.5.2 and Fig. 3.65d). In 1829, he became Chief Surgeon at *La Charité* and, in 1832, Professor of Surgery at Berlin University, and in 1840, at Carl Ferdinand von Gräfe's death, he replaced him as the director of the surgical clinic at *La Charité*. He died suddenly at work in 1847, aged 54. Comprehensive biographies about Dieffenbach were published by Goldwyn [19], Zeis [20], and Gnudi and Webster [6].

Chirurgische Erfahrungen (Surgical Experience), about reconstruction of destroyed parts of the human body using new methods, showed Dieffenbach's interest in plastic surgery [16]. Part One begins with a 40-page account of nasal reconstruction. After a historical review of the operation, Dieffenbach describes reconstruction of the nose using either the forehead or the arm flap. It is followed by lip restoration with a mucosal flap and repair of defects of the velum and urethra. Part Two opens with new cases of nasal reconstruction, mainly with forehead flap, illustrated by 21 lithographic plates published in a separate atlas (Fig. 5.11). He then discusses auricle reconstruction, repair of the lacrimal duct, correction of ectropion with transplantation of the conjunctiva, resurfacing of the exposed testes using scrotal skin, and repair of leg ulcers. Part Three begins with new cases of nasal reconstruction, illustrated by three profile pre- and postoperative views of patients. It follows the treatment of retracting scar tissue as a result of burns and defects around the mouth for noma, repaired by local flaps. The lithographic plate depicts the pre- and postoperative image of the patient (Fig. 5.12). Part Four is devoted to the closure of cleft palate.

Die Operative Chirurgie (Operative Surgery) [17] is a two-volume textbook that, besides reconstruction, deals with almost every type of surgical operation known at that time, including amputation, paracentesis, laparotomy, hydrocephalus, anal fistula, and phimosis. However, emphasis is given to plastic surgical operations (Volume One, p. 312) and in particular to nasal reconstruction with forehead or arm flap. In Volume One, Dieffenbach describes otoplasty (p. 395), cheiloplasty (p. 398), cleft lip (p. 400), genioplasty (p. 429), cleft palate (p. 437), and blepharoplasty (p. 469). Volume Two, issued posthumously, reports on correction of clubfoot, torticollis, hydrocephalus, and genital surgery. Dieffenbach is credited with performing the first nasal aesthetic procedure for improving a drooping tip by two symmetrical dorsal skin excisions (Volume One, p. 371) (see Sect. 7.2.1). He was among the first to close the cleft of the hard palate by gradual bone approximation using a silver thread passed through the bone (see section on "Johannes Dieffenbach"). *Die Operative Chirurgie* was issued without illustrations. The colored atlas, *Die Plastische Chirurgie* (Plastic Surgery) by **H.E. Fritze** and **O.F. Reich** (see later in this chapter) published in the same year, 1845, is regarded as the illustrated atlas for the text.

Fig. 5.10 Portrait of Johann Friedrich Dieffenbach (1794–1847). Lithographic plate. Vienna, Kniehuber, 1840

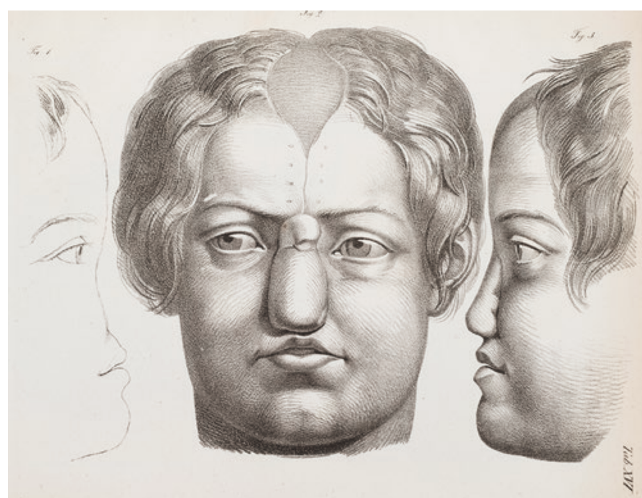


Fig. 5.11 Preoperative and postoperative views of a nasal reconstruction with forehead flap. (From: JF Dieffenbach. *XXI Lithographirte Tafeln zu Dr. Dieffenbach's chirurgischen Erfahrungen*. Berlin, Enslin, 1830)

Fig. 5.12 (*Left*) Preoperative and (*right*) postoperative views of a 7-year-old boy cheek defect for noma, closed by local flaps. (From: JF Dieffenbach. *Chirurgische Erfahrungen.* Part 3. Berlin, Th, Chr. Fr. Enslin, 1834)

5.2.1.3 Eduard Zeis

In 1838, **Eduard Zeis** (1807–1868) published *Handbuch der Plastischen Chirurgie* (Manual of Plastic Surgery) [21], with a stimulating foreword by Dieffenbach that concluded: *May this work be transmitted to posterity, like that of Caspar Taliacotius!* For the use of the term *Plastik*, Zeis gave credit to von Gräfe, who first coined the term *Rhinoplastik*. Zeis chose *Plastischen Chirurgie* as the most comprehensive term, clearly understood by everybody, capable of covering the whole subject. He emphasized that: *Plastic surgery can restore defects of the missing parts, always with skin* (note: at that time skin was the only available autologous tissue). However, *Plastic surgery cannot build an organ*, like an arm or a leg. In general, the typical plastic operation was skin transplantation. *Handbuch der Plastischen Chirurgie* should be regarded as the first comprehensive textbook devoted entirely to plastic surgery. It started with a detailed review of the literature and continued with the history of the discipline, the adopted methods, and their indications. The second part of the volume described special operations, rhinoplasty, blepharoplasty, cheiloplasty, stomatoplasty, genioplasty, otoplasty, and cleft palate suturing, and contained numerous case reports. For the treatment of palmaris fascia contraction (paragraphs 509–515), an operation that was developed by **Guillaume Dupuytren** (1777–1835), Zeis affirmed that the same procedure was also successfully performed by Dieffenbach. *Plastischen Chirurgie* included some text woodcuts and two colored engraved plates of forehead flap for nasal reconstruction. The first one showed the favorable outcome at Day 1 and 2 while the second an unfavorable result at Day 2 and later, with increasing black color, most likely due to the kinking of the vascular pedicle—the first illustration of a failure in the literature (Fig. 5.13).

A few years later, in 1863, Zeis published *Die Literatur und Geschichte der Plastischen Chirurgie* (On the Bibliography and History of Plastic Surgery) and *Nachträge* (Addendum), an impressive bibliographical work, where he assembled all the references related to plastic surgery from the very beginnings up to 1863 and tracing the history of the specialty at the same time [20]. He divided the literature by time period by subject, adding a brief commentary about the role and importance of the major works on plastic surgery, including some essential notes to each reference.

Born in Dresden in 1807, Zeis studied medicine in Leipzig and then in Bonn, where he became a student of **Professor Philipp von Walther** (1782–1849). When von Walther moved to Munich, he followed him, as an assistant. In 1830, he returned to Leipzig from where he graduated in 1832. He established himself in Dresden where he became a disciple of **Friedrich August von Ammon** (1799–1861) and started his surgical practice. In 1850, he was appointed the Head of Surgery of the City Hospital. He died in Dresden in 1868, aged 61, from complications as a result of an operation for a hernia. He was a prolific writer and apart from *Handbuch der Plastischen Chirurgie*, he published on cheiloplasty, femoral neck fractures, and hospital gangrene.

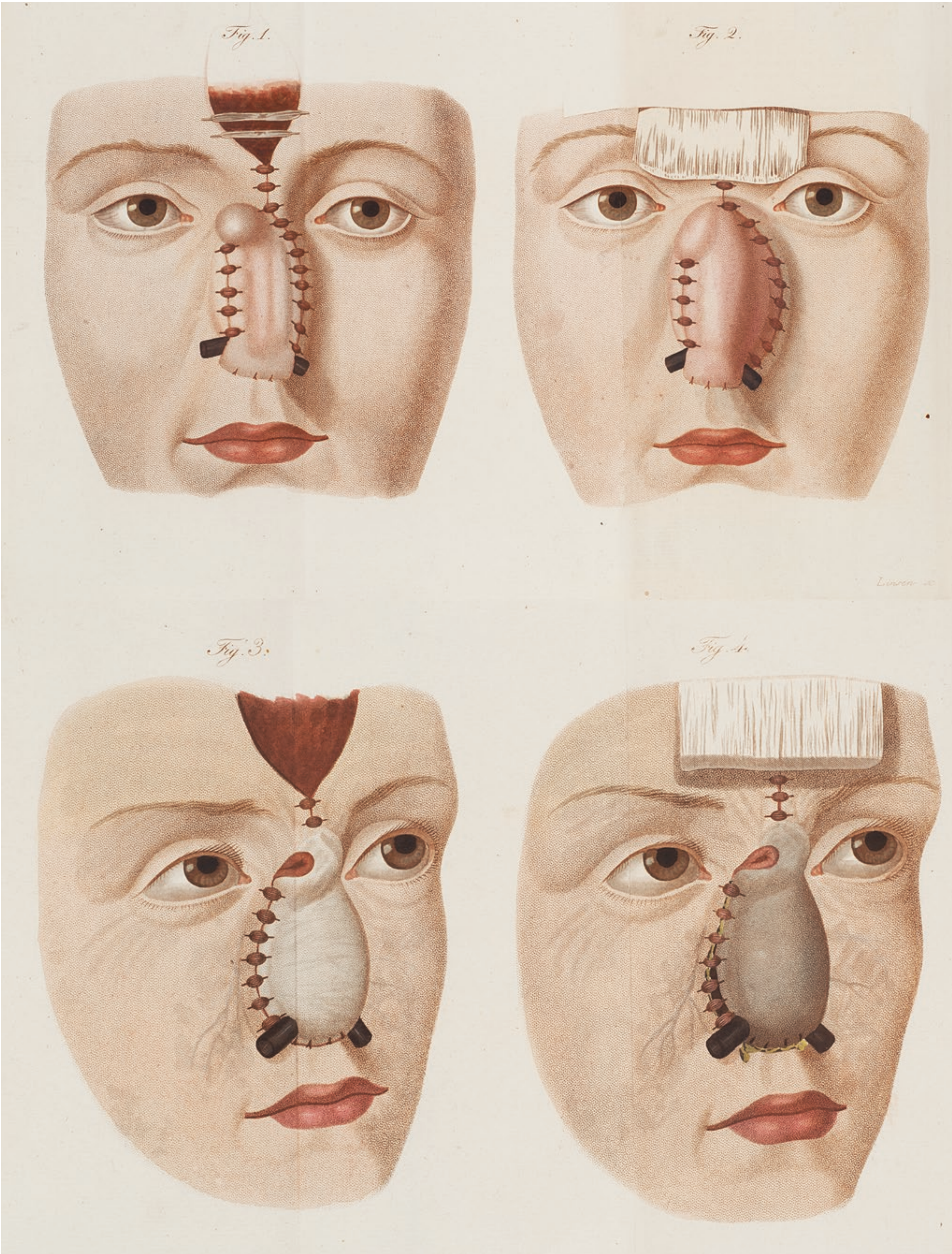


Fig. 5.13 Forehead flap for nasal reconstruction. *Upper*: Successful outcome at Day 1 and 2. *Lower*: Unfavorable result at Day 2 and later, with an increasing black color of the flap. First illustration of a failure in the literature. (From: E. Zeis. *Handbuch der plastischen Chirurgie*. Berlin, G. Reimer, 1838)

5.2.1.4 Friedrich August von Ammon

In 1839, an important event occurred contributing to the diffusion of the specialty. The *Gent Medical Society* established a prize for the best work on *Autoplasty* with the aim to *Décrire tout ce qui est relatif à l'Autoplastique* (Describe all that is related to Autoplasty). **Friedrich August von Ammon** with the cooperation of **Fr. O. Moritz Baumgarten** (1813–1849), a physician and ophthalmologist, working in Dresden, submitted the manuscript *Die Plastische Chirurgie nach ihren bisherigen Leistungen kritisch dargesstellt* (Plastic Surgery, critically examined as to its previous achievements), preceded by the motto *La Chirurgie plastique peut devenir la fleur de toute la médecine opératoire* (Plastic surgery may become the flower of all medical surgery). It won the award as the best work [22]. This prize-winning text, published in 1842 and dedicated to the *Gent Medical Society*, followed immediately Zeis' *Handbuch der Plastischen Chirurgie* in terms of priority. It is divided into two parts. <u>Part One</u> includes the history of the discipline with a comprehensive bibliography, the indications and contraindications, the operative methods, and details about the outlining of a skin flap. <u>Part Two</u> deals with the applications of the abovementioned procedures to rhinoplasty, cheiloplasty, blepharoplasty, canthoplasty, cheek repair, otoplasty, male genital organ, female perineum, and fistulae closure. *Die Plastische Chirurgie* was translated into French and Italian.

Born in Göttingen, **von Ammon** studied medicine in Göttingen and Leipzig. Once graduated in 1823, he established himself in Dresden. In 1828, he was appointed a Professor of the Surgical-Medical Academy of Dresden and, in 1837, personal physician to Friedrich August II, King of Saxony. He wrote numerous scientific works on ophthalmology and an amazing, large *Folio* atlas, *Die angeborenen chirurgischen Krankheiten des Menschen* (On the surgical human congenital malformations of Man) with 34 engraved plates, one of them in color, showing congenital malformations, potentially suitable of surgical correction, such as cleft lip, cleft palate, hypospadias, epispadias, clubfoot, spina bifida, and blepharofimosis [23]. Von Ammon died in Dresden in 1861, aged 62.

5.2.1.5 Hermann Eduard Fritze and Otto Friedrich G. Reich

Two of Dieffenbach's students, **Hermann Eduard Fritze** (1811–1866) and **Otto Friedrich G**. **Reich** (1807–?), who had the opportunity of assisting personally at the operations performed by the *Maestro*, reproduced the intraoperative images of some of the most common plastic surgical procedures known at that time. In 1845, they issued *Die Plastische Chirurgie in ihrem weitesten Umfange dargestellt und durch Abbildungen erläutert* (Plastic Surgery in its broad sense, represented and explained with illustrations) [24]. In the foreword, Otto Reich suggested that the work, dedicated to Dieffenbach, should be regarded as the atlas of Dieffenbach's *Die Operative Chirurgie*, published the same year, without illustrations. With its 48 plates, almost all in color, *Die Plastische Chirurgie* stands among the best textbooks of general plastic surgery of the nineteenth century. Plates 1–16 are dedicated to the nose and to the different types of facial defects repaired by local (Fig. 5.14) or distant flaps. Plates 17–26 concern the tissue loss of eyelids and the orbital region, restored using different methods, among them the temporal flap, first described by **Fricke** in 1829 [25] (Fig. 5.15), and illustrating the instruments necessary to repair them. Plates 27–40 deal with the lip, mouth, oral cavity (Fig. 5.16), and palate and again show the instruments necessary to perform these procedures. Plate 41 regards otoplasty, with auricle reconstruction. Plates 42–44 illustrate male genital anomalies, phimosis and hypospadias, and fistulae repair (Fig. 5.17). Plates 45 and 46 are related to the surgical diseases of the female perineum and show the instruments necessary for closing bladder fistulae. Finally, the last two plates, 47 and 48, were newly added by the authors at the conclusion of their work. They depict correction of syndactyly, ankyloblepharon, and alar nose repair.

Hermann Fritze studied medicine in Berlin, where he graduated in 1835. He practiced in Berlin and worked in Dieffenbach's clinic. **Otto Reich**, born in Berlin in 1807, studied medicine in Berlin and graduated in 1833.

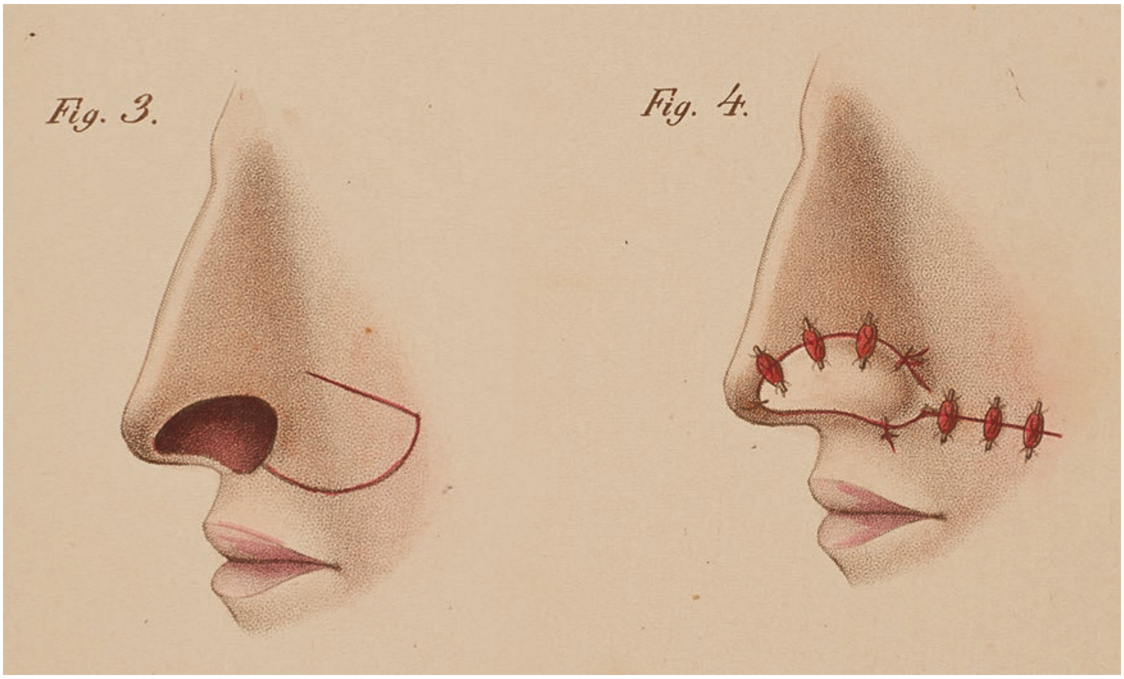


Fig. 5.14 Defect of the ala of the nose. *Left*: outline of a cheek-lip flap. *Right*: the flap transposed and sutured into position. (From: Fritze HE., Reich OFG. *Die plastische Chirurgie*. Berlin, A. Hirschwald, 1845)

Fig. 5.15 Upper eyelid and lower eyelid defect, repaired according to J.K. Fricke, 1829. *Left*: Upper eyelid defect: preoperative view; transposition of an inferiorly based temporal flap. *Right*: Lower eyelid defect: outlining of a superiorly based temporal flap for covering the defect; the flap transposed and sutured into position. (From: Fritze HE., Reich OFG. *Die plastische Chirurgie*. Berlin, A. Hirschwald, 1845)

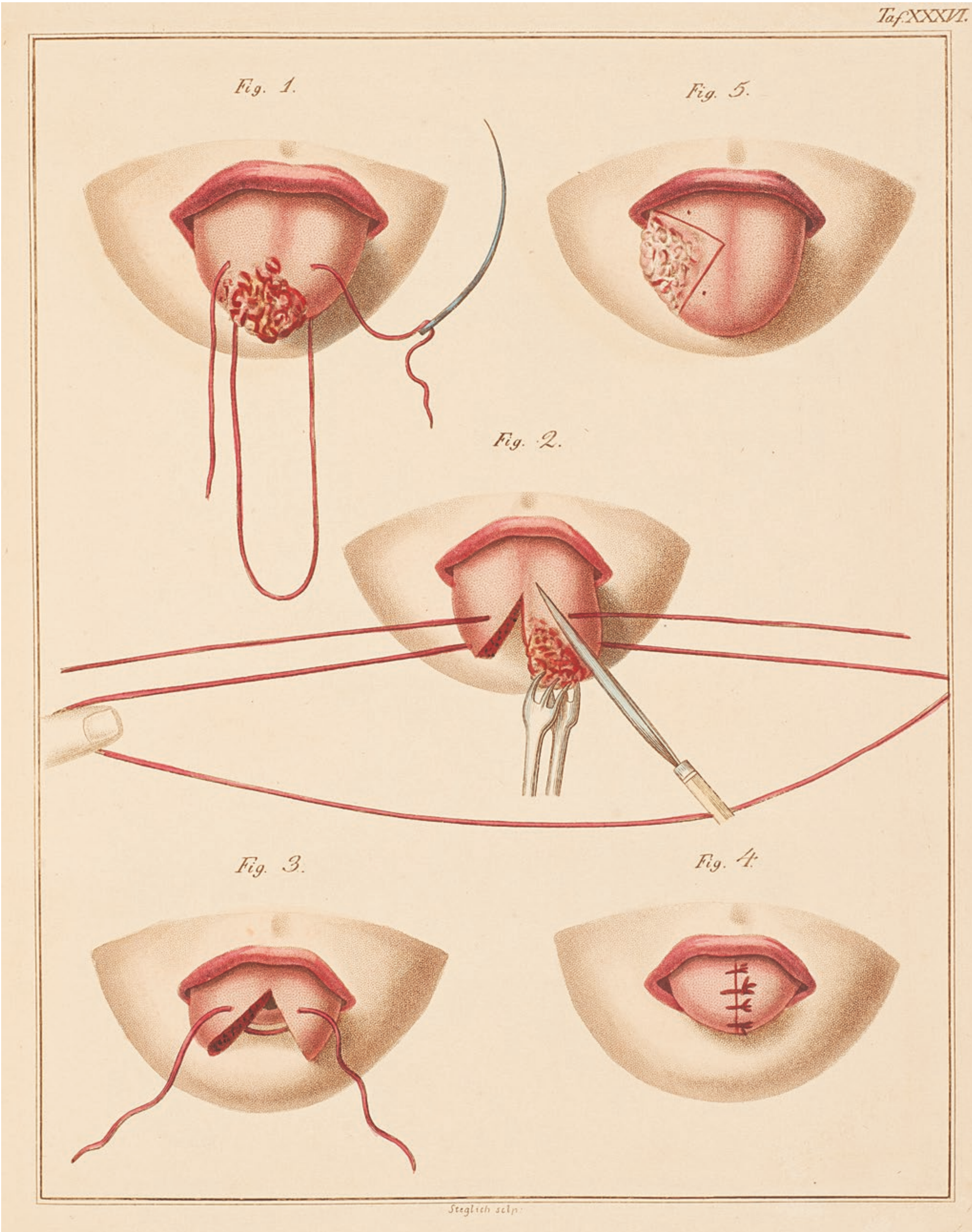


Fig. 5.16 Tumor of the tongue. *Top*, excision of the tumor; *center*, the ensuing defect; *bottom*, final result. (From: Fritze HE., Reich OFG. *Die plastische Chirurgie*. Berlin, A. Hirschwald, 1845)

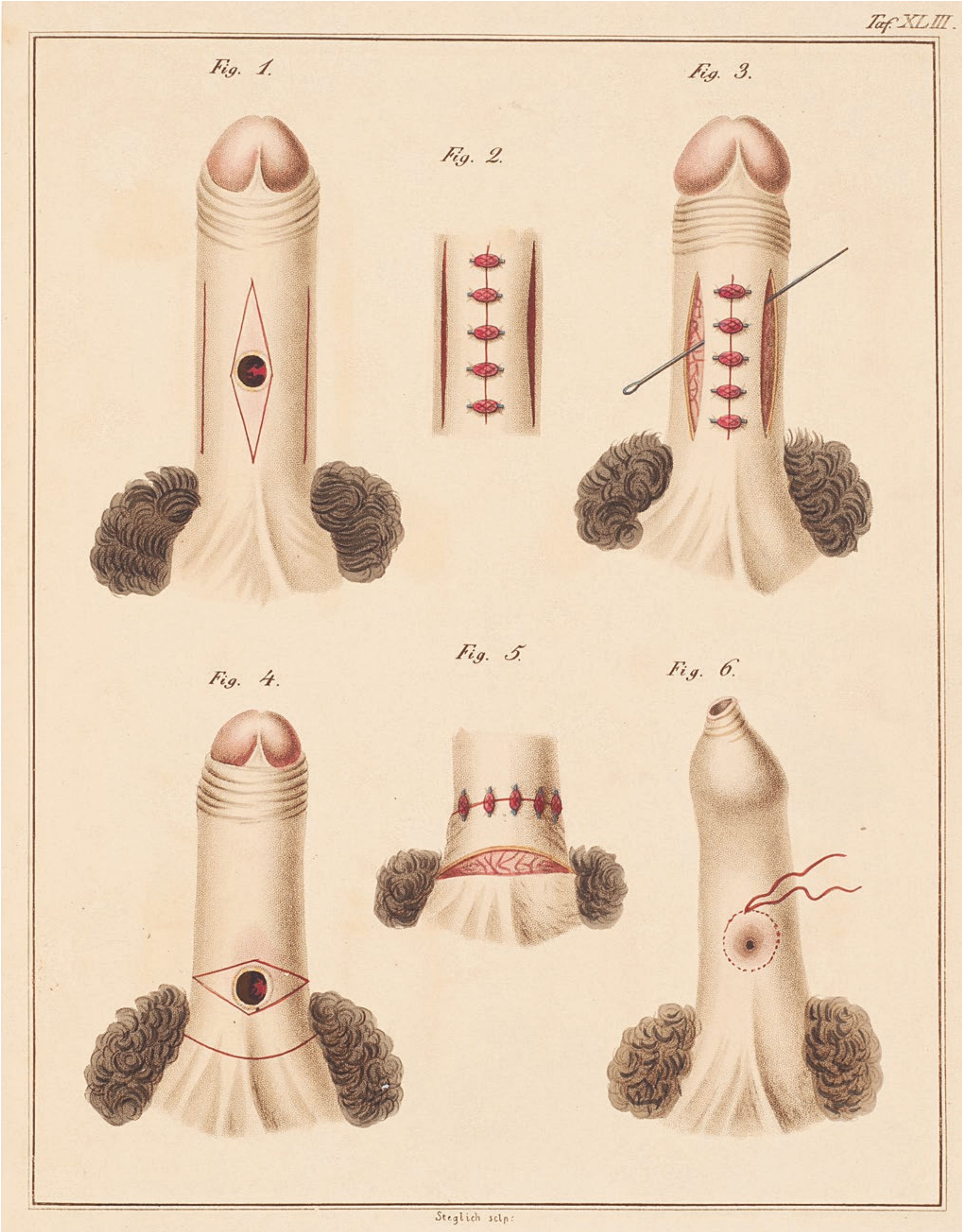


Fig. 5.17 Sequela of hypospadias. Midline fistula closure. *Top left*: Outline of the bipedicled flaps for fistula closure. *Top right*: The bipedicled flaps are undermined and sutured into position. *Lower left*: Outline of the bipedicled flap. *Lower center:* Final result. (From: Fritze HE., Reich OFG. *Die plastische Chirurgie*. Berlin, A. Hirschwald, 1845)

5.2.1.6 Ernst C. Friedrich Blasius

One of the most talented personalities of the period was **Ernst C. Friedrich Blasius** (1802–1875), a disciple of **von Gräfe**. He studied medicine in Berlin, where he graduated in 1823, becoming an army surgeon. In 1831, he was appointed Professor of Surgery and Director of the Surgical-Ophthalmological Clinic at Halle University. He showed great interest in plastic reconstructive surgical procedures, blepharoplasty in particular, and published numerous important works. Among them was *Akiurgischen Abbildungen oder der Darstellung der blutigen chirurgischen Operationen* (Illustrations of blunt Operations or Description of bloody surgical Procedures) [26], a 60-engraved plate, large-*folio,* surgical atlas with more than 3200 illustrations of operative procedures. It was a monumental, iconographic work, first issued in 1833 and reissued, expanded, in 1844 and accompanied by a textbook *Erklärung der Akiurgischen Abbildungen* (Explanation of the illustrations of blunt Operations) [27]. In 1848, he published *Beiträge zur praktischen Chirurgie. Nebst einem Bericht über die chirurgisch-augenārztliche Klinik der Königlichen Universitāt zu Halle* (Contributions to practical Surgery, with a report on the surgical-ophthalmological Clinic of the Royal University of Halle) [28], with a large section on plastic surgery, p. 132–251. He retired in 1867, and **Richard von Volkmann** (1830–1889) replaced him in his position. He died in 1875, aged 73.

Beiträge zur praktischen Chirurgie begins with a short survey on the different reconstructive methods (p. 132). It is followed by the description of reconstructive rhinoplasty (p. 155), reconstruction of the ala (p. 172) (Fig. 5.18), cheiloplasty (p. 185), repair of the cheek (p. 197), blepharoplasty (p. 210), and finally management of scar contractures (p. 237) (Fig. 5.19). He improved the forehead nasal flap considerably by providing the lining for the reconstruction of the alar contour. On page 164, he supplied a detailed description of the two-stage procedure [28, 29] (Fig. 5.20). The nose was prefabricated on the forehead according to the following scheme: *After having incised the contour of the oval skin flap, except for the points a-b, c-d, e-f, and g-h, along with the edges of the parts that will serve for the septum, one makes two incisions a-i and b-k. The parts a-i-c and b-k-e are reflected inwards and fixed with a suture into position, as shown by the dotted lines c-i-m and e-k-m. When the folded flap has completely taken on the back of the skin that has to be transposed, the flap is raised from the forehead by undermining the lines a-b, c-d, and e-f and moved down as far as the points where it has to be fixed*. In this way, the end result was a well-formed nose, provided with lining and nostrils, covered by skin without the presence of any sort of scar tissue.

Fig. 5.18 Reconstruction of the ala with the advancement of a cheek-lip flap. (From: Blasius ECF. *Beiträge zur praktischen Chirurgie.* Berlin, A. Förstner, 1848)

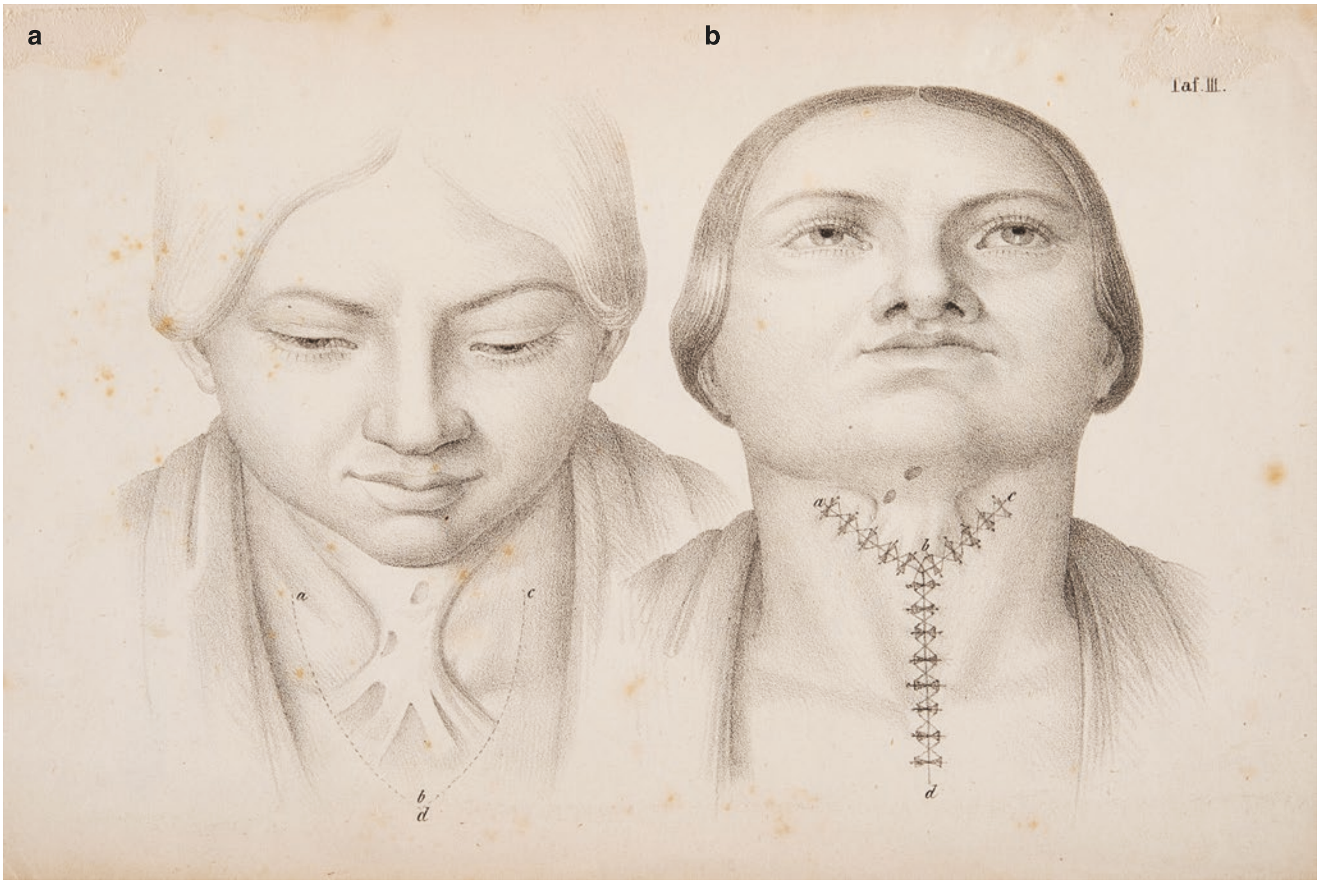


Fig. 5.19 (**a**, **b**) Severe neck retraction sequela of "radesyge" ulceration (a variety of leprosy). *Left*, preoperative situation with neck retraction; *right*, correction by V-Y plasty, with the neck fully extended. (From: Blasius ECF. *Beiträge zur praktischen Chirurgie.* Berlin, A. Förstner, 1848)

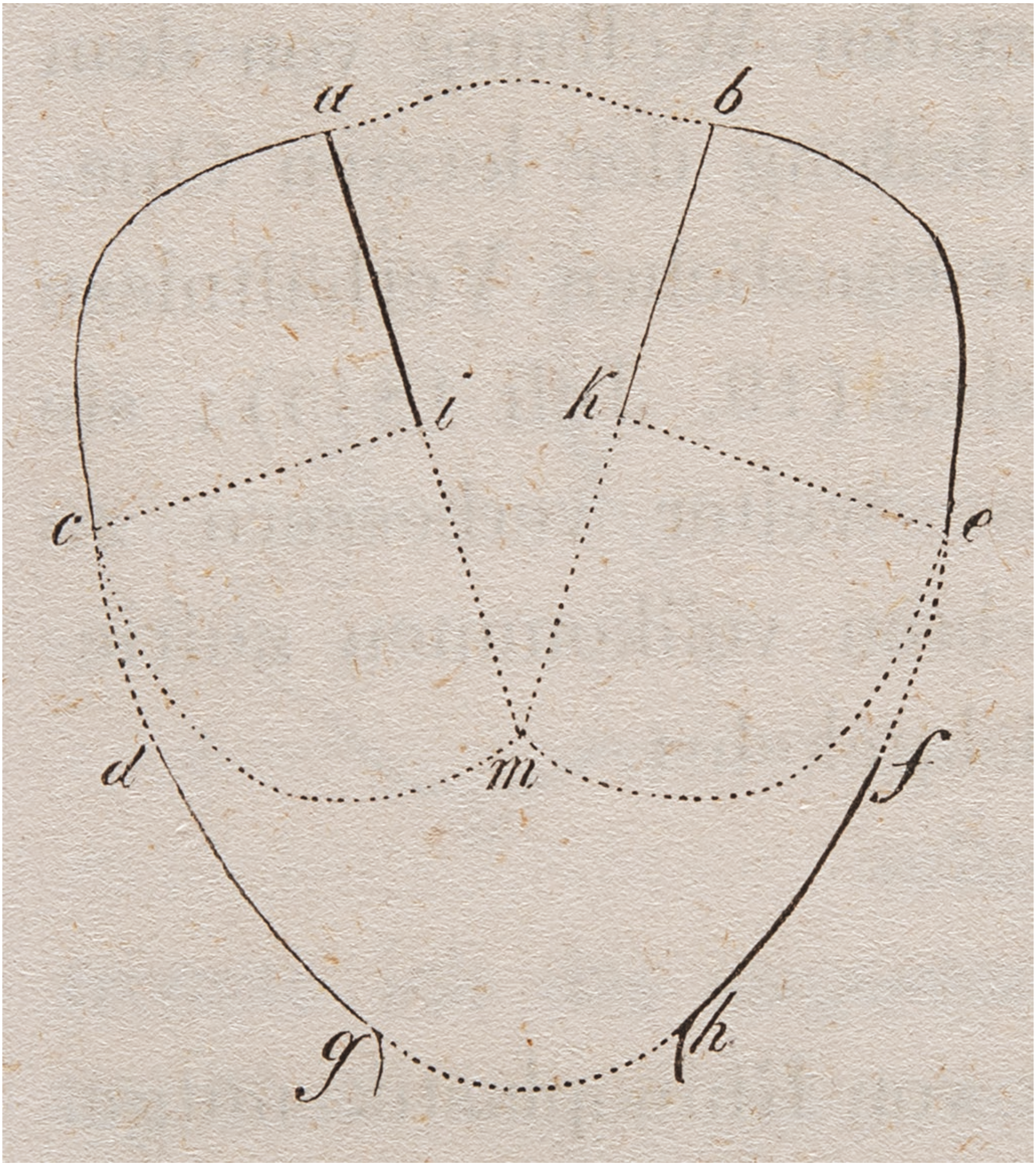


Fig. 5.20 Template for preparing a well-formed nose, provided with nostrils and lining, on the forehead. (From: Blasius ECF. *Beiträge zur praktischen Chirurgie.* Berlin, A. Förstner, 1848)

5.2.1.7 Hermann Friedberg

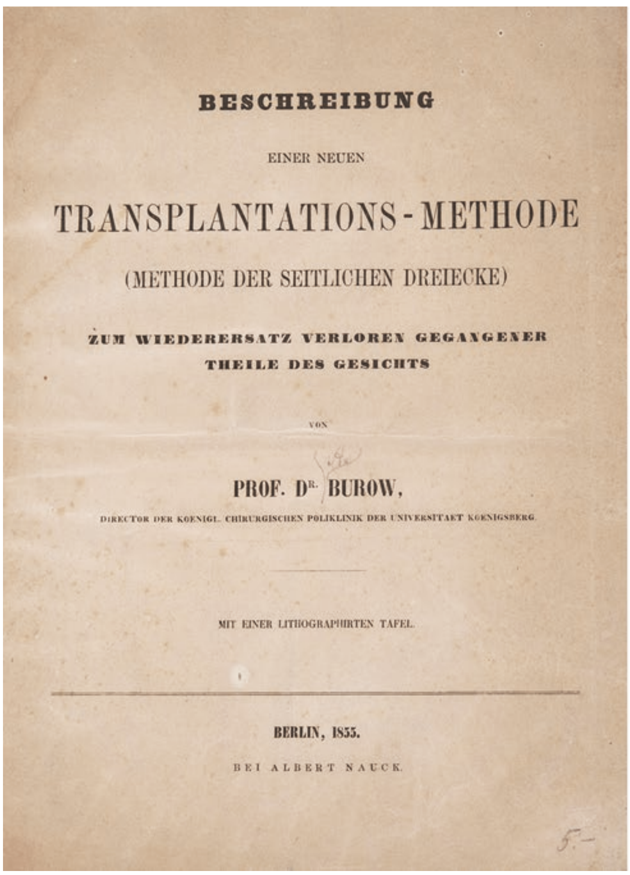
Hermann Friedberg (1817–1884), a disciple of **Bernhard von Langenbeck** (1810–1887), became *privatdozent* (private lecturer) in surgery and practiced in Berlin. In 1855, he published *Chirurgische Klinik* (Surgical Clinic) [30], a textbook specifically devoted to plastic surgical operations, with numerous lithographic plates, showing forehead flap nasal reconstructions, repair of cheek defects by transposition of local flaps (Fig. 5.21), and upper and lower eyelid restoration with local flaps while at the same time demonstrating the astonishing progress achieved by the specialty in the middle of the nineteenth century.

Fig. 5.21 Transposition of a skin flap, to repair a cheek defect. *Left*: preoperative situation. The secondary defect will be closed by transposing a skin flap. *Right*: The flap is sutured into position. (From: Friedberg H. *Chirurgische Klinik.* Jena, Friedrich Mauke, 1855)

5.2.1.8 Karl Heinrich August von Burow

In 1855, **Karl Heinrich August von Burow** (1809–1874) published *Beschreibung einer neuen Transplantations-Methode (Methode der seitlichen Dreiecke) zum Wiederersatz verloren gegangener Theile des Gesichts* (Description of a new Transplantation Method (Method of the lateral Triangles) for the Reconstruction of the missing Parts of the Face), a milestone paper [31]. Von Burow's great idea was to mathematically calculate the amount of skin to be excised, lateral to the flap, when the cutaneous pedicled flap was advanced. In this way, the resulting bilateral swelling in the adjacent tissues (the so-called dog ear) was avoided and flap advancement facilitated. Excision of the skin triangle *(Methode der seitlichen Dreiecke)*, now eponymously named Burow's triangle after him, is still regarded as a fundamental technique of plastic surgery. The lithographic plate illustrates von Burow's idea and the different clinical applications either for covering an upper/lower lip defect (cheiloplasty) or for lower eyelid (blepharoplasty) (Fig. 5.22).

Born in Elbing (northern Germany) in 1809, **von Burow** studied medicine at Königsberg University from where he graduated in 1839. He became an Associate Professor of Surgery and, in 1846, opened a private ophthalmological-surgical clinic in Königsberg which soon became a renowned center. In 1870, he was appointed army surgeon to the troops of Prince Charles Frederich of Prussia. He died in Königsberg in 1874, aged 65.



BESCHREIBUNG

EINER NEUEN

TRANSPLANTATIONS-METHODE

(METHODE DER SEITLICHEN DREIECKE)

ZUM WIEDERERSATZ VERLOREN GEGANGENER THEILE DES GESICHTS

VON

PROF. D^R. BUROW,

DIRECTOR DER KOENIGL. CHIRURGISCHEN POLIKLINIK DER UNIVERSITAET KOENIGSBERG.

MIT EINER LITHOGRAPHIRTEN TAFEL.

BERLIN, 1855.

BEI ALBERT NAUCK.

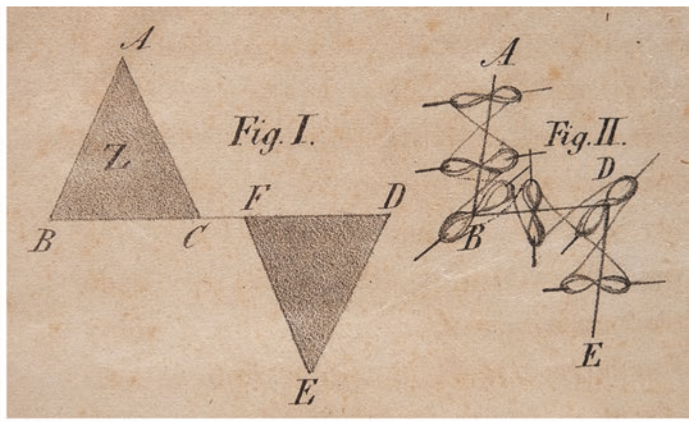


Fig. 5.22 The epoch-marking publication by Karl H. August von Burow (1809–1874) *Left*: Title page. *Right*: The mathematical calculation of the amount of skin to be excised, when advancing a cutaneous pedicled flap. (From: Burow von KHA. *Beschreibung einer neuen Transplantations-Methode (Methode der seitlichen Dreiecke)*. Berlin, Albert Nauck, 1855)

5.2.1.9 Victor von Bruns

One of the most amazing illustrated surgical atlases of the nineteenth century was the *Chirurgischer Atlas. Bildliche Darstellung der Chirurgischen Krankeheiten und der zu ihrer Heilung erforderlichen Instrumente, Bandagen und Operationen* (Surgical Atlas. Illustrations of the Surgical Diseases and of the necessary Instruments, Dressings and Operations for their healing) by **Victor von Bruns** (1812–1883) and published between 1853 and 1858 [32, 33]. It contained 30 large-*folio* lithographic plates, some of them in color, with more than 600 figures showing a great variety of congenital and acquired diseases of the head and face, as well as the surgical procedures known at that time for the treatment of cheiloplasty, cleft lip, noma, hemangiomas, and cheek reconstruction. A brief explanatory text was included. The atlas is divided into two parts. *Erste Abtheilung. Gehirn und Umhüllungen* (Part One. Brain and Envelopes) is devoted to neurology and neurosurgery [32]. Von Bruns illustrates congenital and acquired diseases of the brain, encephaloceles, neurofibromatosis, craniosynostosis cloverleaf, Romberg disease, tumors, and the instruments necessary for performing a neurosurgical operation, along with the position of the surgeon in the operating room. *Zweite Abtheilung. Kau- und Geschmacks-Organs* (Part Two. Masticatory and Taste Organs) is devoted to congenital and acquired soft tissue defects of the cheeks, lips, and oral cavity [33]. For the cheeks, von Bruns illustrated macrostomia, sequelae of burns, noma, and tumors (Fig. 5.23). For the lips, he described clefts, cheiloplasty, inflammations, and tumors. Many of the surgical techniques devised and depicted by von Bruns are still used today such as the elliptical tumor excision, the bilateral flap advancement [34], the double upper lip flap for closing a lower lip defect (Fig. 5.24), and the vermilionectomy. The text to which the atlas refers, *Die chirurgische Pathologie und Therapie des Kau- und Geschmacks-Organs* (On Surgical Pathology and Therapy of the Masticatory and Taste Organs) published in 1859, is without images [35]. Both the text and the atlas represent sources of invaluable information about the evolution of plastic surgery in the nineteenth century [36].

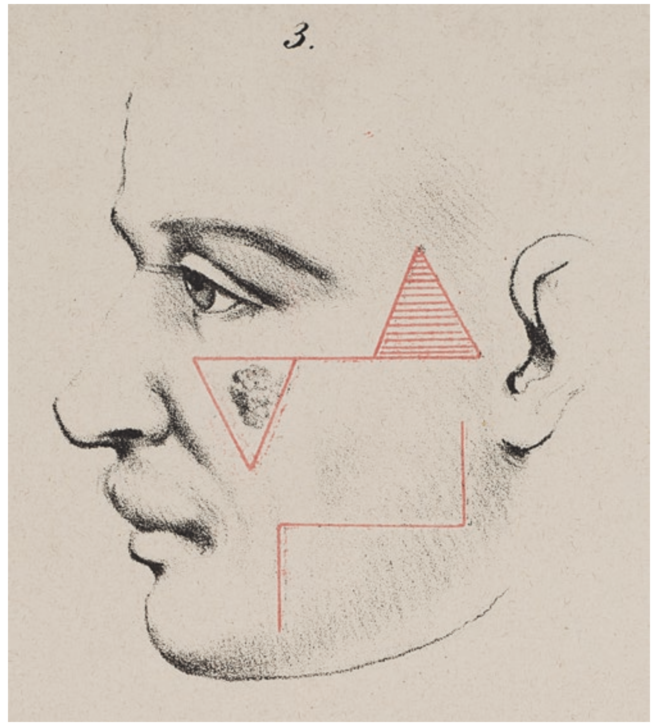


Fig. 5.23 Cheek repair following excision for cancer, using von Burow technique. (From: von Bruns V. *Chirurgischer Atlas*. Tübingen, H. Laupp, 1857–1858)

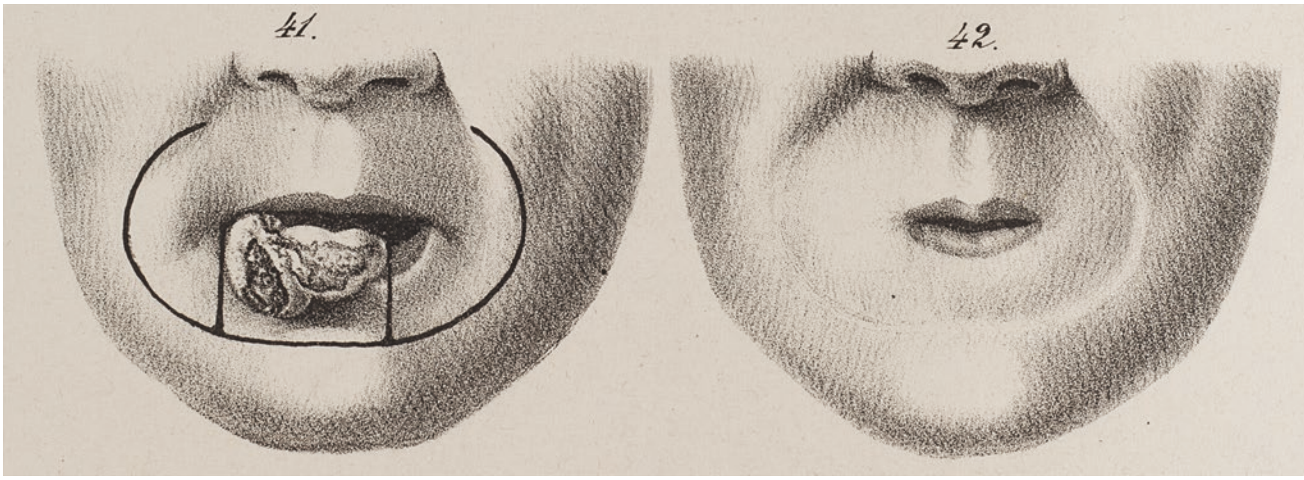


Fig. 5.24 Lower lip reconstruction, following excision for cancer. (*Left*) Preoperative and (*right*) postoperative view. (From: von Bruns V. *Chirurgischer Atlas*. Tübingen, H. Laupp, 1857–1858)

5.2.1.10 Bernhard Rudolph Conrad von Langenbeck

Bernhard Rudolph Conrad von Langenbeck (1810–1887) studied medicine at Göttingen. After graduation, he made an instructional trip to Belgium, France, and England. In 1840, he became Professor of Pathological Anatomy and then Professor of Surgery at Kiel, and during the Holstein wars, he was appointed army surgeon. At Dieffenbach's death in 1847, von Langenbeck replaced him as Chair of Surgery at Berlin University. The observation of bone regeneration taking place through the periosteum led him to release the periosteum from the underlying palatal bone in cleft palate repair. In the meantime, thanks to the discovery of general anesthesia in 1846 (see Sect. 5.5.1), control of pain was introduced [37]. The periosteum release, associated with bilateral relaxing incisions, changed the course of cleft palate surgery completely. This epoch-marking technique, still used today, was first presented at a meeting of the *Berlin Medical Society* in 1861 [38] (see Sect. 9.2.2.3 on "Bernhard von Langenbeck"). Langenbeck was one of the leading European surgeons of the period. With Theodor Billroth and Ernst Julius Gürlt, he founded the *Archiv f. klinische Chirurgie* (Archive for clinical Surgery) in 1860. In 1872, he established the *German Society of Surgery* with **Gustav Simon** and **Richard von Volkmann**. He trained nearly every prominent surgeon of the second half of the nineteenth century and had the most important disciples including **Bergmann**, **Billroth**, **Esmarch**, **Gürlt**, and **Trendelenburg**. Regrettably, he published very little given his massive contribution. He died in 1887, aged 77. Comprehensive biographies of von Langenbeck were published by Goldwyn [39], Zeis [20], Gnudi and Webster [6], and Garrison [11].

5.2.1.11 Johann Friedrich August von Esmarch

A disciple of Bernhard von Langenbeck, **Johann Friedrich August von Esmarch** (1823–1908) was one of the leading personalities in military surgery. He studied medicine at Kiel and became an assistant of Professor Langenbeck and later of Professor **Georg Friedrich Stromeyer**. In 1854, von Esmarch was appointed director of the surgical clinic in Kiel. Three years later, he was nominated head of the general hospital and professor at Kiel University. In 1872, after his wife's death, he married the Princess Caroline Henrietta Schleswig-Holstein, aunt of the Empress Augusta Victoria, Prussia's Empress. He was given a noble title by Emperor William I. He died in Kiel in 1908, aged 85.

Von Esmarch wrote the *Handbuch der kriegschirurgischen Technik* (Textbook of War Surgery Techniques), an award-winning manual published in 1877 with minimal, essential text and numerous self-explanatory, spectacular illustrations for use on the battlefield [40]. It was one of the most important surgical textbooks on military surgery of modern times. Much of the progress in the treatment of the wounded on the battlefields and the organization of military hospitals is due to von Esmarch and summarized in this manual. The work is divided into two parts. Part One shows different types of bandages, stabilization devices, and stretchers. Part Two begins with anesthesiological techniques in current use since their discovery in 1846, including an illustration of the chloroform mask (Fig. 5.25). The rubber compression bandage, eponymously named after him, used to perform surgery in a bloodless field, and first published in 1873, is described on page 128 (Figs. 5.26 and 5.27). The colored plates depict the anatomy of the vessels to be ligated for controlling hemostasis. A successful work, translated into different languages, the manual was awarded a prize by the Red Cross, which explains the insignia on the title page. A few years later, in 1892, he issued *Chirurgische Technik. Ergänzungsband zum Handbuch der kriegschirurgischen Technik* (Surgical Techniques. A supplement to the Textbook of War Surgery Techniques) containing other operations in a well-illustrated manual of surgery, describing in detail numerous plastic surgical operations performed at that time: cheiloplasty, cheek repair, nasal reconstruction, cleft lip, cleft palate, mastectomy, and hernia [41]. It was a very successful text, which enjoyed numerous editions. A brief biography about von Esmarch was published by **Sharon Romm** [42].

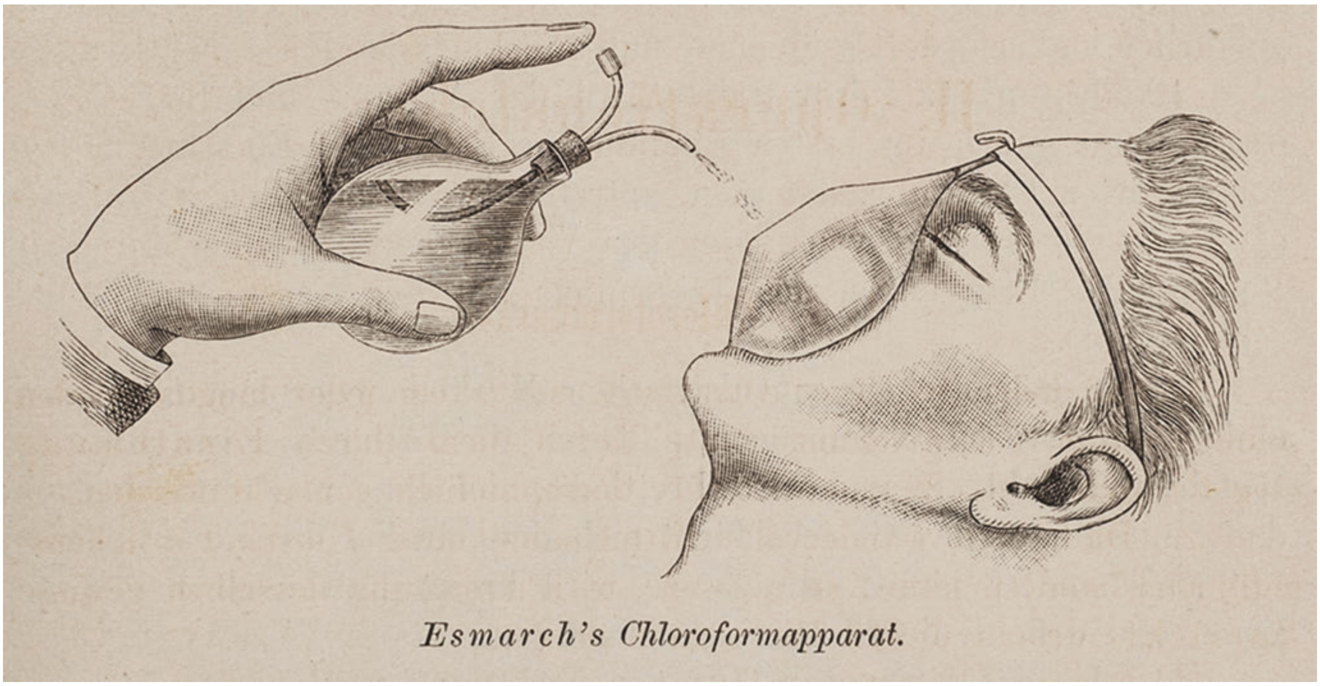


Fig. 5.25 The chloroform mask devised by Esmarch for anesthesia. (From: Esmarch von JFA. *Handbuch der kriegschirurgischen Technik*. Hannover, Carl Rümpler, 1878)

Fig. 5.26 Esmarch's rubber compression bandage to exsanguinate the limb, eponymously named after him. (From: Esmarch von JFA. *Handbuch der kriegschirurgischen Technik*. Hannover, Carl Rümpler, 1878)

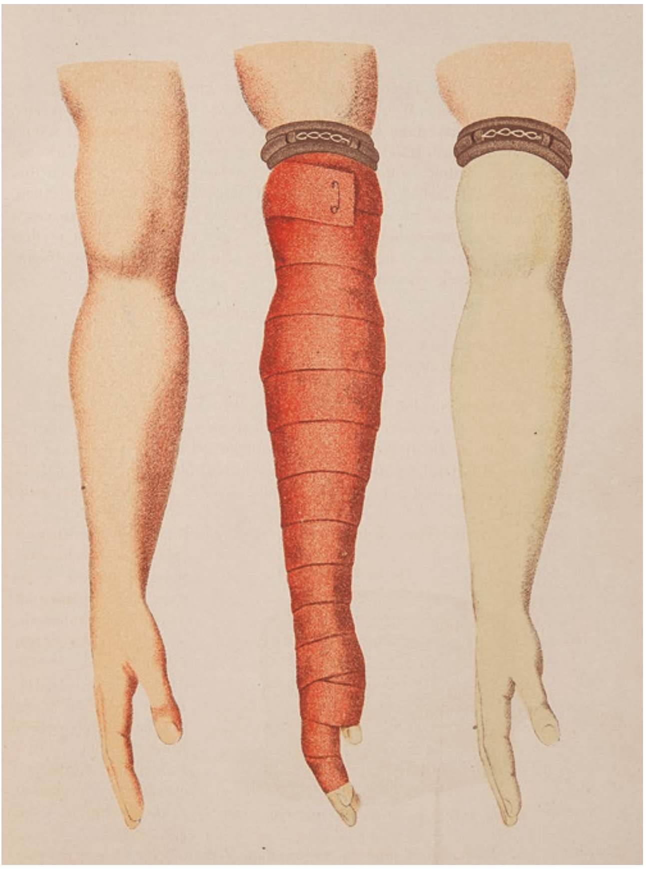


Fig. 5.27 The application of Esmarch's rubber compression bandage to exsanguinate the limb. *Left*, normal upper limb; *middle*, the bandage is wound tightly around the limb from the distal end toward the shoulder; *right*, the limb exsanguinated. A tourniquet prevents the return of blood after bandage's removal. (From: Esmarch von JFA. *Handbuch der kriegschirurgischen Technik*. Hannover, Carl Rümpler, 1878)

5.2.1.12 Christian Albert Theodor Billroth

Another well-known disciple of Bernhard von Langenbeck was **Christian Albert Theodor Billroth** (1829–1894), regarded as one of the leading surgeons of the second half of the nineteenth century and a pioneer of modern abdominal surgery [11, 43]. Born in Bergen (Prussia), he studied medicine in Greifswald, Göttingen, and Berlin. In 1852, he obtained his medical degree in Berlin and began working in the ophthalmological clinic of **Albrecht von Gräfe** (1828–1870). In 1860, he was appointed as *Ordinarius* (Professor) of Surgery at the University of Zürich and retained that position until 1867. While in Zürich, he wrote his major work *Die allgemeine chirurgische Pathologie und Therapie* (General surgical Pathology and Therapy) in 1863, the most important textbook on surgery of the second half of the nineteenth century and began a cooperation with **Franz von Pitha** (1810–1875). Together, they issued a 19-volume work, *Handbuch der allgemeinen und speciellen Chirurgie* (Manual of general and special Surgery), from 1865 to 1882, accompanied by an atlas with more than 200 plates [44]. In 1867, he moved to Vienna to become Professor of Surgery at the University of Vienna where he built his own private clinic. He was a famous surgeon and a great artist. He carried out the first laryngectomy (1873), systematized abdominal surgery with stomach excision for cancer (the so-called Billroth I and II), and was a supporter of the aseptic principles of Lister (see Sect. 5.5.2.3). He greatly contributed to plastic surgery, mainly of the face, with operations for cleft palate, facial reconstruction, and closure of breast defects following mastectomy [45]. In 1880, he published *Krankheiten der weiblichen Brustdrüsen* (Diseases of the female Mammary Gland), where he discussed mammary carcinoma, prognosis of metastasis, recurrence, and surgical treatment, illustrated by dramatic colored images [46] (Fig. 5.28). He was a prolific scientific writer and a genial and learned man. His house in Vienna was a cultural center. A talented musician, he played second violin and became a good friend of Johannes Brahms who dedicated two string quartets to him. He died in Abbazia (Istria), in what was then part of the Austrian-Hungarian Empire, in 1894, aged 65.

Fig. 5.28 Ulcerated right breast carcinoma. (From: Billroth CAT. *Die Krankheiten der weiblichen Brustdrüsen*. Stuttgart, F. Enke, 1880)

5.2.2 France

During the nineteenth century, European leadership in reconstructive surgery was shared by Germany and France where it was concentrated in two centers, Montpellier and Paris. In Montpellier, **Jacques Delpech** (1772–1832), a great orthopedist and surgeon, performed the first rhinoplasty of the modern era in France, following Carpue's and von Gräfe's teachings, and organized a school for reconstructive surgery. In Paris, a series of brilliant surgeons issued important scientific contributions with outstanding surgical achievements.

5.2.2.1 Dominique-Jean Larrey

The leading French military surgeon of his time was **Dominique-Jean Larrey** (1766–1842), the surgeon of Napoleon. He served the *grande armée* (grand army), participating in more than 60 battles and 25 campaigns, as Surgeon-in-Chief [47, 48]. He was born in Baudéan (Pyrénées) and studied medicine in Paris under Desault. He wrote *Mémoires de Chirurgie militaire et Campagnes* (Memoirs of military Surgery and Campaigns), issued in four volumes between 1812 and 1817 [49]. A fifth volume was added in 1841, covering the campaigns from 1815 to 1840. *Mémoires* relates Larrey's medical and surgical experiences during his campaigns and voyages to Italy, North America, Corsica, Egypt, Syria, Prussia, Russia, Poland, Spain, Austria, Saxony, and Belgium—and his activity after Napoleon's defeat. They provide a fascinating record of the battles, the medical and surgical problems encountered, and the life and social and sanitary customs in the different lands. He invented numerous beneficial solutions and improvements for the care of the injured on the battlefield, from the introduction of light, mobile ambulances (*flying ambulance*), to collect the wounded on the battlefield, bringing them rapidly to the hospital, to amputations at the hip joint level, disarticulations, and treatment of penetrating wounds. He favored the use of maggots on wounds, with a positive therapeutic effect, and treated scrotal lymphoedema. He was a strong supporter of debridement for wound management, a technique that he learned from his teacher **Pierre-Joseph Desault** (1738–1795). The engraved illustrations show the flying ambulance (Fig. 5.29), the panniers on the camel's back for transportation of the injured during the Egyptian campaign (Fig. 5.30), and treatment of limb wounds and scrotal lymphoedema. Napoleon, who bestowed on Larrey the title of Baron after the battle of Wagram (1809), used to say: *Larrey, c'est l'homme le plus vertueux que j'aie connu* (Larrey is the most virtuous man I have ever known). Larrey died in 1842, aged 76, as an honored and beloved person.

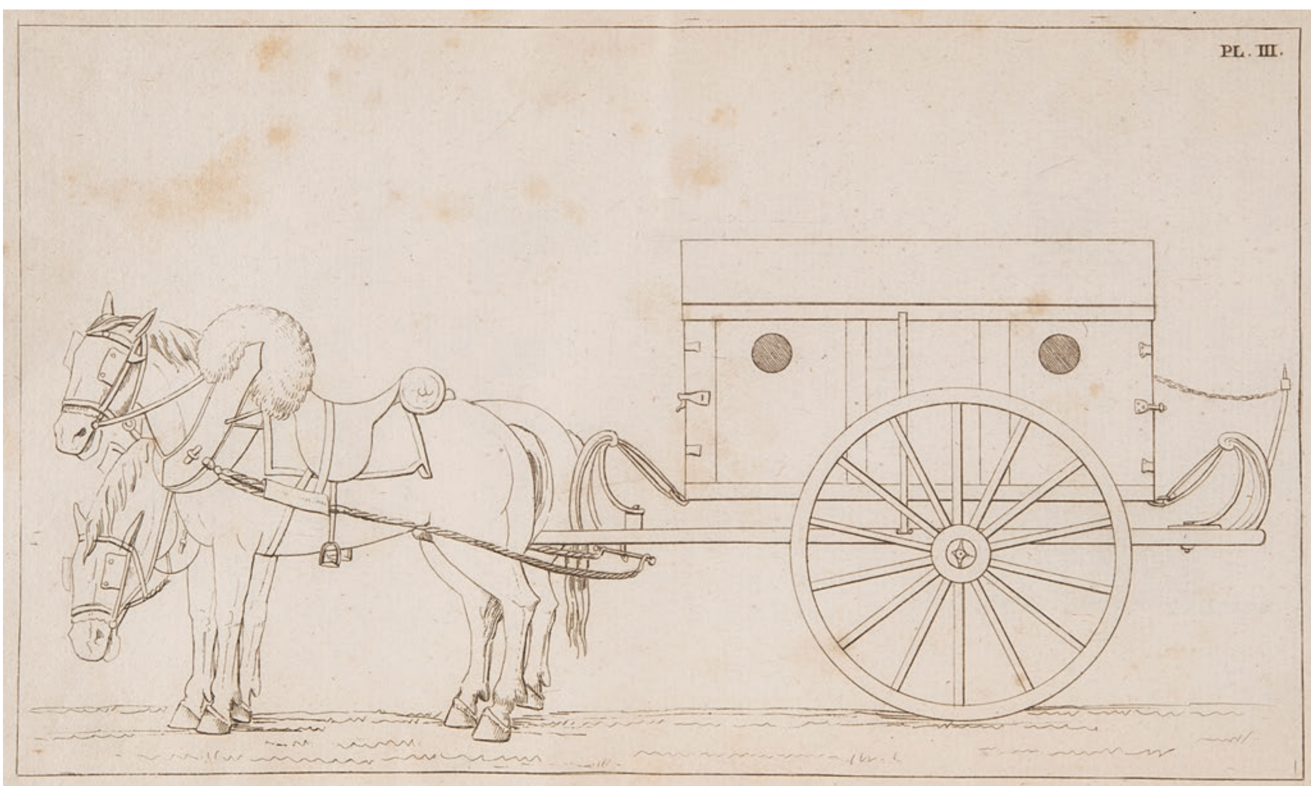


Fig. 5.29 The light ambulance for transportation of the wounded from the battlefield to the hospital. (From: Larrey DJ. *Mémoires de Chirurgie militaire, et Campagnes*. Paris, J. Smith, 1812–1817)

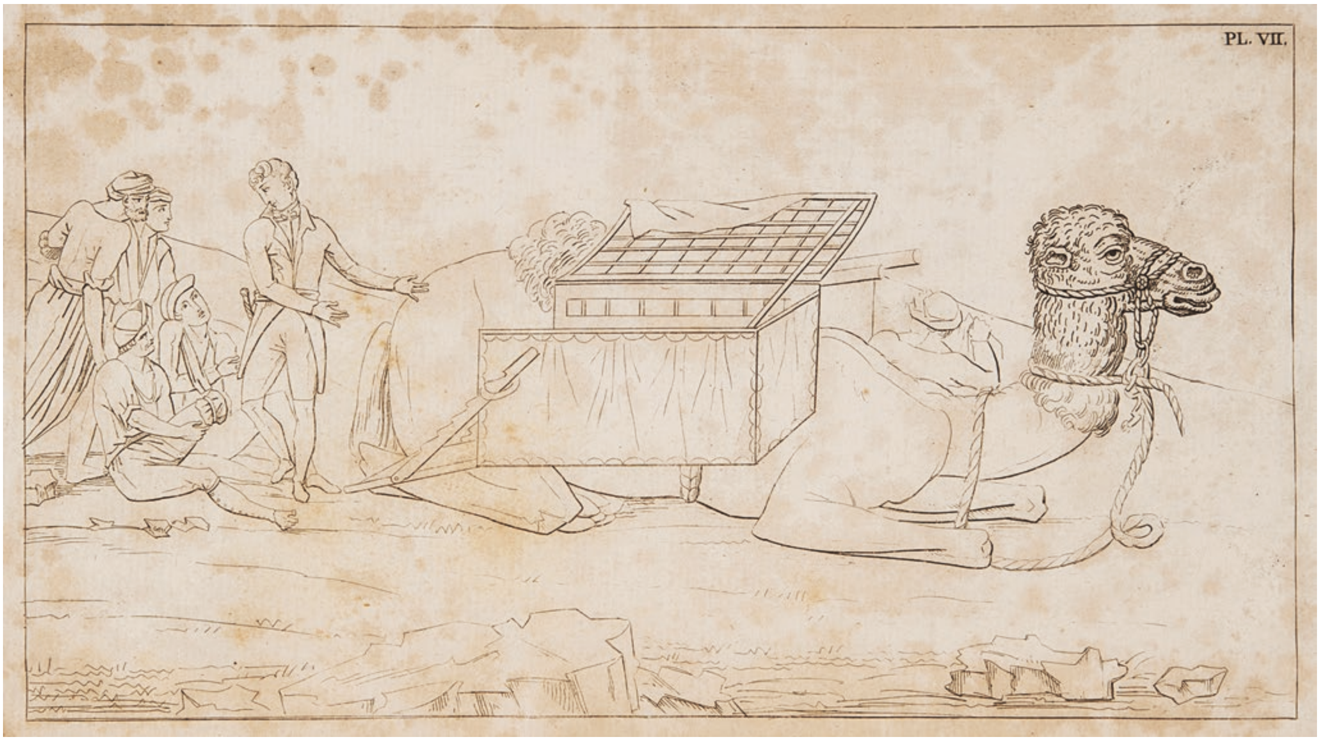


Fig. 5.30 Larrey's camel ambulance, fitted with panniers for the transportation of the wounded in the desert. (From: Larrey DJ. *Mémoires de Chirurgie militaire, et Campagnes*. Paris, J. Smith, 1812–1817)

5.2.2.2 Jacques Mathieu Delpech

Jacques Mathieu Delpech (1772–1832), born in Toulouse, was trained in surgery by Professor **Raphaël Bienvenu Sabatier** (1732–1811) and **Guillaume Dupuytren** (1777–1835). In 1812, he was appointed Professor of Surgery at Montpellier University and Director of the Hôpital St. Eloi of Montpellier. He was a renowned orthopedist. Having read of the successful results achieved by Carpue and von Gräfe in the field of rhinoplasty, on June 4, 1823, he performed the first of six cases of nasal reconstruction, all of them by the Indian forehead flap. He added an arm flap procedure, following von Gräfe, which failed [6, 20]. His account, *Observations et Refléxions sur l'Opération de la Rhinoplastique* (Observations and Considerations on the Rhinoplasty operation), published in *Chirurgie Clinique de Montpellier* (Clinical Surgery of Montpellier) in 1828 [50] (Fig. 5.31), was the first report of the Indian rhinoplasty to appear in France and one of the first in general after Carpue and von Gräfe. He included a strong defense of Tagliacozzi, saying that: *Nothing is more exact than his observations, nothing is more clever than his principles* (…). Delpech considered Tagliacozzi's method a "stroke of genius," useful to repair not only the nose but also the lip, eyelid, and cheek. He created in Montpellier a real school of plastic surgery, opposing the German supremacy [51].

Fig. 5.31 A 12-year-old boy affected by congenital malformation of the nose and eyelid (*naso-ocular cleft*). *Left,* preoperative situation; *middle*, paramedian forehead flap used for reconstructing the congenital lateral-nasal defect; *right*, final result. (From: Delpech JM. *Chirurgie Clinique de Montpellier*. Paris and Montpellier, Gabon, 1823–1828)

5.2.2.3 Pierre Léon Auguste Labat

Pierre Léon Auguste Labat (1803–1847) studied medicine at Montpellier University, becoming a student of Professor Delpech, and graduated in 1824. He went to Egypt as a personal physician to Mohamed-Aly, Viceroy of Egypt and Syria. Upon his return to France, he wrote numerous scientific works, among them *De la Rhinoplastie*. He died in 1847, aged 44.

De la Rhinoplastie, art de restaurer ou de refaire complètement le Nez (On Rhinoplasty, art of restore or completely repair the Nose) issued in 1838 [52] represented the first account entirely devoted to nasal reconstruction to be published in France. It is the result of the increased interest in plastic surgical procedures among French physicians. The work began with a detailed historical review of the art of reconstructing noses using the Italian or Indian method, partly in Labat's own practice and partly by other surgeons. Then Labat described the use of different methods, according to the defect [20]. The lithographic illustrations took the different clinical situations into account: loss of the ala, columella, lobule, and dorsum. The upper lip, cheek, and even the hand were used as a donor site. A fairly optimistic postoperative result was always shown. The work concluded with the description of other facial reconstructions: otoplasty, genioplasty, cheiloplasty, blepharoplasty, and palatoplasty. Plate 5 illustrates a lower third nasal reconstruction performed by Delpech and published in *Chirurgie Clinique de Montpellier* in 1828, with a *fleur-de-lys* type of design for the concurrent repair of the lining and the outside of the nose [50] (Fig. 5.32). It is interesting to note that the same type of flap, called the *flying seagull flap*, was published by Ralph Millard in 1974, 150 years later, as an innovative procedure, without acknowledging the predecessor [53].

Fig. 5.32 *Fleur-de-lys* flap for the concurrent repair of the nasal lining and cover, practiced by J.M. Delpech. *Left*, preoperative situation with defect in the lower third of the nose; *middle*, the fleur-de lys forehead flap; *right*, final result. (From: Labat PLA. *De la Rhinoplastie*. Paris, Ducessois, 1834)

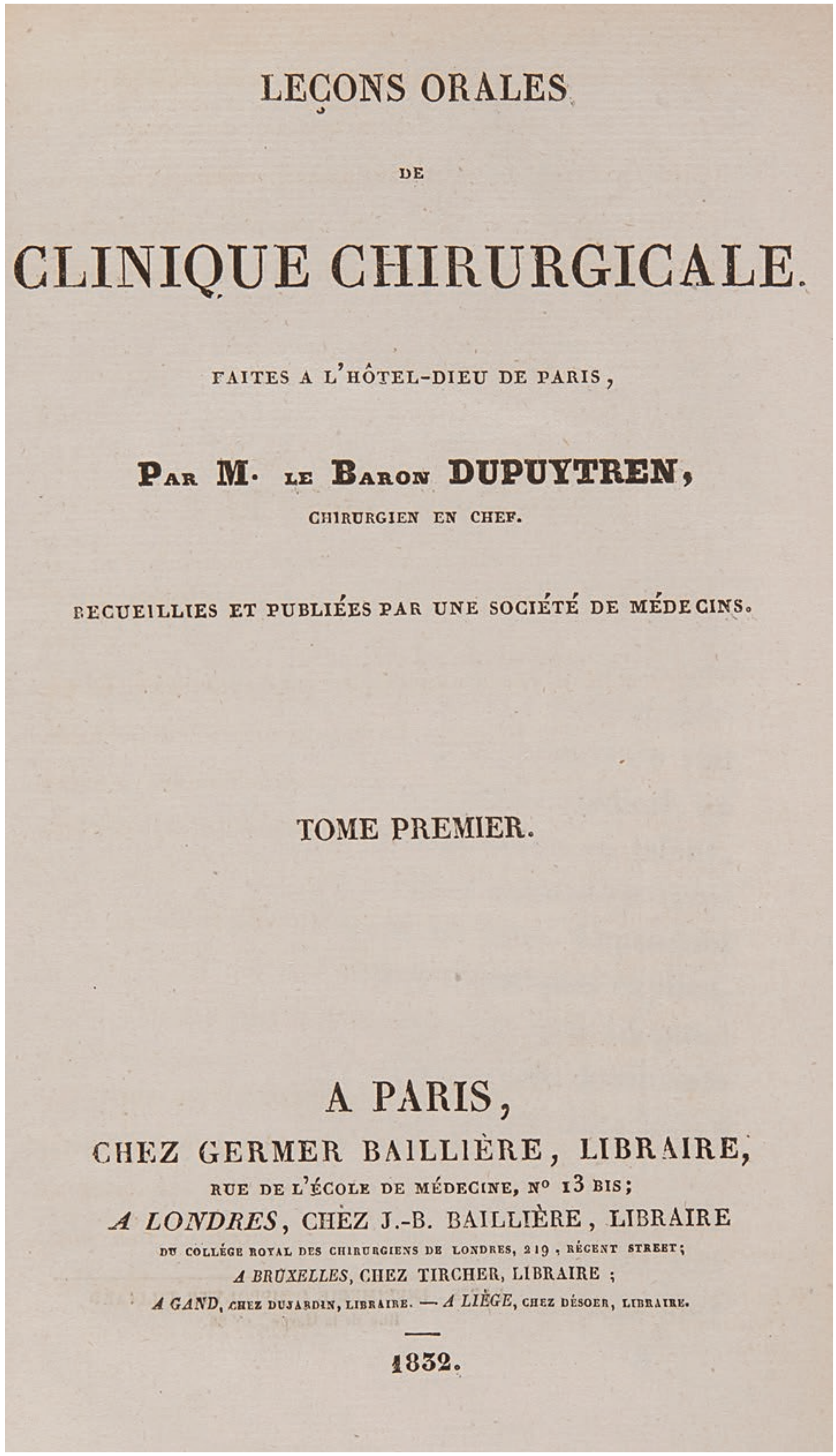
5.2.2.4 Baron Guillaume Dupuytren

One of the greatest surgeons of the nineteenth century was **Baron Guillaume Dupuytren** (1777–1840). Born in Pierre-Buffière (Nouvelle Aquitaine, north-central France) in 1777, Dupuytren studied medicine in Paris. He received his medical degree in 1795 and dedicated himself to the field of anatomy. In 1803, he was appointed Assistant Surgeon at Hôtel-Dieu of Paris and in 1811 Professor of Operative Surgery at the same hospital, replacing Professor Raphaël Sabatier after his death. The title of Baron was granted to him by King Louis XVIII. Dupuytren was extremely proud of this title and always signed his name as Baron Dupuytren—and everybody had to address him as "Monsieur le Baron." He became personal surgeon to Louis XVIII and to his successor Charles X and was elected as a member of the *Academy of Medicine* and of the *Academy of Sciences*. He had an enormous clinical practice both in the hospital and beyond. Dupuytren was a perfectionist and favored bedside teaching. His lectures were followed by students from all nations. Regrettably, he had a very difficult character: arrogant, rude, ambitious, and austere. He didn't accept rivals or dissent. His colleagues used to say about him: *Dupuytren, first of surgeons, but the least of men*. He wrote very little. His notes and writings were collected by his co-workers who published them as *Leçons orales* (Oral lectures). He died in 1835, aged 57. He was one of the most renowned surgeons in Europe [6, 11, 48, 54–56].

Like most of Dupuytren's lectures, the *Leçons Orales de Clinique Chirurgicales, faites à l'Hôtel-Dieu de Paris* (Oral lectures on Clinical Surgery, delivered in the Hôtel-Dieu of Paris) were prepared, collected, and published by an association of physicians, in particular by two of his disciples, J.A. Buet and Alexandre Brierre de Boismont, and first issued in four volumes between 1832 and 1834 [55] (Fig. 5.33). The work covers a great deal of the many facets of surgery and plastic surgery of the period, from cleft lip and palate, to burns, tracheostomy, fracture of the femur, tumors, jaw resection, treatment of congenital torticollis, and gunshot wounds. It was one of the most important works on surgery issued in the nineteenth century.

The chapter *Des brulures* (On burns) in Volume One, p. 413–516, included the account and management of burns with the well-known classification in six degrees, depending on their extension and depth (p. 424). To release a burn contracture, he used immobilization and traction devices. The chapter on permanent finger contraction, due to the retraction of the palmar aponeurosis, *Des diverses causes de rétraction permanente des doigts* (On the different causes of permanent finger retraction), was first published by Dupuytren in *J Univ hebd Méd et Chir* (1832; 5: 352–365) [56] and reissued in Volume One, p. 517–530 of *Leçons Orales*. This is the detailed description of the permanent contraction of fingers and its possible cause: *The affection begins usually in the ring-finger, whence it extends to the adjacent, especially to the little finger, and increases by almost imperceptible degrees. The patient at first feels a little stiffness in the palm of the hand and a difficulty in extending the fingers, soon the fingers remain bent to a quarter, to a third, or to a half. The flexure is sometimes carried much farther, and the tips of the fingers come to rest on the palm of the hand. From the very beginning, a cord is appreciated on the palmar surface of the fingers and of the hand, which is more tense when an effort is made to straighten the fingers, and it disappears entirely, when they are quite bent* (…). *Its extremities are lost insensibly at the second phalanx of the finger, and about the middle of the palm of the hand, or perhaps short of this point. The skin covering the finger is thrown into arched folds, the concavity of which is below, and the convexity above. This condition is for a time limited to the finger primarily affected, but at a later period the other fingers are, though to a lesser degree, involved in the deformity*. (…) *It was, therefore, natural to conclude that the origin of the affection was in the extreme tension of the palmar fascia, and that the contraction itself resulted from injury to the fascia by forcible and continued action of some hard body against the palm of the hand*.

Despite the fact that contracture of the palmar aponeurosis bears Dupuytren's name, the condition was first described 218 years earlier by the Swiss physician **Felix Platter** (1536–1614) in Book One, p. 140 of *Observationum in Hominis affectibus, Libri Tres* (Observations of the diseases of Men, in three books), published in 1614. Platter observed the retraction of the palmar aponeurosis and the bending of the fifth finger over the palm in a stonecutter. He incorrectly attributed it to a shortening of the flexor tendons of the fingers [57].



LEÇONS ORALES

DE

CLINIQUE CHIRURGICALE.

FAITES A L'HÔTEL-DIEU DE PARIS,

PAR M. LE BARON DUPUYTREN,

CHIRURGIEN EN CHEF.

RECUEILLIES ET PUBLIÉES PAR UNE SOCIÉTÉ DE MÉDECINS.

TOME PREMIER.

A PARIS,

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RUE DE L'ÉCOLE DE MÉDECINE, N° 13 BIS;

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1832.

Fig. 5.33 Title page of G. Dupuytren (1777–1835) four-volume textbook *Leçons Orales de Clinique Chirurgicales*, first published in Paris between 1832 and 1834

5.2.2.5 Alfred Armand Louis Marie Velpeau

Alfred Armand Louis Marie Velpeau (1795–1867), the son of a blacksmith, was born in Brèche (Indre et Loire, north central France) in 1795 [11]. He studied medicine initially in Tours with **Pierre Bretonneau** (1778–1862) and then in Paris from where he graduated in 1823. He was initially appointed surgeon at Hôpital St. Antoine (1828–1830), then at Hôpital de la Pitié (1830–1834), and finally at Hôpital de la Charité (1834–1867). In 1835, he became Professor of Clinical Surgery, replacing **Alexis Boyer** (1757–1833) after his death, a position that he maintained until his death in 1867. In 1843, he succeeded **Dominique-Jean Larrey** at the *Academy of Sciences* (Section of Medicine/Surgery). A skilled surgeon and renowned anatomist, he was a very prolific writer, publishing on surgical anatomy, embryology, operative surgery with atlas, obstetrics, and diseases of the breast. He died in 1867, aged 72.

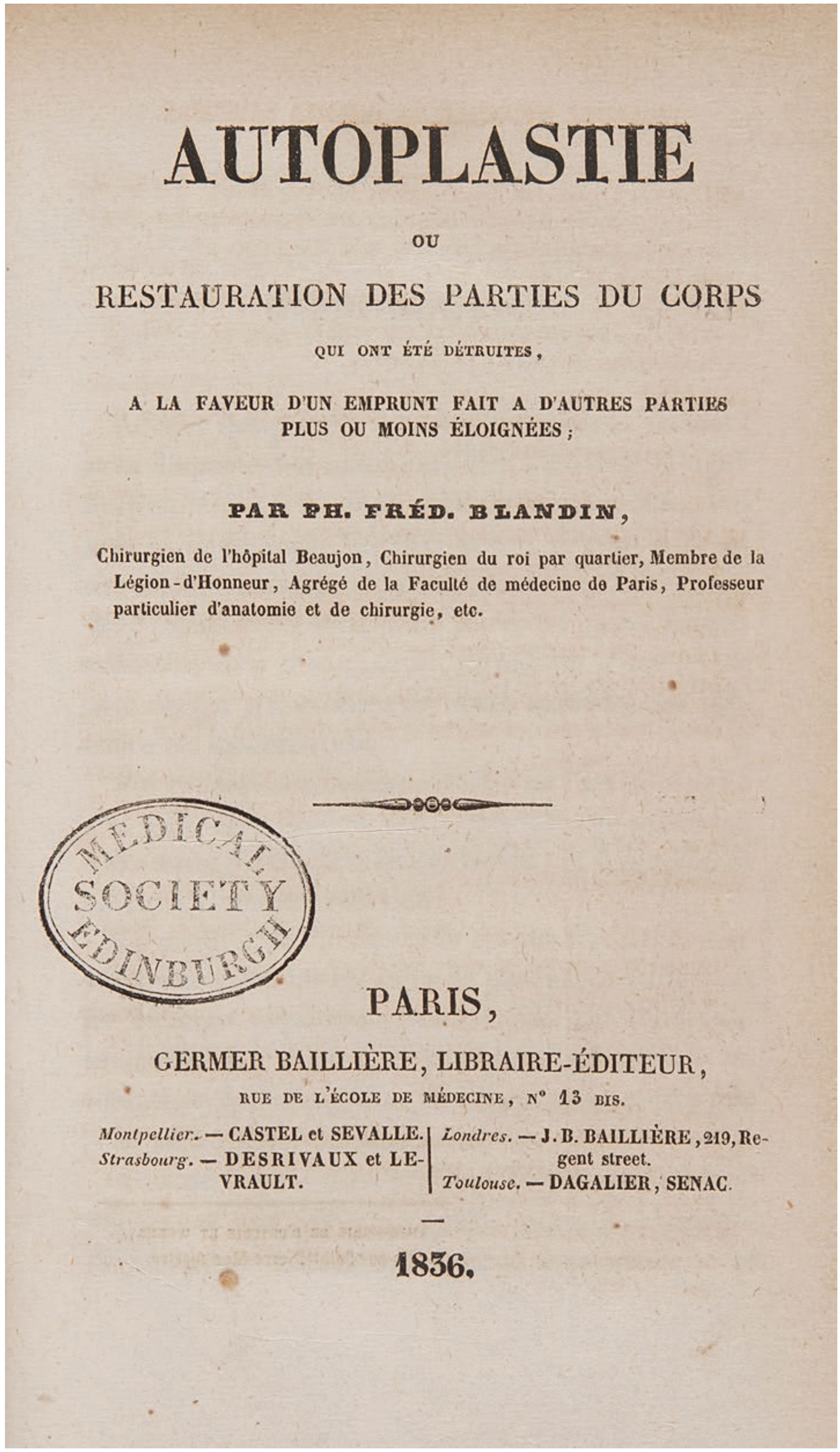
Nouveaux Elements de Médecine Opératoire accompagnés d'un Atlas (New Elements of Operative Surgery accompanied by an Atlas) [58] is a massive, four-volume text in which all the operations known at that time are reported, with a 22 engraved plates atlas containing hundreds of illustrations of surgical procedures and of the instruments to perform them. In Volume One (p. 607–705), a significant section on reconstructive surgery is included. Velpeau explains the different procedures for replacing the missing parts, favoring the term anaplasty to autoplasty, which, according to him, better indicates the idea of reunion of completely separated parts of the body. He illustrates nasal reconstruction either with the Tagliacozzi arm flap or with the forehead flap, as reported by von Gräfe; blepharoplasty; cheiloplasty; genioplasty; and palatoplasty. In Volume Three, he discusses cleft lip (p. 485) and cleft palate (p. 572).

Traité des Maladies du Sein et de la Région Mammaire (Treatise on the Diseases of the Breast and Mammary Region) [59], first published in 1854, is considered the most authoritative of Velpeau's works and one of the first to illustrate hyperplastic cystic diseases. He described benign as well as malignant lesions of the female breast, their etiology, classification of the different forms, their prognosis, and recurrence. Surgical treatment is reported, with excision, axillary lymph node removal, and direct closure of the defect by wound approximation. Three pages are devoted to *anaplasty* (autoplasty), using different types of flaps (p. 604–607). He was strongly against those who considered anaplasty a possible solution to impair recurrence: *Anaplasty is not a way to prevent recurrence following tumor excision*. In the last part of the work, Velpeau illustrated breast disease in the male. The eight lithographic plates show gross morbid anatomy.

5.2.2.6 Philippe Frédéric Blandin

Philippe Frédéric Blandin (1798–1849), born in Aubigny in 1798, studied medicine in Paris, from where he graduated in 1824. He became a prosector in anatomy and later surgeon at Hôpital Beaujon as an assistant to **Jean-Nicolas Marjolin** (1780–1850). Along with Velpeau who published a treatise on surgical anatomy in 1825–1826, Blandin is considered a pioneer in the field of surgical anatomy, originated with the aim *to teach the surgeon how to direct his scalpel with safety in the deep layers as if they were transparent*. His treatise on topographic anatomy, accompanied by an atlas with 12 plates, issued in 1826, represents a new way of exposing the topic [60] (see Sect. 8.8.1.4 on "Philippe Frédéric Blandin"). In 1836, he wrote and discussed a thesis on autoplasty for a post at Hôtel-Dieu, after Dupuytren's death [6, 61]. In the same year, he participated in the contest for the Chair of Anatomy with a thesis *Des dents* (On teeth) [62]. Finally in 1841, he obtained the Chair of Operative Medicine, after Professor Sabatier's death. He died at Paris in 1849, aged 50, after contracting pneumonia.

Autoplastie ou Restauration des Parties du corps qui ont été détruites à la faveur d'un emprunt fait à d'autres parties plus ou moins éloignées (Autoplasty or Reconstruction of Parts of the body which have been destroyed by borrowing from other parts more or less distant) [61] is an important account of plastic surgery, one of the first on this topic, originally the thesis that Blandin wrote for the competition for the Chair of Clinical Surgery at Dupuytren's death [20] (Fig. 5.34). It is divided into seven parts. Part One traces the history of the discipline and defines the term autoplasty, apparently coined by him, which comes from the Greek αὐτός (autologous) and πλάσσειν (to form); Part Two illustrates the indications. Part Three describes the most typical operations: rhinoplasty, blepharoplasty, otoplasty, cheiloplasty, genioplasty, and cleft palate. Part Four explains the different types of flaps used to cover defects. Part Five shows the postoperative management; Part Six the follow-up with possible complications; and Part Seven the importance of the procedure.



AUTOPLASTIE

OU

RESTAURATION DES PARTIES DU CORPS

QUI ONT ÉTÉ DÉTRUITES,

A LA FAVEUR D'UN EMPRUNT FAIT A D'AUTRES PARTIES
PLUS OU MOINS ÉLOIGNÉES;

PAR PH. FRÉD. BLANDIN,

Chirurgien de l'hôpital Beaujon, Chirurgien du roi par quartier, Membre de la Légion-d'Honneur, Agrégé de la Faculté de médecine de Paris, Professeur particulier d'anatomie et de chirurgie, etc.

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1836.

Fig. 5.34 Title page of PF. Blandin (1798–1849) account *Autoplastie*, first published in Paris in 1836

5.2.2.7 Joseph-François Malgaigne

Joseph-François Malgaigne (1806–1865) was one of the leading personalities of nineteenth-century French surgery [11, 63]. The son of a French health officer, he was born in 1806 in Charmes-sur-Moselle (northeast France). He studied medicine in Nancy with great difficulty due to his poor economic situation, becoming a sanitary officer of that city. In 1830, he served as a medical officer in the war between Poland and Russia after which he went to Paris, where he presented a thesis for a post in surgery. In defending his thesis, he began his own discourse by criticizing the other competitor: *There are several things in the thesis of Monsieur X. Y., just defended. Some are new, others are good. Unfortunately, those which are new are not good, and those which are good are not new*. He didn't win the post. He was first associated with Hôpital St. Louis and de La Charité and later appointed Professor of Operative Medicine at the School of Medicine and Head Surgeon at Hôpital Beaujon and Saint-Antoine. In 1834, he published *Manuel de Médecine Opératoire* (Handbook of Operative Medicine) [64]. He was well educated in Latin and Greek, highly interested in the history of medicine, and a prolific and successful writer. In 1840, he edited the complete set of **Ambroise Pare's** (1510–1590) works, adding a well-documented biography of the author and a large section on the history and evolution of surgery from the fifteenth century to the Renaissance [65]. In 1843, he founded and directed the *Journal de Chirurgie*, an important monthly scientific publication, which continued until 1846, when it became *Revue Médico-Chirurgicale de Paris*. His *Traité des Fractures et des Luxations* (Treatise on Fractures and Dislocations), printed between 1847 and 1855 and translated also into English, is considered a reference point in the field of traumatology [66].

Manuel de Médecine Opératoire, fondée sur l'Anatomie normale et l'Anatomie pathologique (Handbook of Operative Medicine, based on normal and pathologic Anatomy) was a very successful and influential textbook on surgery that went through nine editions and five translations [64]. It described the operations known at that time as well as the surgical instruments to perform them. The most common plastic surgical procedures were reported: autoplasty (p. 97), nasal reconstruction (p. 300), cleft lip (p. 317), lip reconstruction (p. 324), genioplasty (p. 326), and cleft palate (p. 341). The text had no illustrations. Only the eighth edition, posthumously published in 1877, has woodcut illustrations in the text.

5.2.2.8 Charles-Pierre Denonvilliers

In 1865, Malgaigne was succeeded as the Chair of Surgical Pathology by **Charles-Pierre Denonvilliers** (1808–1872), the great anatomist and surgeon. Denonvilliers is best remembered for his description of the prostato-peritoneal aponeurosis, eponymously named after him, and by the description of the Z-plasty for the repair of ectropion of the right lower eyelid [51]. In 1843, he was one of the founders of the *Société de Chirurgie de Paris*. In 1854, he presented the description of the correction of a cicatricial ectropion before the members of the society: *Two incisions parallel to the borders of the upper and lower eyelids, meeting at the outer angle of the right eye, allowed detachment of the depressed external angle. A second triangular flap was raised above the preceding, and an exchange of these two triangular flaps was easily performed* [67, 68]. Regrettably, no illustration was supplied. Apparently, the triangular-flap switching, called an *exchange procedure*, is the first report of a Z-plasty in medical literature. The case was recorded by **Émile Honoré Cazelles**, a student of Denonvilliers, in his thesis for the Doctorate in Medicine, published in 1860 (Case No. 12) [69]. The same case was also reported in 1866 by **Pierre Édouard Gabriel Cruveilhier** (1835–1906) in his thesis for the Aggregation in Surgery, supplying a very clear scheme of the procedure [70] (Fig. 5.35).

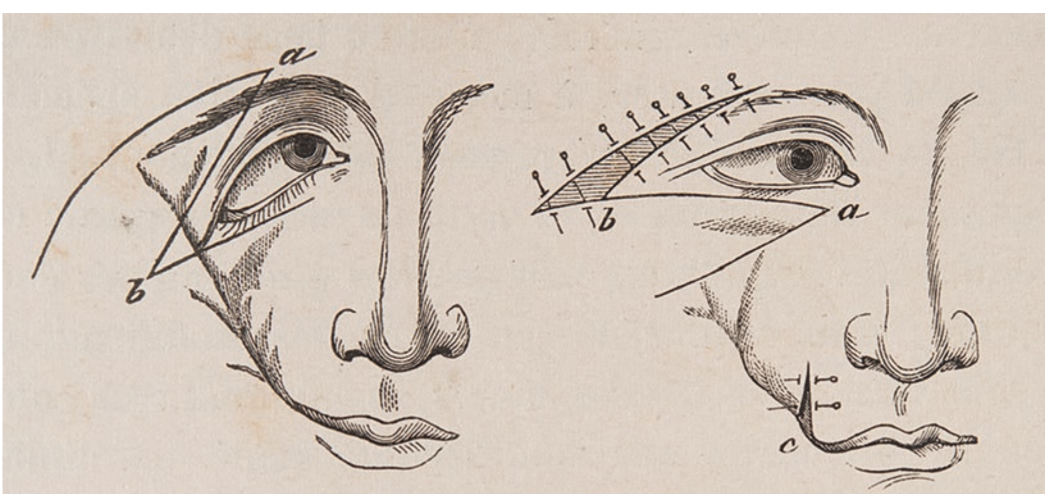


Fig. 5.35 Correction of cicatricial ectropion by Z-plasty, as described by C.P. Denonvilliers (1808–1872) in 1854. (*Left*) Preoperative and (*right*) postoperative view. (From: Cruveilhier PÉG. De l'ectropion. Thèse. Paris, Asselin, 1866)

5.2.2.9 Auguste Nélaton

Auguste Nélaton (1807–1873) [11], born in Paris in 1807, graduated in medicine in 1836 and became Professor of Surgery at the Paris Medical Faculty and Director of Surgery at Hôpital St. Louis. An excellent operator and teacher, he was recognized as the foremost French surgeon of his time. He was the surgeon to Napoleon III and treated Giuseppe Garibaldi for the gunshot wound he suffered at Aspromonte in August 1862. His son Charles (1851–1907) was also a surgeon. Nélaton died in Paris in 1873. Between 1844 and 1859, he published *Élémens de Pathologie Chirurgicale* (Elements of Surgical Pathology), a five-volume treatise containing most of the surgical operations known at that time [71]. Nélaton devised numerous original procedures and created original instruments such as the soft, tubular rubber bladder catheter, which eponymously bears his name. Before that, catheters were made of metal. In Volume Two, he described reconstructive surgical operations, the so-called autoplasty, for the nose, lip, and cheek (p. 654–712) as well as cleft lip and cleft palate.

5.2.2.10 Michel Serre

Michel Serre (1799–1849) was born in Montpellier in 1799, studied medicine at the University of Montpellier, and graduated in 1825. He became a student of **Jacques Delpech** (1777–1832). At Delpech's death, Serre succeeded him as Professor of Surgery at Montpellier University.

He died in 1849, aged 50. He is best known for two major contributions to plastic surgery: *Traité de la Réunion immediate* (…) (1830) [72] and *Traité sur l'art de restaurer les difformités de la Face* (…) [73] issued in 1842.

In *Traité de la Réunion immediate* (Treatise on immediate approximation), Serre emphasizes that defects heal better and faster when direct approximation of the wound margins by primary intention is achieved. After a historical review of the literature, Serre reports the basis for the direct approximation of the margins. Then he describes the different clinical situations where the method is applicable: craniotomy, cataract, cleft lip, cheiloplasty, cleft palate, hernia, tumor removal, and amputations.

For cleft palate suture, Serre affirms that he unsuccessfully tried twice the palatorraphy using the procedure advocated by **Philibert Joseph Roux** (1780–1854). However, in both cases the palate reopened. *Traité sur l'art de Restaurer les Difformités de la Face, selon la Méthode par Déplacement, ou Méthode Française* (Treatise on the art of Restoring Facial Deformities by the Sliding Method, or French Method) begins with a chapter on the history of reconstructive surgery of the nose, starting with the Indian method and evolving to Tagliacozzi, Carpue, von Gräfe, Dieffenbach, and others [6, 20, 73]. In the following chapters, Serre explains the classification of the different types of skin flaps available for facial reconstruction, transplantation (Italian method), rotation (Indian method), and finally the sliding flap (French method). According to him, the sliding flap technique (*Méthode par déplacement, ou Française*), nowadays called *advancement flap*, represents the solution of choice for covering facial defects. It is applicable to the lips (upper, lower, and commissure), rhinoplasty, genioplasty, and blepharoplasty. To demonstrate the advantages of the sliding flap, he describes numerous case reports. Serre concludes his treatise by saying that with the current techniques, every type of facial deformity can be treated properly. The best results are obtained by excising the scar, using the sliding flap (French method) and margin approximation, and finally comparing the different procedures, that is, the Italian, the Indian, and the French (sliding flap). The last is simpler, less dangerous, and it leaves linear scars on the face. *La Méthode Italienne et la méthode Indienne*, he proudly writes at the beginning, *doivent désormais faire place à la méthode Française* (The Italian method and the Indian method should now be replaced by the French method).

An atlas with 30 double-page lithographic plates by Aumont is associated with the textbook. They show before and after images of different clinical situations, mainly tumors of the lip (Fig. 5.36), cheek (Fig. 5.37), eyelid, nose, scar retraction, nasal defects, and cleft lip. At the bottom of each plate, a scheme explains the steps of the procedure. Emphasis is given to the sliding flap technique (French method). Patients are depicted in their village costume, wearing traditional caps or hats. *Traité sur l'art de Restaurer les Difformités de la Face* is the first atlas on facial deformities published in France and one of the first in the plastic surgical literature.

Fig. 5.36 Lower lip carcinoma. *Left*, preoperative situation with the scheme of the used procedure; *right*, final result. (From: Serre M. *Traité sur l'art de Restaurer les Difformités de la Face.* Montpellier, Louis Castel and Paris, J.-B. Baillière, 1842)

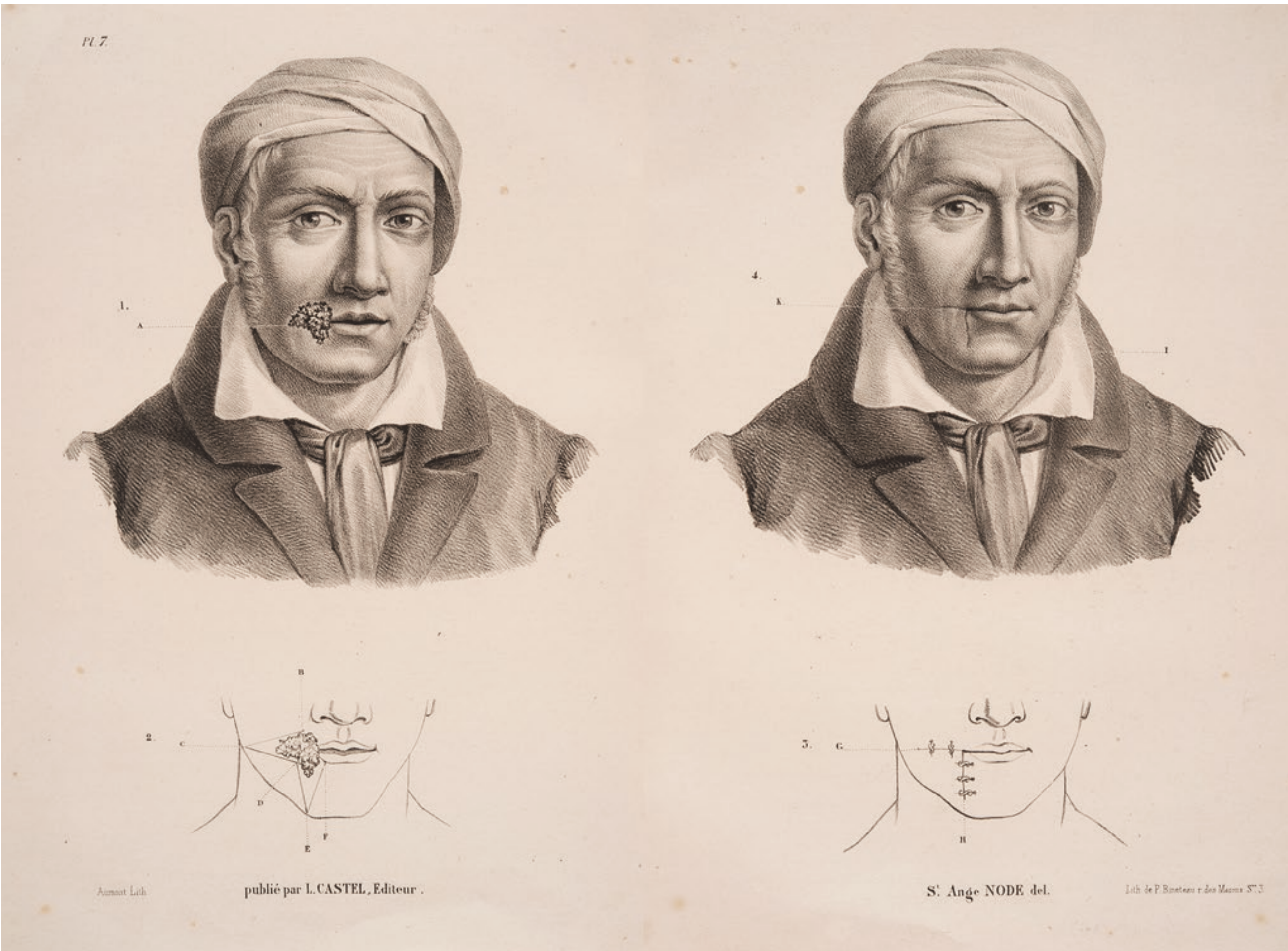


Fig. 5.37 Right cheek carcinoma. *Left*, preoperative situation with scheme of the used procedure; *right*, final result. (From: Serre M. *Traité sur l'art de Restaurer les Difformités de la Face.* Montpellier, Louis Castel and Paris, J.-B. Baillière, 1842)

5.2.2.11 Antoine-Joseph Jobert de Lamballe

Antoine-Joseph Jobert de Lamballe (1799–1867), born in Matignon (Brittany) in 1799, studied medicine in Paris. A disciple of **Baron Balthasar Anthelme Richerand** (1779–1840) and **Jules Germain Cloquet** (1790–1883), he was appointed surgeon at Hôpital St. Louis in 1830 and in 1849 at Hôtel-Dieu. In 1854, at Roux's death, Jobert, already a member of the *Academy of Medicine*, became the chair of the surgical clinic. A talented surgeon, with a very difficult character, Jobert dedicated himself to autoplasty and to its various clinical applications, using the sliding flap technique [6, 20]. While at St. Louis, he was the first to introduce general anesthesia in France. He was consulting physician to King Louis-Philippe and surgeon to Emperor Napoleon III. He died in 1867 of general syphilitic paralysis. Jobert wrote numerous works including *Plaies d'armes à feu* (On gunshot wounds) [74], *Traité de Chirurgie Plastique* (Treatise on Plastic Surgery) [75], and *De la Réunion en Chirurgie* (On Approximation in Surgery) [76].

Traité de Chirurgie Plastique (…) *accompagné d'un Atlas In-folio* (A Treatise of Plastic Surgery, accompanied by an Atlas In-folio) in two volumes with an 18-plate atlas was first issued in 1849 [75]. The term *Chirurgie Plastique* was used for the first time in France in this work. In the foreword of the text, Jobert defines *Chirurgie Plastique* (Plastic Surgery) as a procedure with the goal of repairing defects using skin flaps coming either from surrounding areas or from distant regions. After a historical review of *autoplasty* (the term introduced by Blandin), he gives the indications of the procedure used for covering skin defects with healthy neighboring tissue. He lists the typical methods of plastic surgery: the Indian, with a twisted flap, for forehead nasal reconstruction; the Italian, with transplantation flap; the French, with displacement; and two other methods, introduced by him, the sliding and the folding. He describes various operations for the restoration of different defective parts: otoplasty, blepharoplasty, genioplasty, cheiloplasty, cleft lip, palatoplasty, thoracoplasty following excision of massive breast tumors, closure of vesico-vaginal fistulae, and closure of penile fistulae with emphasis on the sliding flap technique, the so-called French method. He also affirms that the sliding flap technique prevents recurrence of cancer. This statement will be strongly contradicted by Velpeau in *Traité des Maladies du Sein* in 1854 [58].

The accompanying atlas is a masterpiece of nineteenth-century medical illustration due to the amazing images accurately drawn. Plate 1 shows the use of the folding flap for restoration of the labial mucosa; Plate 2 the reconstruction of the upper eyebrow and lateral commissure; Plate 3 the restoration of the lower eyelid; Plate 4 the reconstruction of the lower eyelid by a cheek flap transposition and closure of a cheek defect by an advancement flap (*sliding flap*) (Fig. 5.38); and Plate 5 is on thoracoplasty, with closure of a bronchial fistula by a sliding flap. The following three plates, from 7 to 9, depict closure of male urethral fistulae, using the advancement of a scrotal flap (Fig. 5.39). The other plates illustrate the pelvic vascularization and the closure of vesico-vaginal or recto-vaginal fistulae, using the author's procedure. The final plate depicts the instruments used to perform the sliding flap procedure.

Fig. 5.38 Repair of a cheek defect by the sliding flap procedure (*French method*). (From: Jobert de Lamballe A-J. *Traité de Chirurgie Plastique. Atlas.* Paris, J.-B. Baillière, 1849)

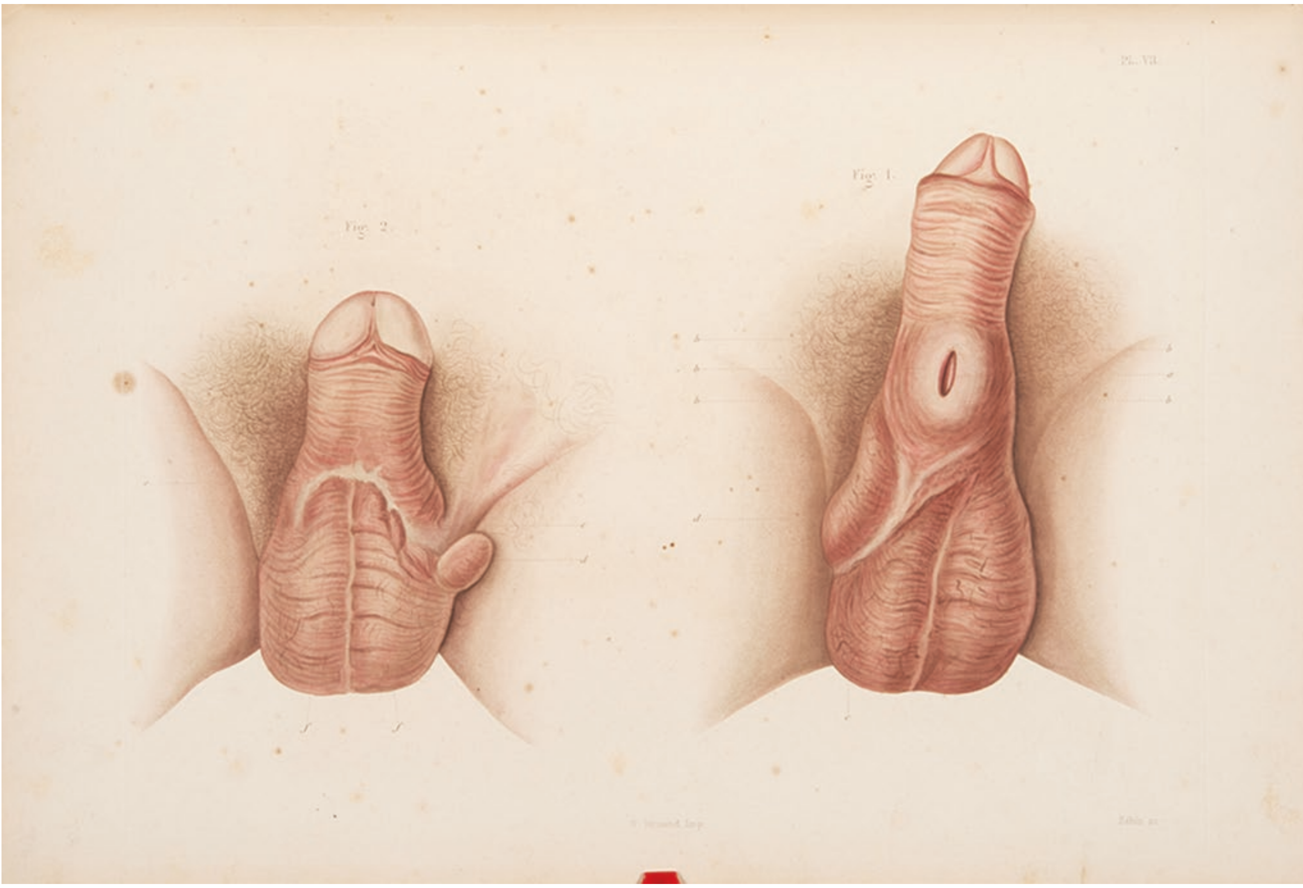


Fig. 5.39 Closure of a penile fistula in case of hypospadias using a scrotal sliding flap. *Right*, preoperative situation; *left*, final result. (From: Jobert de Lamballe A-J. *Traité de Chirurgie Plastique. Atlas.* Paris, J.-B. Baillière, 1849)

5.2.2.12 Philibert Joseph Roux

Philibert Joseph Roux (1780–1854), born in Auxerre (Yonne, Burgundy) in 1780, was initially trained as a military surgeon in that city. In 1797, he moved to Paris where he studied anatomy at the School of Medicine. He became a co-worker and then a friend of **Marie François Xavier Bichat** (1771–1802), celebrated anatomist, working for 4 years with him and contributing to his treatise on descriptive anatomy. At Bichat's death in 1802, Roux replaced him as a lecturer in anatomy and operative medicine. The following year, he discussed his doctoral thesis and completed Volume Five of his teacher's *Traité d'anatomie descriptive*. In 1807, he was appointed surgeon at Hôpital Beaujon and 3 years later at Hôpital de la Charité in the department of **Alexis Boyer** (1757–1833), whose daughter he had just married. In 1812, at **Raphäel Sabatier's** (1732–1811) death, Roux competed with Guillaume Dupuytren (1777–1835) for the succession of the Chair of Operative Medicine with a thesis *De la Résection ou retranchement de portions d'os malades* (On the resection or excision of parts of deteriorated bone), but he didn't obtain the position. In 1835, he succeeded Dupuytren as surgeon at Hôtel-Dieu as full Professor of Surgery.

A surgeon of great dexterity, he contributed significantly to the treatment of cataract and repair of the ruptured female perineum, gunshot wounds, aneurysms, and cleft palate. He is considered one of the pioneers in the field of plastic surgery.

In 1853, he started an ambitious project of collecting all the clinical observations of his career in a six-volume work entitled *Quarante années de pratique chirurgicale* (40 years of surgical practice) that begins with the following: *Si les circostances le permettent, si quelques années de vie me seront encore reservées, et si ma santé n'éprouve aucune de* *ces atteintes qui paralysent les meilleures dispositions au travail, les quelques volumes que je fais paraitre aujourd'hui seront suivi de plusieurs autres*. (If circumstances allow, if a few years of life still remain, and if my health does not experience any attacks that paralyze the best intentions, the volumes that I present today will be followed by many others.)

Regrettably the work he began in 1853, at the age of 74, was never completed. Only volumes one (devoted to plastic surgery) and two appeared, printed posthumously. Roux died on March 23, 1854, of a cerebral hemorrhage. A commission chaired by Larrey, under the aegis of the *French Society of Surgery*, took over the job of assembling and publishing the manuscripts.

Originally, the plan of the work included the publication of all the observations seen and treated by Roux over 40 years of clinical practice from 1811 onward. The work was written in the form of letters. Volume One is addressed to **Sir William Lawrence**, surgeon at London's St. Bartholomew's Hospital, who taught numerous surgical procedures to Roux during his trip to England in 1814, whereas Volume Two is dedicated to **Joseph Maximilian Chelius**, Professor of Surgery at Heidelberg University.

The entire Volume One of Roux's *Quarante années de pratique chirurgicale* deals with reparative surgery [6, 20, 77]. The basic principles of autoplasty, blepharoplasty, genioplasty, cheiloplasty, nasal reconstruction, cleft lip, cleft palate, and repair of female perineum are reported. For this reason, Roux is regarded as a pioneer in plastic surgery in France. As far as closure of cleft palate is concerned, Roux reconsiders the question of the priority of the operation and remarks that **von Gräfe**'s case was performed in 1816, 3 years before him, but published as a short note in a local German journal, with no circulation abroad—and not in France in particular. Moreover, it was unsuccessful. This is the reason why, according to him, his case deserves the priority of palatoplasty.

Volume Two, preceded by a detailed biography of Roux, written by **René Marjolin** (1812–1895), son of the most famous **Jean-Nicholas Marjolin** (1780–1850), deals with arterial diseases and with aneurysms in particular. It describes the procedures for ligation of the arteries and management of bony hemangiomas.

5.2.2.13 Aristide Auguste Stanislas Verneuil

Aristide Auguste Stanislas Verneuil (1823–1895) was born in Paris in 1823 and studied medicine in Paris, from where he graduated in 1852 [6, 20]. He became *Interne des Hôpitaux* and was appointed surgeon at Hôpital Lariboisière, then at Hôpital de la Pitié, and finally at Hôtel-Dieu. In 1869, he was elected a member of the *Academy of Medicine* and then of the *Academy of Sciences* (Section of Medicine/Surgery). In 1872, he became Professor of Clinical Surgery at Hôpital de la Pitié. Considered a skilled surgeon, he is well-known for his observations on wound healing. He died in 1895, aged 71.

Chirurgie Réparatrice (Reconstructive Surgery) is Volume One, of the five-volume *Mémoires de Chirurgie* (Memories of Surgery), that **Verneuil** issued between 1877 and 1888. It is a relevant account of plastic surgery, witness of the importance given to the newly discovered discipline. It traces the origin of plastic surgery and the indications for the typical operations of this specialty: rhinoplasty, blepharoplasty, cheiloplasty, cleft lip, cleft palate, and hand—and their description. A detailed bibliography was added [78].

5.2.2.14 Claude Bernard

In 1846, the physiologist **Claude Bernard** (1813–1878) along with **Charles Huette** (1820–1881) published *Précis ichonographique de Médecine Opératoire* (Ichonographic account of Operative Medicine) [79], a very successful pocket edition (*In-8vo*) surgical atlas, which went through numerous editions and translations over the years, where nearly 100 of the most common surgical operations are accurately described and illustrated step by step. The small format favored its distribution among army surgeons and doctors in the provinces to become informed about surgical operations they could otherwise not learn. The atlas is one of the few works that Claude Bernard, the founder of Experimental Medicine, wrote on subjects other than physiology. Plastic surgery is well represented with harelip and cleft palate repair, cheiloplasty, nasal reconstruction with forehead flap, blepharoplasty (Fig. 5.40), excision of massive tumors of the face, hypospadias, and phimosis [6, 20, 80].

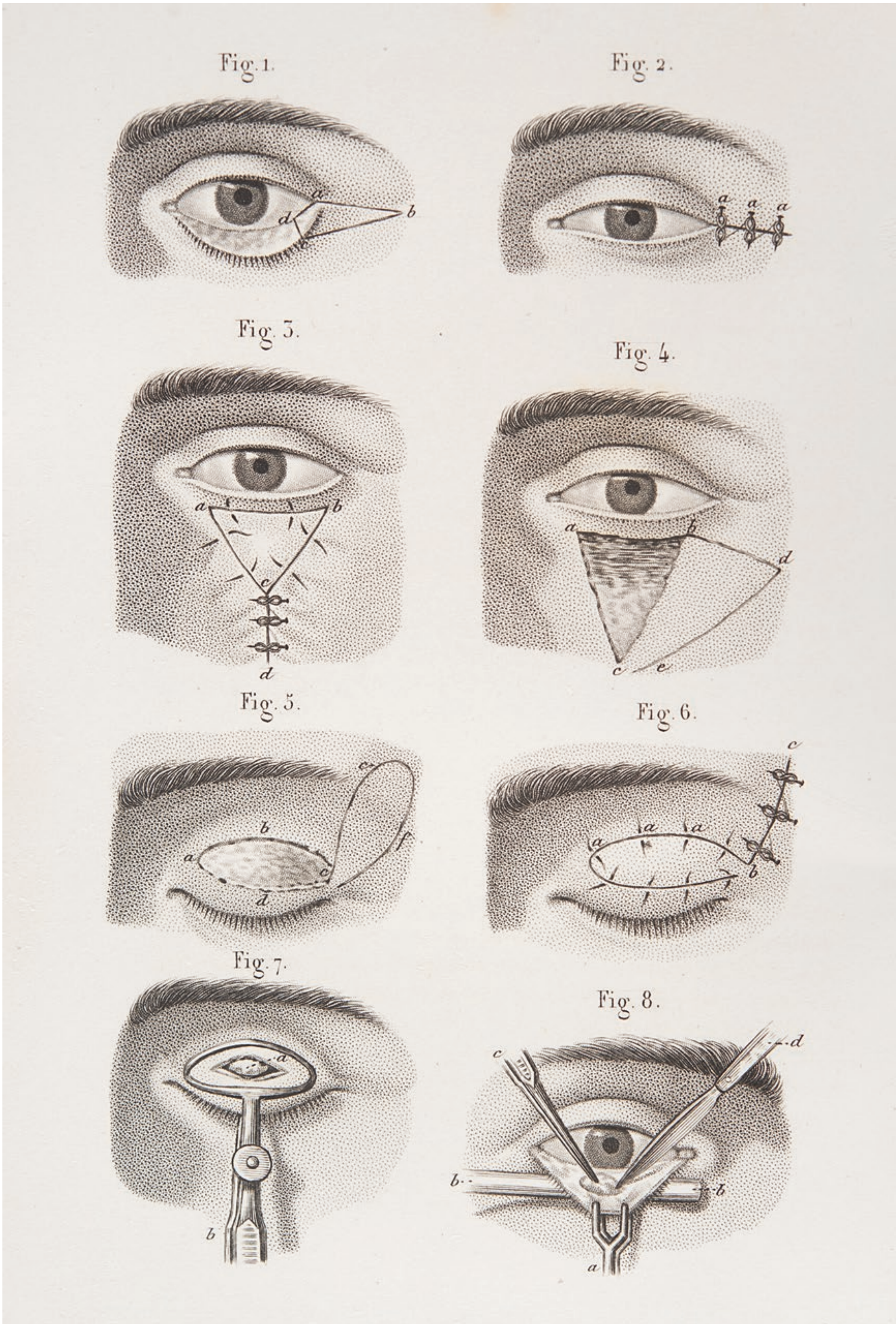


Fig. 5.40 Different plastic surgical procedures for the correction of eyelid defects. (From: Bernard C, Huette C. *Précis ichonographique de Médecine Opératoire*. Paris, Méquignon-Marvis, 1855)

5.2.3 Italy

During the nineteenth century, Italian leadership in medical and surgical sciences, which lasted for almost a millennium, gradually faded. With very few exceptions, this period was characterized by the absence of names of international relevance. Reconstructive surgery was practiced in Turin (Piedmont, Kingdom of Sardinia), Pavia, at that time under Austrian domination, Padua, Bologna, and Rome. Nevertheless, numerous surgeons made scientific contributions with significant surgical accomplishments.

5.2.3.1 Paolo Assalini

Paolo Assalini (1759–1840) was born in Reggio Emilia (near Bologna) in 1759. A disciple of **Antonio Scarpa** (1752–1832), he was appointed Professor of Surgery at the Hospital at Reggio Emilia. In 1797, he had to leave Italy due to problems with justice and enlisted in the French army, working with Larrey and becoming chief surgeon to Napoleon. He distinguished himself in Egypt, fighting against cholera. In 1811, he was nominated personal surgeon to Eugène of Beauharnais, Viceroy of Italy. In 1824, he moved to Catania where he became a Professor of Surgery at Santa Marta Hospital. He died in Naples in 1846, aged 81 [81].

Manuale di Chirurgia (Handbook of Surgery), a tract of military surgery, was written for the battlefield surgeons of Napoleon's troops in Italy [82]. It is divided into two parts. In Part One, the author describes the treatment of different types of wounds, in particular stabbing and gunshot. He provides practical hints for the management of fractures and dislocations and for ligating arteries. The text is accompanied by four folding engraved plates showing stabilization of the lower limb on the battlefield and the instruments required. Plate 4 includes the famous small pocket case with the instruments necessary for performing amputation of limbs on the battlefields. The case was awarded the silver medal prize of the *Reale Istituto di Scienze, Lettere e Arti* at the Milan Expo in 1811. Part Two, with three folding engraved plates, deals with the duties of military surgeons, details of hygiene in military hospitals, and health equipment specific to military medicine. One of the illustrations shows a model of a very light wheeled battlefield stretcher holding a single wounded man and pulled by a soldier (Fig. 5.41). This litter was a medical innovation in the Napoleonic campaigns. The work went through numerous editions and was translated into different languages.

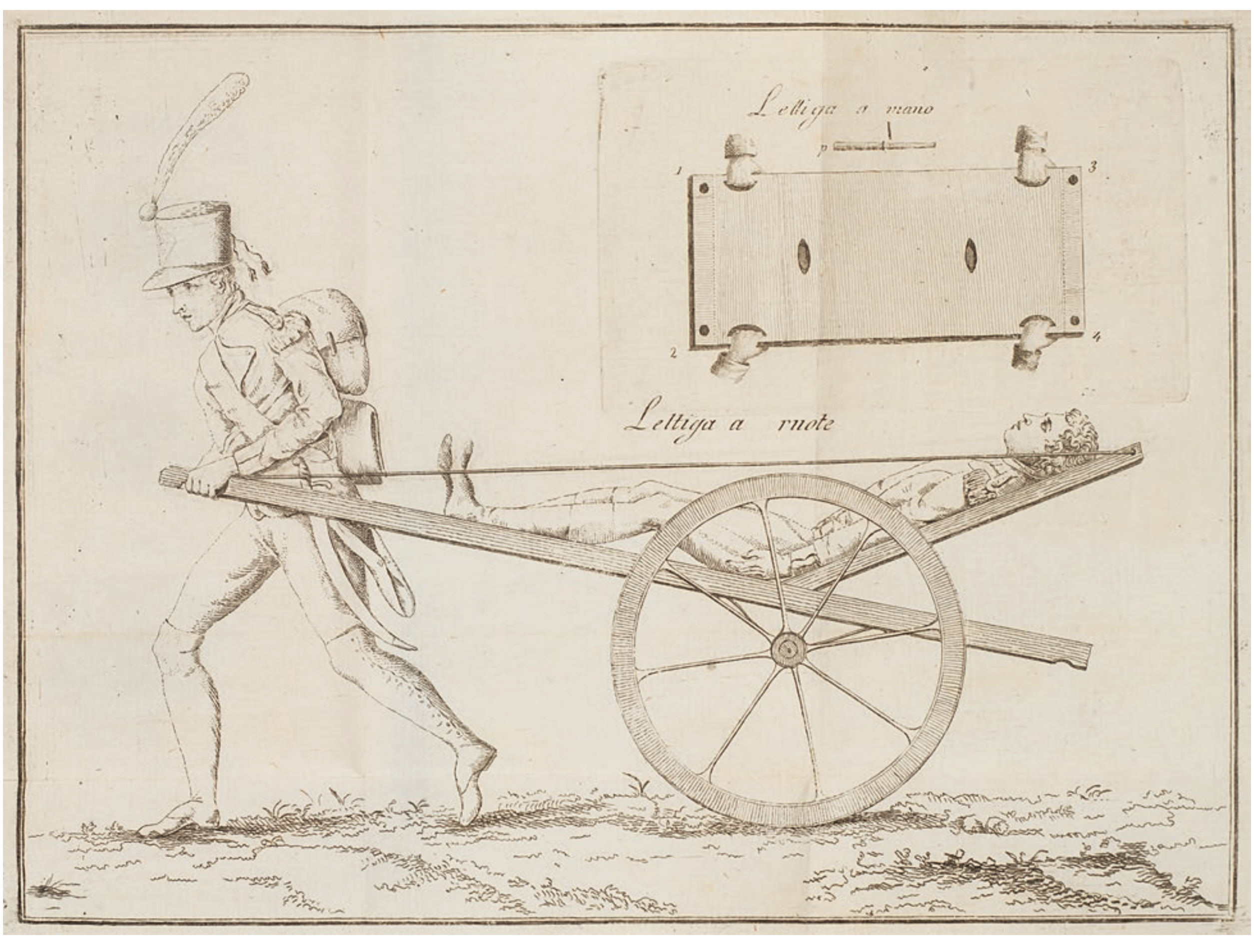


Fig. 5.41 Assalini's light and handy battlefield wheeled stretcher, holding a single wounded man and pulled by a soldier. (From: Assalini P. *Manuale di Chirurgia*. Milano, Giacomo Pirola, 1812)

5.2.3.2 Antonio Scarpa

In Pavia, **Antonio Scarpa** (1752–1832) stands among the nineteenth century's greatest personalities in the field of anatomy and surgery [48] (Fig. 5.42). Born in 1752 in Motta Livenza (Treviso, northeastern Italy), Scarpa studied medicine at Padua University under Giovanni Battista Morgagni and graduated in 1770. Shortly afterwards, he made important studies of the inner ear. For this he was offered the Chair of Anatomy and Surgery at the military hospital in Modena in 1772. He travelled around Europe to visit the leading surgical centers London, Paris, and Vienna. In 1783, on the proposal of the Austrian Holy Roman Emperor Joseph II (1741–1790), who succeeded Maria Theresa (1717–1780), he was appointed Professor of Anatomy and Surgery at Pavia, at that time the leading university in northern Italy, where he dedicated himself to anatomy. In Pavia, he began the construction of the Anatomical Theatre, designed by the Architect Giuseppe Piermarini (1734–1808), which he inaugurated in 1785. In 1787, he became Professor of Surgery at the same University. His reputation grew rapidly. An unsurpassed anatomist, especially in the field of the nerves, a great observer, formidable teacher, and superb writer, he was regarded as the most famous surgeon, orthopedist, and ophthalmologist of that period in Italy, but with a very difficult character. He wrote on orthopedics, urology, neurology, otology, and surgery. Scarpa was also a remarkable artist and medical illustrator; he made the drawings of his works personally and trained **Faustino Anderloni** (1766–1847) to become the official engraver of his numerous publications. The images by Scarpa and Anderloni stand among the finest anatomical illustrations ever produced. In 1805, Napoleon visited Pavia on his way to Rome and awarded him the Legion of Honor. In 1813, aged 62, he retired completely from surgical practice and teaching, but maintained the anatomical laboratory and the direction of the medical faculty, which he administered in a very ruthless and dictatorial way, until his death in 1832, aged 80, as a consequence of nephritis. He had numerous enemies and very few friends and coworkers. His head is now preserved at the Anatomical Museum in Pavia.

Scarpa is best remembered for the discovery of the membranous labyrinth, the nasopalatine nerve, correction of ectropion, representation of the facial musculature (Fig. 5.43), and the description of the triangle of the thigh and abdominal fascia, which eponymously bears his name. This description appeared in *Sull'ernie. Memorie anatomico-chirurgiche* (On hernias. Surgical-anatomical memoires), first published in 1809 [83], an atlas with spectacular life-size plates, drawn by Scarpa himself and engraved by Faustino Anderloni. *Scarpa's fascia* and *Scarpa's triangle* of the thigh are illustrated on Plates I, II, and VIII (Fig. 5.44).

Scarpa distinguished between femoral and inguinal hernias and congenital and acquired and described the difference between them. He wrote numerous important works: *Anatomicae disquisitiones de Auditu et de Olfacto* (Anatomical disquisitions on Hearing and Smell) (1789), *Tabulae Neurologicae* (Neurological Tables) (1794), *Saggio di Osservazioni ed Esperienze sulle principali Malattie degli Occhi* (Essay on Observations and Experiences on the main Diseases of the Eye) (1801), the first treatise on eye diseases written in Italian [84], *Sull'Aneurisma* (On Aneurysm) (1804), and *Memoria Chirurgica sui Piedi Torti Congeniti dei fanciulli* (Surgical Memoire on Congenital Club Feet of children) (1803) where he devised an orthopedic shoe for clubfoot, not very dissimilar from what is in use today [85].

Fig. 5.42 Antonio Scarpa (1752–1832) portrait. (From: Scarpa A. *Saggio di Osservazioni ed Esperienze sulle principali Malattie degli Occhi*. Pavia, B. Comino, 1801)

Fig. 5.43 Dissection of the head, with emphasis on the orbicularis oculi muscle and the inner canthal ligament. Drawing made by A. Scarpa and engraved by Faustino Anderloni (1766–1847). (From: Scarpa A. *Saggio di Osservazioni ed Esperienze sulle principali Malattie degli Occhi*. Pavia, B. Comino, 1801)

Fig. 5.44 Illustration of the abdominal fascia, and the triangle of the thigh, which eponymously bears Scarpa's name. (From: Scarpa A. *Sull'ernie. Memorie anatomico chirurgiche*. Milano, Stamperia Reale, 1809)

5.2.3.3 Luigi Porta

Reconstructive surgery continued in Pavia with **Luigi Porta** (1800–1875) and his disciple **Angelo Scarenzio** (1831–1904). After studying in Vienna, **Porta** was appointed Professor of Surgery at Pavia University from 1832 until his death in 1875. He developed plastic surgery by translating **Philipp von Walther's** (1782–1849) works into Italian and by performing numerous surgical reconstructive procedures, namely, cheiloplasty, nasal reconstruction, and genioplasty [86]. In 1866, he published an essay *Dell'Autoplastica. Memoria.* (On Autoplasty. Memoire.) [87].

5.2.3.4 Angelo Scarenzio

Angelo Scarenzio (1831–1904), trained by Luigi Porta, was appointed Professor of Dermatology in Pavia and dedicated himself to nasal reconstruction with successful results, using Blasius' folded flap technique [29, 86, 88].

5.2.3.5 Alessandro Riberi

In Turin (Piedmont), **Alessandro Riberi** (1794–1861), surgeon of the royal family, with a large clinical practice, collected his unusual case reports in *Raccolta delle Opere Minori* (Collection of Minor Works), a two-volume publication issued in 1851 [6, 89]. In Volume One, he presented a case of *Rino-geno cheiloplastica* (Nose-cheek cheiloplasty) in a 28-year-old man with a large full-thickness cheek and hemi-nose defect, possibly resulting from noma. To cover the tissue loss, he decided to use the sliding flap procedure. He outlined a cheek skin flap and advanced it toward the midline. The engraved illustration shows the pre- and postoperative situation (Fig. 5.45). The case report was preceded by a detailed review on the origin of plastic surgery, with Tagliacozzi extensively quoted.

The enduring historical tradition of anatomy and surgery was maintained in Padua by **Bartolomeo Signoroni** and **Francesco Marzolo**.

Fig. 5.45 Extensive full-thickness defect of the right cheek and hemi-nose in a 28-year-old old man affected by noma. *Left*: Preoperative situation. *Right*: Postoperative result with reconstruction by sliding flap procedure. (From: Riberi A. *Raccolta delle Opere Minori*. Torino, Carlo Schieppati, 1851)

5.2.3.6 Bartolomeo Signoroni

Bartolomeo Signoroni (1794–1844) studied medicine at Pavia University, and after graduation, he spent a 2-year period of specialization in surgery in Vienna. Upon his return, he was appointed Professor of Clinical Surgery in Pavia, and in 1830 he became Professor of Clinical Surgery in Padua [6]. He was among the first to use the forehead flap technique for nasal reconstruction in Italy [90].

5.2.3.7 Francesco Marzolo

Francesco Marzolo (1818–1880), Professor of Theoretic Surgery at Padua University, published on *Autoplastiche* (Autoplasties) in 1869 [91] where he illustrated different reconstructive cases, including excision of a large skin tumor of the nose, with immediate closure of the residual defect by two sliding flaps from the cheek; removal of a lower lid tumor and concurrent repair by an advancement flap; lower lip cheiloplasty; and cleft palate closure.

5.2.3.8 Pietro Sabattini

Among the numerous techniques available for lip repair, one of the most challenging was the lip switch flap. In 1838, the Bolognese **Pietro Sabattini** (1810–1864), an innovator in the craft of plastic surgery, described a triangular flap, outlined on the lower lip, containing skin, muscle, and mucosa, vascularized by the circumlabial artery, and transposed to the upper lip with the aim of restoring a lip defect resulting from a severe injury, re-establishing the interrupted sphincteric continuity at the same time, and anticipating the musculocutaneous flap revolution of today [6, 92, 93].

Pietro Sabattini (1810–1864), the son of a Bolognese physician, was born in 1810 (Fig. 5.46). He studied medicine at the University of Bologna and, having obtained the degree of medical doctor, became assistant surgeon at *Ospedale della Vita e della Morte*, the same hospital where Gaspare Tagliacozzi practiced almost three centuries before. In 1838, he was appointed head surgeon at *Ospedale Santa Maria* *della Scaletta* in Imola, a historic city 20 miles east of Bologna.

He served the Imola hospital continuously as head surgeon and later as administrator. He lived in a beautiful Palazzo in Imola, where he died unmarried in 1864, aged 54, after a short, but painful disease. He was buried in the Imola cemetery.

Sabattini wrote four scientific papers: *Cenno storico dell'Origine e Progressi della Rinoplastica e Cheiloplastica* (A Historical survey on the Origin and Progresss of Rhinoplasty and Cheiloplasty) in 1838; *Sull'utilità del Trapano nelle lesioni del capo* (On the use of Trephination in head lesions) in 1847; *Storia di un vasto aneurisma spurio* (…) *dell'arteria femorale* (History of a large post-traumatic aneurysm of the femoral artery) in 1848; and *Sulle ferite d'arma da fuoco* (On gunshot wounds) in 1857.

Cenno storico dell'origine e progressi della Rinoplastica e Cheiloplastica seguita dalla descrizione di queste operazioni praticamente eseguite sopra un solo individuo (A historical survey of the origin and evolution of Rhinoplasty and Cheiloplasty followed by the description of these operations performed on the same individual) [94] (Fig. 5.47 *left*) was dedicated by Sabattini to the noblemen of the city of Imola to celebrate his new appointment as head of surgery at *Ospedale Santa Maria della Scaletta.*

The work begins with a survey on the history of rhinoplasty and the value of the forehead flap. Then it continues with lip repair, where the author emphasizes that numerous procedures are available. *It is better that the surgeon should adapt cheiloplasty according to each particular case, rather than learning methods by heart*.

He describes the case of a coach driver who received a blow with a sword that cut off his nose and upper lip completely and passed into the two lateral portions of the lower lip, so that it was hanging down. The patient was immediately treated to stop the bleeding, but no attempt of either nasal or upper lip repair was envisaged. He was discharged from the hospital in this dramatic situation, without having the lower lip margins sutured together. A few weeks later, he was brought to the attention of Sabattini who planned the restoration of the missing parts (Fig. 5.47 *middle*). Seven months after the event, nasal repair, with transposition of a midline forehead flap, was successfully performed. One month later, reconstruction of the upper lip defect was initiated by a new method which included the harvesting of *enough tissue from the lower lip to restore almost all the upper lip without creating a deformity in the former*.

This is Sabattini's description: *I conceived the idea of excising a portion of it* (i.e., lower lip) *and using this to construct the upper lip. This would provide to the upper lip its shape, thickness and specific character that could not be supplied by any other tissue. With this operation I could even manage to replace the moustache. I started to freshen the deformed margins. After having taken the lower lip between the thumb and the index finger of the left hand, I incised the lining of the mouth to allow its extension in a downward direction. With a mildly bellied scalpel, I began to incise the lip on the free margin at a distance of half an inch from the left angle and extended the incision toward the symphysis of the chin. After that, I transfixed the lip and cut until I connected with the original incision so that I obtained a portion of lip cut in the shape of a pyramid with the tip toward the chin and the base above corresponding to the free margin of the lip. This base remained attached by a pedicle at its right side. I turned up this flap and with a stitch I joined the apex to the upper part of the upper lip defect, so that the left margin of this base corresponded to the freshened right margin of the missing upper lip and the right one remained pulled and contracted downward. Then I united the whole left margin of the upper lip with a twisted suture. Then I closed the lower lip with three needles in a manner similar to the operation for harelip. However, this was not entirely possible because of the presence still of the everted portion of the lip and its pedicle. In the following days, there was no setback. On the fifth day I performed the first dressing and found the right side of the new lip completely united. I severed the pedicle on the seventh day and united the planned pyramid to the left superior margin of the missing lip. Within fifteen days they were perfectly united. The base of the pyramid which had previously formed the free margin of the lower lip now constituted the free margin of the upper lip*.

Sabattini concludes by saying that both procedures had a successful outcome (Fig. 5.47 *right*). By reading the account, it is amazing to note that the lip switch procedure, described in 1838, is still used today, practically unchanged. The fame of this new operation was limited. It was seldom quoted afterwards, and Sabattini's name does not appear in major plastic surgery textbooks, possibly because the pamphlet had restricted visibility, or because Sabattini did not try to circulate his procedure in the academic world. *Cenno storico* (…) is an epoch marking publication for upper lip repair. Priority for the lip switch flap was wrongly attributed to **Robert Abbe** (1851–1928) who published a similar procedure for the correction of a sequela of bilateral cleft lip in 1898, exactly 60 years later [95].

In Rome, reconstructive surgery was carried out by **Costanzo Mazzoni** and **Paolo M. Baroni**.

Fig. 5.46 Portrait of Pietro Sabattini (1810–1864)

Fig. 5.47 Post-traumatic upper lip and nasal defect. *Left*: Title page of Sabattini's publication. *Middle*: Preoperative situation with concurrent nasal and upper lip defect; *Right*: Postoperative result. Nasal repair was achieved by forehead flap, whereas upper lip reconstructed by the lip switch method. First description in the literature. (From: Sabattini P. *Cenno storico dell'origine e progressi della Rinoplastica e Cheiloplastica.* Bologna, Belle Arti, 1838)

5.2.3.9 Costanzo Mazzoni

Born in 1823 in Ascoli (central Italy), **Costanzo Mazzoni** (1823–1885) graduated in surgery at La Sapienza in Rome. To improve his surgical knowledge, he went to the Hôtel-Dieu and Hôpital de la Pitié in Paris to practice with **Malgaigne**, **Nélaton**, and **Velpeau**. Upon his return to Italy, he was appointed head of the *San Giovanni* Hospital in Rome. In 1872, he became Associate Professor of Surgery and in 1879 was named full professor at La Sapienza. He was among the founding members of the *Italian Society of Surgery* and the first President. He contributed to nasal reconstruction and other types of facial repairs [6]. *Tre Operazioni Chirurgiche* (Three Surgical Operations), in addition to two operations in general surgery, reports on *Risecazione delle ossa mascellari superiori ed inferiore e relativa anaplastica* (Sectioning of the upper and lower maxillary bone followed by anaplasty), an account of a post-traumatic case with severe bone and soft tissue defects, resulting from a bomb explosion. Mazzoni performed different types of local skin flaps to repair nasal, cheek, and upper lip defects, with favorable final results [96]. He died in 1885, aged 62.

5.2.3.10 Paolo Baroni

Paolo Baroni (1799–1854) was born in Bologna, studied medicine there graduating in 1822, and was appointed Professor of Anatomy and Theoretical Surgery. After a period of training in Paris, he returned to Italy. In 1836, he moved to Rome, where he became the personal physician to Pope Gregory XVI and later to Pius IX. In Rome he was appointed the Director of the Military Health Service and dedicated himself to lithotripsy and to autoplasty. He died in Rome in 1854, aged 55 [6, 20, 97].

An outstanding surgeon, Baroni published on facial repair with excellent results [98]. His most important work was *Operazioni Chirurgiche* (Surgical Operations), an account of different surgical procedures for facial reconstruction as well as lithotomy, described and assembled by his co-worker **Alceo Feliciani** [99]. The facial reconstruction cases included cheek repair (autoplasty), covered by a local transposition flap, following excision for cancer and full-thickness defect of the lower lip, restored by the rotation of a bilobed submandibular flap (cheiloplasty) (Fig. 5.48).

Fig. 5.48 Full-thickness defect of the lower lip, following excision for cancer, performed by Paolo Baroni. *Left*: Preoperative situation. *Middle*: the outlining of the bilobed submandibular flap. *right*: Final result. First example of a bilobed flap in the literature. (From: Feliciani A. *Operazioni Chirurgiche fatte in Roma dal Professor Paolo Baroni*. Roma, Belle Arti, 1837)

5.2.3.11 Paolo Fabrizi

Paolo Fabrizi (1805–1859) studied in Pisa, from where he graduated in 1828. An ardent patriot, he had to leave Italy for political reasons and migrated to the island of Malta, where he practiced surgery and performed nasal reconstructions using the arm flap procedure [6, 100].

5.2.4 England

During the nineteenth century, the Scottish contribution to surgery was determinant. **Charles Bell** (1774–1842), **Robert Liston** (1794–1847), and **William Fergusson** (1808–1877) were all born in Scotland, trained at Edinburgh University, and finally established themselves in London where **Sir Astley Paston Cooper** (1768–1841) and **Francis Mason** (1817–1886) actively practiced already. Some of them are particularly relevant for plastic surgery.

5.2.4.1 Charles Bell

Charles Bell (1774–1842), the younger brother of John, was born in Edinburgh in November 1774 [48]. He attended an excellent high school, where he was given drawing and painting lessons, and obtained a degree in medicine in the University of Edinburgh under **Alexander Monro**. In 1804, due to conflicts with Monro, he moved to London where he established a school of anatomy and surgery. He became a Fellow of the *Royal Society*, the most prestigious English scientific society. He was appointed head surgeon at Middlesex Hospital in London and later at the University College. He was not only an esteemed surgeon but also a versatile and talented man: an anatomist, physiologist, artist, and prolific writer. He published extensively on a wide number of medical subjects, including neuroanatomy, surgery, the hand [101], and facial expression, and being a skilled artist, he was able to accurately draw the anatomical illustrations in all his publications (see Sect. 8.8.2.1).

Throughout the period he spent as an army surgeon during the Napoleonic wars, he had the opportunity to gather experience about different operations [102] and the relationships existing between facial injuries and impairment of motility of the facial muscles. On the basis of his clinical practice as a military surgeon, and with experience derived from experimental anatomical dissection, Bell traced the course of the nerves of the face. He is considered the first to describe the neuroanatomical etiology of peripheral facial paralysis as related to lesions of the seventh cranial nerve, which he named the *respiratory nerve* [103]. He gave the first demonstration of facial paralysis in a human being, later eponymously named **Bell's palsy.** *In the human face, the actions of the muscles which produce smiling and laughing are a consequence of the influence of this respiratory nerve* (i.e., the facial nerve). *A man had the trunk of the respiratory nerve of the face injured by a suppuration which took place anterior to the ear* (…). *It was observed that in smiling and laughing his mouth was drawn* (…) *to the opposite side*.

Bell performed some experiments on the nerves of an ass, to demonstrate the paralysis of the muscles of the face upon sectioning the fifth and the seventh nerve. In 1821, in *Philosophical Transaction*, the official Journal of the Royal Society of London, he published *On the Nerves*, a cornerstone work extremely important in the history of neurology, where he showed that on cutting the facial nerve *the side of the face remained at rest and placid, during the highest excitement* [103].

In 1836, he returned to Edinburgh to assume the position of Chair of Surgery at that University. He died in 1842, aged 68.

Illustrations of the Great Operations of Surgery [102] is one of the most remarkably illustrated works in the history of surgery. Bell himself sketched operations over several years. He had his own typical style in illustrating medical textbooks, with vividness, energy, and feeling. Scenes are often crude and dramatic, as in Plates 11 and 12, representing amputation at the shoulder joint (Fig. 5.49). Plates were colored by hand. **Thomas Landseer** (1795–1880), brother of the animal painter Edwin Landseer and a foremost engraver of the nineteenth century, was probably the illustrator of all the drawings, as some of them were signed by him.

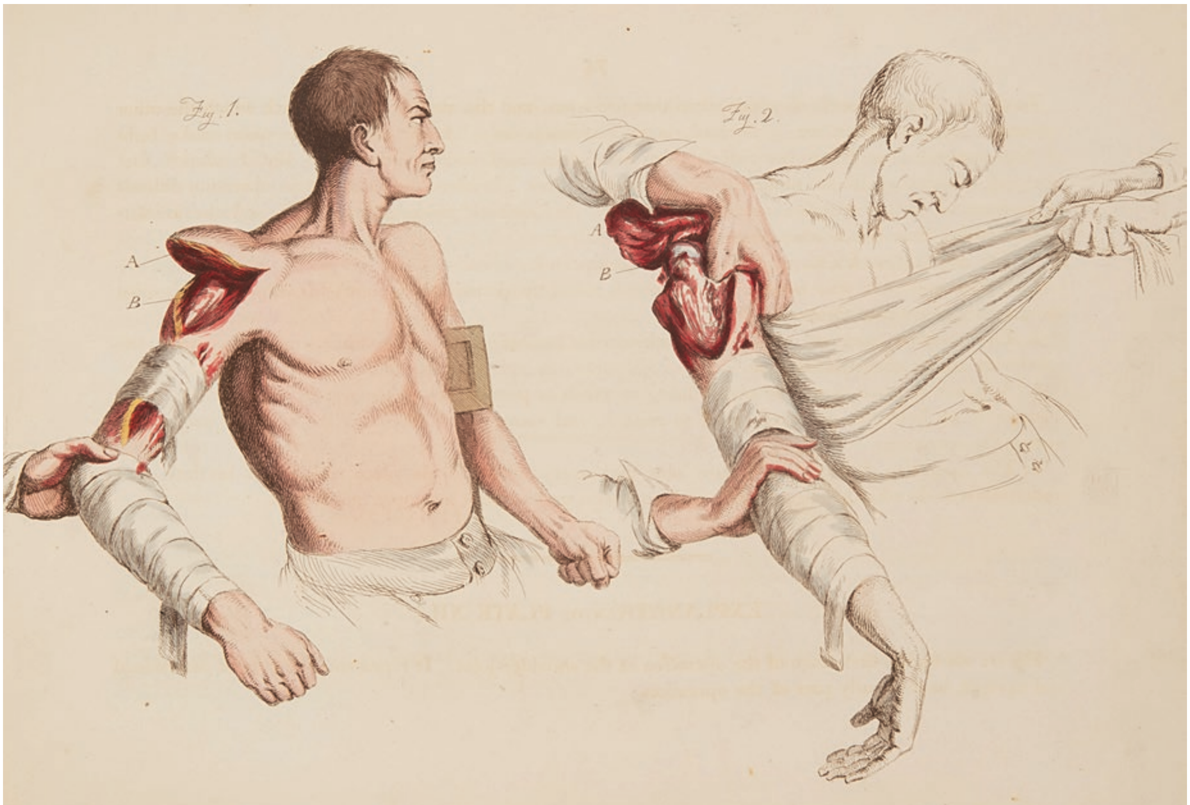


Fig. 5.49 Amputation of the upper limb at the shoulder joint (drawn by Charles Bell). *Left*: Preoperative situation. *Right*: Upper limb resection, with the patient fainting. (From: Bell C. *Illustrations of the Great Operations of Surgery*. London, Longman, and others, 1821)

5.2.4.2 Astley Paston Cooper

Astley Paston Cooper (1768–1841) was born in Brooke (Norfolk), the son of a clergyman, and studied medicine in London under **Henry Cline**, surgeon and anatomist. He became a student of **John Hunter** (1728–1793), one of the most remarkable surgeons of the period [48]. In 1792, he moved to Paris to practice under **Pierre-Joseph Desault** and **François Chopart**. Upon his return to London, he was appointed head surgeon at St. Thomas Hospital and, in 1793, Professor of Anatomy at Surgeon's Hall. In 1805, he succeeded his uncle, William Cooper, as a surgeon at Guy's Hospital, London. In the same year, Cooper was one of the founding members of the *Royal Medical and Chirurgical Society of London.* He was one of the most prominent surgeons of London with a flourishing private practice. His patients were the most exclusive and influential of the city. He treated King George IV, who conferred a baronetcy upon him. Later, he was surgeon to William IV and Queen Victoria. In 1836–1837, he was nominated as President of the Royal College of Surgeons. As a teacher of surgery, he was considered unsurpassed among the British surgeons by his contemporaries. Cooper's contributions to surgery were numerous and varied, mainly in the field of arterial surgery, hernia, thymus, and breast.

On the anatomy of the breast, one of Cooper's last works, issued in 1840, is a complement to *Illustrations of the diseases of the breast*, first published in 1829, which remained incomplete as far as malignancies are concerned. It is intended to describe the natural structure and physiology of the female as well as the male breast [104]. The atlas has beautiful lithographic illustrations, many of them in color.

The text includes the description of the suspensory ligaments of the mammary gland, fibrous processes extending from the body of the mamma to the corium, the so-called eponymously named Cooper's ligaments: *The fascia mammae is divided into two layers: the superficial and the deeper layer of the breast, between which the gland of the breast is included*. (…) *The anterior of the superficial layer passes upon the anterior or cutaneous surface of the breast: here it forms a fibrous covering, but not a true capsule, spread upon the surface of the gland and passing between the gland and the skin, but it also enters the interior of the secretory structure. Here it sends out two sets of processes of a fibrous nature from its two surfaces. Anteriorly, large, strong and numerous fibrous or fascial processes, to the posterior surface of the skin, which covers the breast and to the substance of which it is received and with which it is incorporated. It is by these processes that the breast is suspended in its situation and I shall therefore call them the ligamenta suspensoria. By these processes the breast is slung upon the forepart of the chest, for they form a moveable but very firm connexion with the skin, so that the breast has sufficient motion to* *elude violence; yet this fibrous tissue it is, excepting under age, lactation or relaxation, prevented from much change of place. The ends of these ligaments are spread out and incorporated with the posterior surface of the skin, and give it its whiteness and firmness*. (…) *When the breast is placed in its natural position, the posterior extremities of the ligamenta suspensoria are spread over the fore-part of the gland, support numerous folds of the glandular structure, penetrate the substance of the organ and everywhere connect the portion of glands to each other* (Fig. 5.50).

Fig. 5.50 The suspensory ligaments of the breast. The illustration (*above*) shows the *ligamenta suspensoria* passing from the anterior surface of the gland to the skin, supporting the folds and leaving considerable cavities between them in which the fat is contained. (From: Cooper AP. On the Anatomy of the Breast and Atlas. London, Longman, 1840)

5.2.4.3 Francis Mason

In 1878, **Francis Mason** (1817–1886) issued *On the Surgery of the Face*, one of the first texts, if not the first, to be entirely devoted to surgery of the face [105]. It contains three *Lettsomian* lectures, delivered by Mason at the *Medical Society of London*, dealing with facial tumors, traumas, congenital malformations, nasal reconstruction, cheiloplasty, and scar contractures. He illustrates the case of a child with severe neck contracture from burns, successfully treated with the transposition of skin flap harvested from the thorax (Fig. 5.51).

Francis Mason studied medicine at King's College, London. Appointed assistant surgeon at King's College Hospital, he became lecturer in anatomy and full surgeon at Westminster Hospital in 1871 and later at St. Thomas Hospital. He dedicated himself to facial surgery and cleft lip and palate, publishing a book on cleft lip and palate in 1877. He died in 1886, aged 69, from a severe throat inflammation.

Fig. 5.51 Sequelae of severe burns of the neck in a child. *Top*: Preoperative situation. *Bottom*: Treatment by transposition of a skin flap from the anterior thorax. (From: Mason F. *On the Surgery of the Face*. London, John and A. Churchill, 1878)

5.2.5 Hungary

The nineteenth century saw the beginning of the development of medicine and surgery in Hungary [106]. The great majority of the professors of Pest University had studied medicine in Vienna.

Janos Balassa (1814–1868) was probably the most relevant personality of the period [107]. He was a medical student at Pest. After graduation, he went to Vienna and to Paris to improve his surgical knowledge. Upon his return, he was appointed head of surgery at the University Hospital in Pest. During the Hungarian War of Independence, he took care of the military hospital and showed great interest in plastic reconstructive procedures, in particular nasal repair. He favored the lining concept to avoid flap shrinkage. He died in 1868, aged 54, from complications of appendicitis.

Balassa published several works on plastic surgery, among them *Uj Mütetmodorok as Orrkeplés Körül* (New operative methods of Nasal Reconstruction) issued in 1863 [108] and *A Képző-Műtétek* (*Operationes Plasticae*) (Plastic Operations), issued in 1867 [109], where Balassa reported different cases of facial repairs, cheiloplasty, nasal reconstruction (Fig. 5.52), and lower eyelid repair, accurately illustrated in color, with before and after surgery images and details about the adopted technique. It was based on the inaugural lecture delivered at the *Academy of Sciences.*

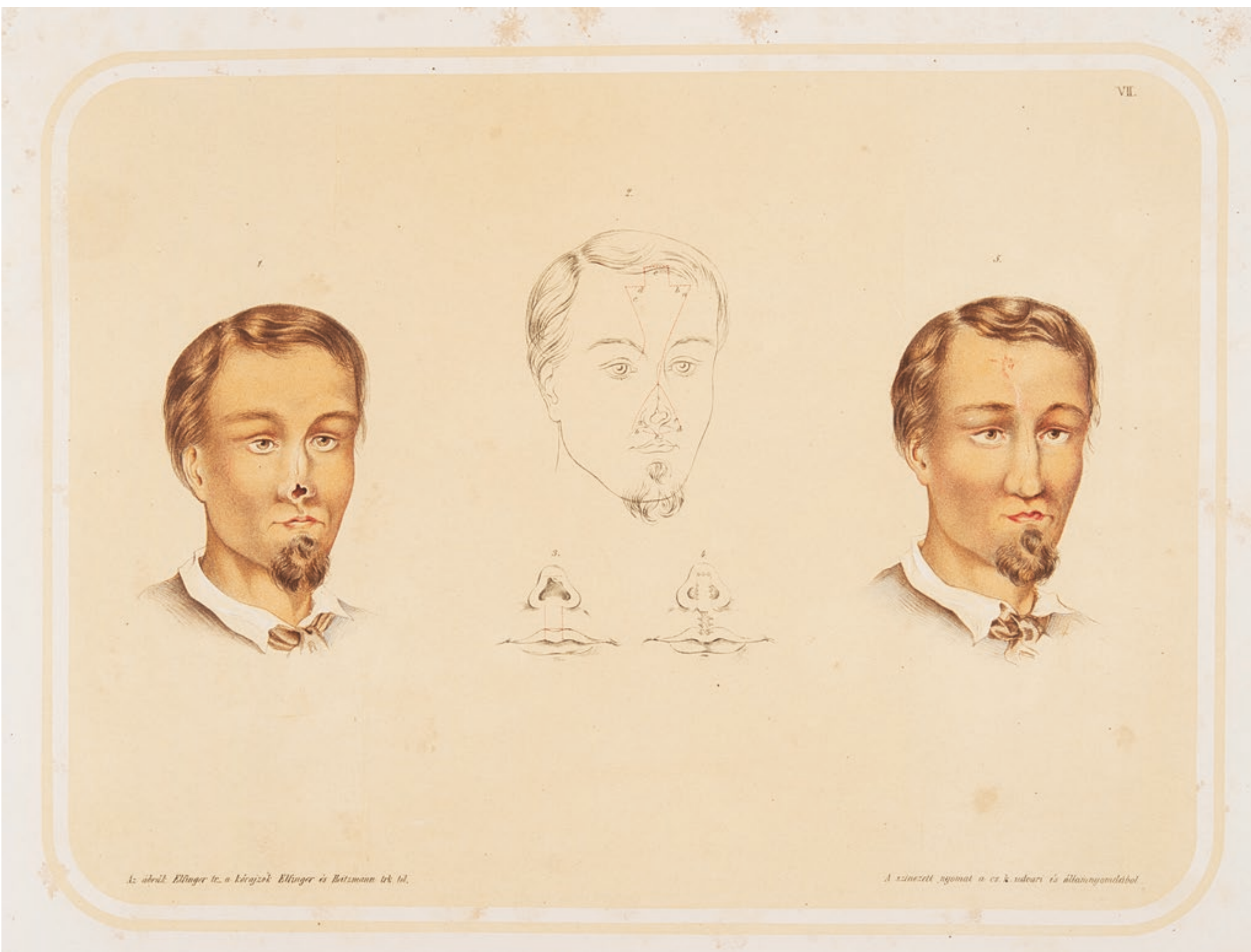


Fig. 5.52 Reconstruction of the nose with the transposition of a forehead flap. *Left*: Preoperative situation. *Right*: Final result following forehead flap transposition. The columella was provided using labial tissue. (From: Balassa J. *A Képző-Műtétek (Operationes Plasticae)*. Pest, G. Emich, 1867)

5.2.6 Russia and Ukraine

5.2.6.1 Nikolay Pirogov

Nikolay Pirogov (1810–1881) was one of the greatest surgeons and anatomists of the nineteenth century. Born in Moscow, he studied surgery and anatomy at Dorpat University in Estonia. Professor of Surgery in Moscow and later in St. Petersburg, he is best known for his contribution to surgery and to war medicine and for the revolutionary methods for the treatment of injured soldiers, given his experience in the Crimean War, during the siege of Sebastopol. He introduced the use of plaster of Paris for immobilizing fractures and was among the first to use general anesthesia after its discovery in 1846. In anatomy, he described the triangle of the neck, bound by the intermediate tendon of the digastric muscle, the posterior border of the mylohyoid, and the hypoglossal nerve to locate the lingual artery. In 1866, he operated on **Julius von Szymanowski** for the excision of a testicular carcinoma. He died in 1881, aged 71, at his estate in Vishnya.

5.2.6.2 Julius von Szymanowski

Julius von Szymanowski (1829–1868) was born in Riga (Latvia) to a Polish noble family. He studied at the Tallinn Gymnasium in Estonia and attended medical school at Dorpat University. He was a student of **Georg von Adelman** (1811–1888) who replaced the Russian surgeon **Nicolay Pirogov** (1810–1881) at Dorpat University. He served with the Russian army in the Crimean War (1854–1856) with his teacher Adelmann. Having such a great opportunity, he soon became a talented surgeon. At the completion of the war, he returned to Dorpat where in 1856 he obtained his medical degree discussing the thesis *Additamenta ad Ossium Resectionem* (Additions to Bone Resection). He was appointed university lecturer, and in 1857 he published *Adnotationes ad Rhinoplasticem* (Annotations about Rhinoplasty), an important historical review of all the known cases of nasal reconstruction from the Brancas in the fifteenth century to the year 1856, when von Szymanowski performed his first nasal repair. He listed and documented 225 cases from the literature.

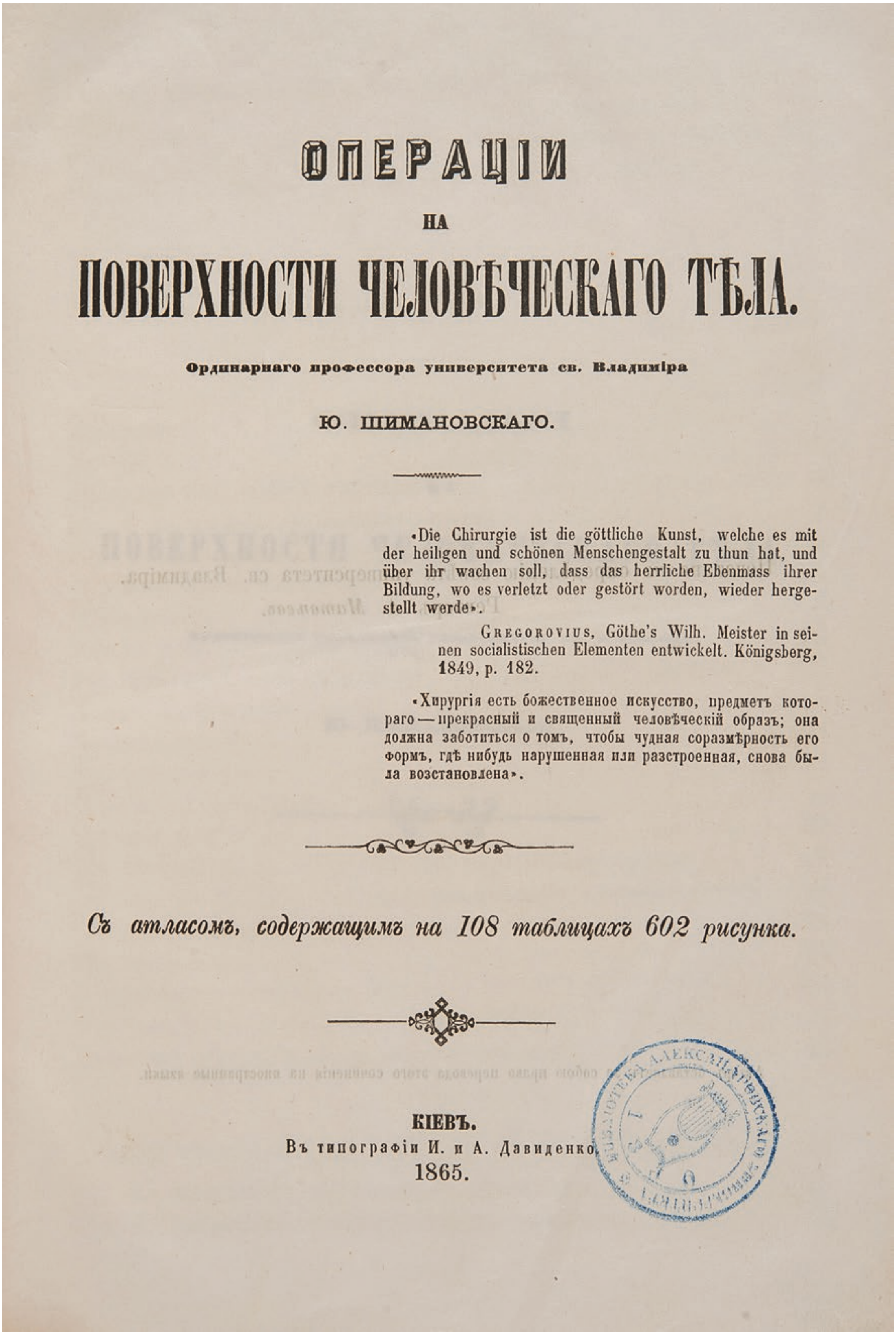
In 1858, he was nominated as University Professor of Surgery to Emperor Alexander University in Helsinki. During this period, he became very interested in reconstructive procedures, published numerous papers, and contributed to Pirogov's textbook *Surgical Anatomy of the Arteries and Fascia*. While in Helsinki he married Adelaide, a Finnish lady [110].

In 1860, at the age of 30, he was appointed Professor of Operative Surgery at St. Wladimir Imperial University Hospital Surgery in Kyiv (Ukraine). Despite his young age, he started to collect cases for his future textbook on plastic surgery *Operatzij na poverchnosti* (…), which was published in 1865, in Russian [111] (Fig. 5.53). With the cooperation of his co-worker **Carl Wilhelm Ferdinand Uhde** (1813–1883) of Braunschweig (Germany), he began its translation into German [112]. Regrettably, the following year he was diagnosed with testicular carcinoma, which was excised by the famous Nikolay Pirogov, but it eventually recurred and metastasized. He died in 1868, aged 39 [110, 113].

Operatzij na poverchnosti (…) (Operations on the surface of human body) contains more about plastic surgery than any other nineteenth-century book, states Blair Rogers in his biography of von Szymanowski [114].

The work is divided into two parts with a separate title page [111]. <u>Part One</u> includes text about operations for management of eyelid, lip, ear, nose, genital area, and skin diseases. <u>Part Two</u> contains the atlas with 108 plates with more than 600 illustrations. It shows the steps of the different procedures, simple or complicated, used for reconstructing the different areas of the body, mainly in the face. Blepharoplasty, cheiloplasty, genioplasty, otoplasty, and rhinoplasty—all these operations are extensively illustrated, with drawings made by von Szymanowski himself. The book is an endless source of ideas for closing facial defects or for reconstructing missing parts [6].

In tracing Julius von Szymanowski's biography, the Dutchman Klaas Marck emphasized his unique, original contributions to plastic surgery and entitled the textbook he wrote *Another way of thinking. The life of Julius von Szymanowski* [110]. The operation for the correction of the ectropium is illustrated in Plate 51 (Fig. 5.54). The procedure was further improved by the German ophthalmologist **Herrman Kuhnt** (1850–1925). Nowadays, it is eponymously named the Kuhnt-Szymanowski operation. Elongation of a short nose, with a VY-plasty, is reported in Plate 90 (Fig. 5.55); closure of the inner canthal defect using a forehead flap, in Plate 48; the submandibular flap for repairing the oral commissure in Plate 62; ear reconstruction for microtia in Plate 76 (Fig. 7.70); and the cross-leg flap in Plate 6 (Fig. 5.56). Several illustrations are inspired by or even taken from the atlas of *Plastische Chirurgie* by **Fritze** and **Reich** (1845) [24]. The work was well received by the Medical Faculty of Kyiv who decided to support the printing expenses of <u>Part One</u> and awarded <u>Part Two</u> with a grant of 1500 silver rubles. The book, little known in the western world, constitutes a landmark of nineteenth-century plastic surgery.



ОПЕРАЦІИ

НА

ПОВЕРХНОСТИ ЧЕЛОВѢЧЕСКАГО ТѢЛА.

Ординарнаго профессора университета св. Владиміра

Ю. ШИМАНОВСКАГО.

«Die Chirurgie ist die göttliche Kunst, welche es mit der heiligen und schönen Menschengestalt zu thun hat, und über ihr wachen soll, dass das herrliche Ebenmass ihrer Bildung, wo es verletzt oder gestört worden, wieder hergestellt werde».

Gregorovius, Göthe's Wilh. Meister in seinen socialistischen Elementen entwickelt. Königsberg, 1849, p. 182.

«Хирургія есть божественное искусство, предметъ котораго — прекрасный и священный человѣческій образъ; она должна заботиться о томъ, чтобы чудная соразмѣрность его формъ, гдѣ нибудь нарушенная или разстроенная, снова была возстановлена».

Съ атласомъ, содержащимъ на 108 таблицахъ 602 рисунка.

КІЕВЪ.

Въ типографіи И. и А. Давиденко.

1865.

Fig. 5.53 Title page of Julius von Szymanowski *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865

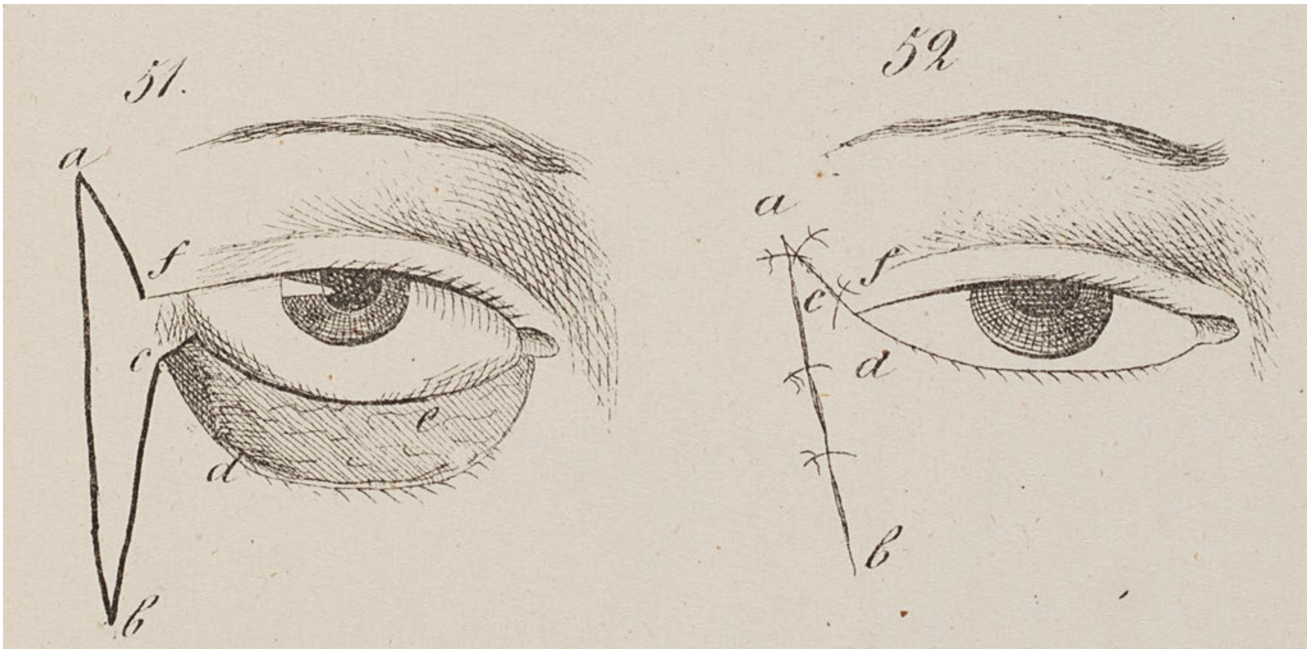


Fig. 5.54 Correction of ectropion by Szymanowski's method. *Left*: Preoperative situation with the scheme of the procedure. *Right*: Final result with the advancement of the lower lid skin-tarsal flap in an upward position with respect to the external canthus. (From: Szymanowski J. *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865)

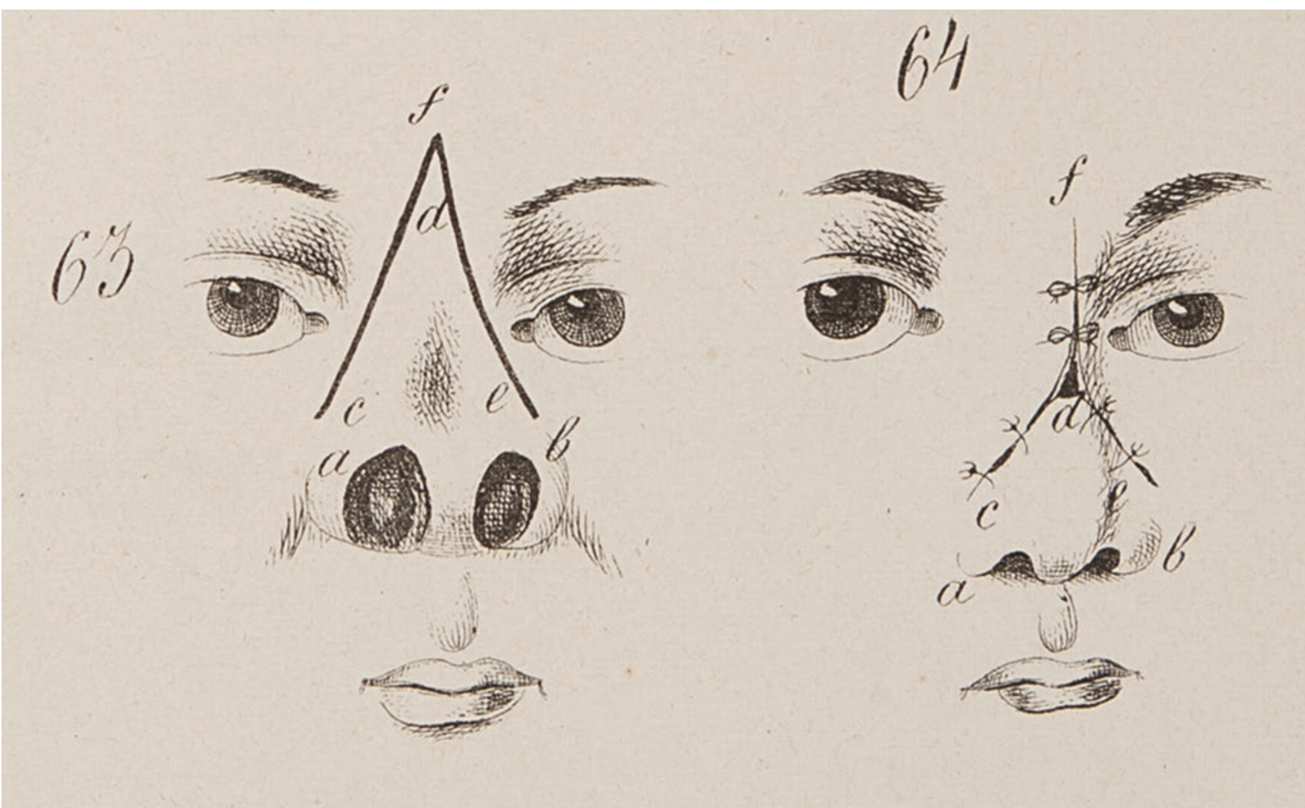


Fig. 5.55 Elongation of a short nose by the V-Y advancement flap. (From: Szymanowski J. *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865)

Fig. 5.56 Repair of cutaneous defects of the lower leg by using the contralateral leg as donor site, the so-called cross-leg flap. (From: Szymanowski J. *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865)

5.2.7 Finland

In 1860, after von Szymanowski left for Kyiv, the Finnish **Jakob August Estlander** (1831–1881), despite his young age, won the contest to become the new Professor of Surgery at the Emperor Alexander University in Helsinki. Estlander graduated in medicine in 1858. To improve his medical education, he visited numerous centers in France, England, and Germany. He was interested in various fields of surgery, reconstructive surgery included. In 1881, on a trip to Italy, Estlander contracted malaria and died in Messina (Sicily), aged 50, and was buried in the Messina Cemetery *Camposanto Evangelico* [115].

A method of reconstructing the loss of substance in one lip from the other lip, published in *Archiv f. klinische Chirurgie,* illustrates a procedure still used today for repairing a lower lip defect following cancer excision, using a full-thickness flap outlined in the upper lip, vascularized by the coronary artery. The author describes three cases and accompanies the text by two self-explanatory woodcut illustrations [116, 117] (Fig. 5.57).

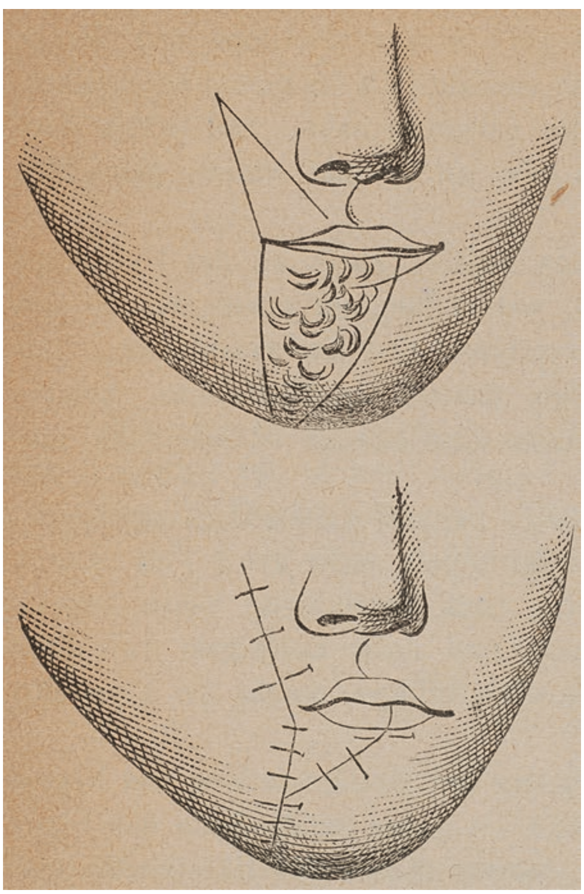


Fig. 5.57 Full-thickness flap outlined in the upper lip, vascularized by the coronary artery, and transposed to the lower lip to close a defect, following excision for cancer. *Top*: Preoperative situation. *Bottom*: Final result with the flap in position. The donor site is primarily closed. (From: Estlander JA. Eine Methode aus der einen Lippe Substanzverluste der anderen zu ersetzen. *Arch f klin Chir.* 1872; 14: 622–631)

5.2.8 United States

In colonial America, the need for physicians grew desperate. Doctors arriving in the colonies were ship's surgeons, more interested in selling remedies than treating wounds or curing patients. The sanitary situation was critical and did not allow one to pioneer in science. Books were scarce. European cultural centers, as well as medical universities, were too far away to refer to them, and only a few privileged families could afford to send their sons to Europe to obtain the necessary education. Doctors were trained by the apprentice system because medical schools were lacking. Very few had a university degree.

However, in the middle of the eighteenth century, the situation gradually changed. Three doctors, **William Shippen** (1736–1808) and **John Morgan** (1735–1779) from Philadelphia and **Sam Bard** (1742–1821) from New York, went to Europe to obtain training and medical degrees in Edinburgh [118]. Upon their return to their home city in 1762, **William Shippen Jr.** and **John Morgan** established the first medical school in America for teaching anatomy, surgery, and obstetrics in 1762 in Philadelphia.

The Pennsylvania Hospital, the oldest in America, established in 1751, grew rapidly into an educational center of great importance. Another key figure in the development of American medicine was **Benjamin Rush** (1745–1813), also from Philadelphia. He had a similar background to that of Shippen and Morgan, having obtained an MD from Edinburgh and trained more than 3000 doctors, remaining an inspiring example. He was a physician of great intellectual stature and the first American doctor to achieve an international reputation [118]. In 1768, **Sam Bard** founded the first medical school and hospital in New York and the second in America, at King's College, later Columbia University. Numerous other medical schools were soon established throughout America rapidly contributing to a change in the medical situation in general surgery, obstetrics, and orthopedics.

In this new, favorable scenario, American reconstructive surgery developed, thanks to some leading personalities of the period, **Mettauer**, **Mütter**, **Pancoast**, **Prince**, **Mason Warren**, **Buck**, **Monks**, and others [119], and to the introduction of general anesthesia on October 16, 1846, at Massachusetts General Hospital in Boston.

5.2.8.1 John Peter Mettauer

John Peter Mettauer (1787–1875) was born in Prince Edward County, Virginia, and graduated in medicine from the University of Pennsylvania in 1809. He returned to Virginia where he practiced surgery and gynecology. He was considered one of the best surgeons of the period and credited with having carried out the first cleft palate closure in the Americas (1827). He died in 1875, aged 88.

He published *On Staphyloraphy* in 1837 in *American Journal of Medical Sciences*, where he described the technique for cleft palate closure in detail and the instruments necessary to perform it [6, 119, 120].

5.2.8.2 Thomas Dent Mütter

Thomas Dent Mütter (1811–1857), a native of Virginia, graduated in medicine from the University of Pennsylvania in 1831. Soon thereafter, he went to Europe to specialize in surgery. He visited Dupuytren, Roux, Boyer, Lisfranc, Velpeau, and Larrey in Paris; Dieffenbach in Berlin; and Liston in London [6, 20, 119]. He carefully studied the origin of scars, their characteristics, and the dramatic consequences of scar contractures in the neck. In 1841, he operated on a 28-year-old woman, severely burned when she was 5 years old, with her chin drawn down *to within one and one-half inches from the top of the sternum, which made her unable to close her mouth, nor could she turn her head from side to side*. (…) *I began the operation by making an incision which commenced on the outside of the cicatrix in sound skin, and passed across the throat into sound skin on the opposite side*. He created an extensive release of the scar, divided both sterno-cleido-mastoid muscles, and outlined a large skin flap in the shoulder, which he transposed to cover the defect. *I commenced at the terminal extremity of the first incision and carrying the scalpel downwards and outwards over the deltoid muscle, dissected up an oval piece of integument, six and one-half inches in length, by six inches in width, having it attached at the upper part of the neck. The dissection was painful, but not bloody, only one small vessel being opened. The flap thus detached was next brought around by making a half turn in its pedicle, placed in the gap it was destined to fill, and carefully attached by several twisted sutures* [121] (Fig. 5.58). The final result demonstrated a considerable improvement of the neck contracture.

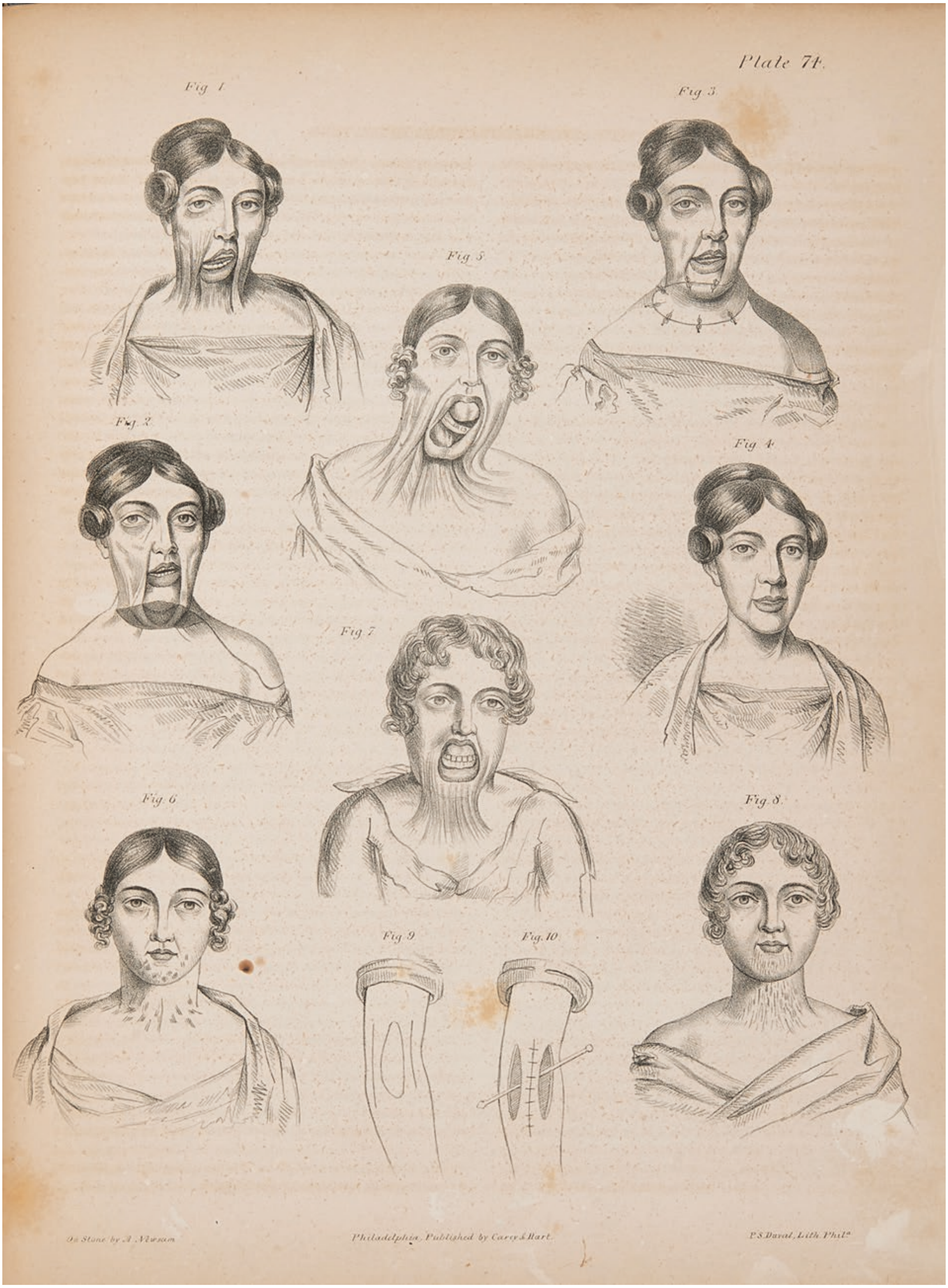


Fig. 5.58 Severe neck contracture from burns. Repair by transposing a shoulder flap as described by T.D. Mütter. (Fig. 1) Preoperative situation. (Fig. 2) Excision of the scar tissue. Outlining of the shoulder flap to cover the skin defect. (Fig. 3, 4) Final result. The shoulder flap is sutured in position. (From: Pancoast J. *A Treatise on Operative Surgery*. Philadelphia, Carey and Hart, 1844)

5.2.8.3 Joseph Pancoast

Another surgeon of the period was **Joseph Pancoast** (1805–1882), who also graduated from the University of Pennsylvania, in 1828. He became Professor of Anatomy and Surgery at Jefferson Medical College, Philadelphia, in 1838. Pancoast performed a number of reconstructive operations including the first successful management of the exstrophy of the bladder, nasal reconstruction, a free skin graft for earlobe repair, and section of the second and third branch of the fifth cranial nerve at their emergence from the base of the brain [6, 119].

In 1844, he published *A Treatise on Operative Surgery*, a beautiful, well-illustrated surgical atlas, among the most spectacular ever printed in the United States in the nineteenth century [122]. It included 80 plates, drawn by the author himself, with 486 lithographic illustrations showing the operations known at that time. Some plates were adapted and reduced in size from larger images by **Nicholas Henri Jacob** (1882–1871), published in *Traité complet de l'Anatomie de l'Homme* by Bourgery (see Sect. 8.8.1.3). Part Four is entirely devoted to plastic surgery. It is probably the most important account of the discipline issued in America during the period. Pancoast described numerous original operations, among them the closure of a perforation of the hard palate by two reverse quadrilateral flaps, nasal reconstruction with the forehead flap, repair of a nasal defect with skin harvested from the cheek (Fig. 5.59), restoration of the upper and lower lip by transposing flaps from the adjacent region, blepharoplasty, and otoplasty.

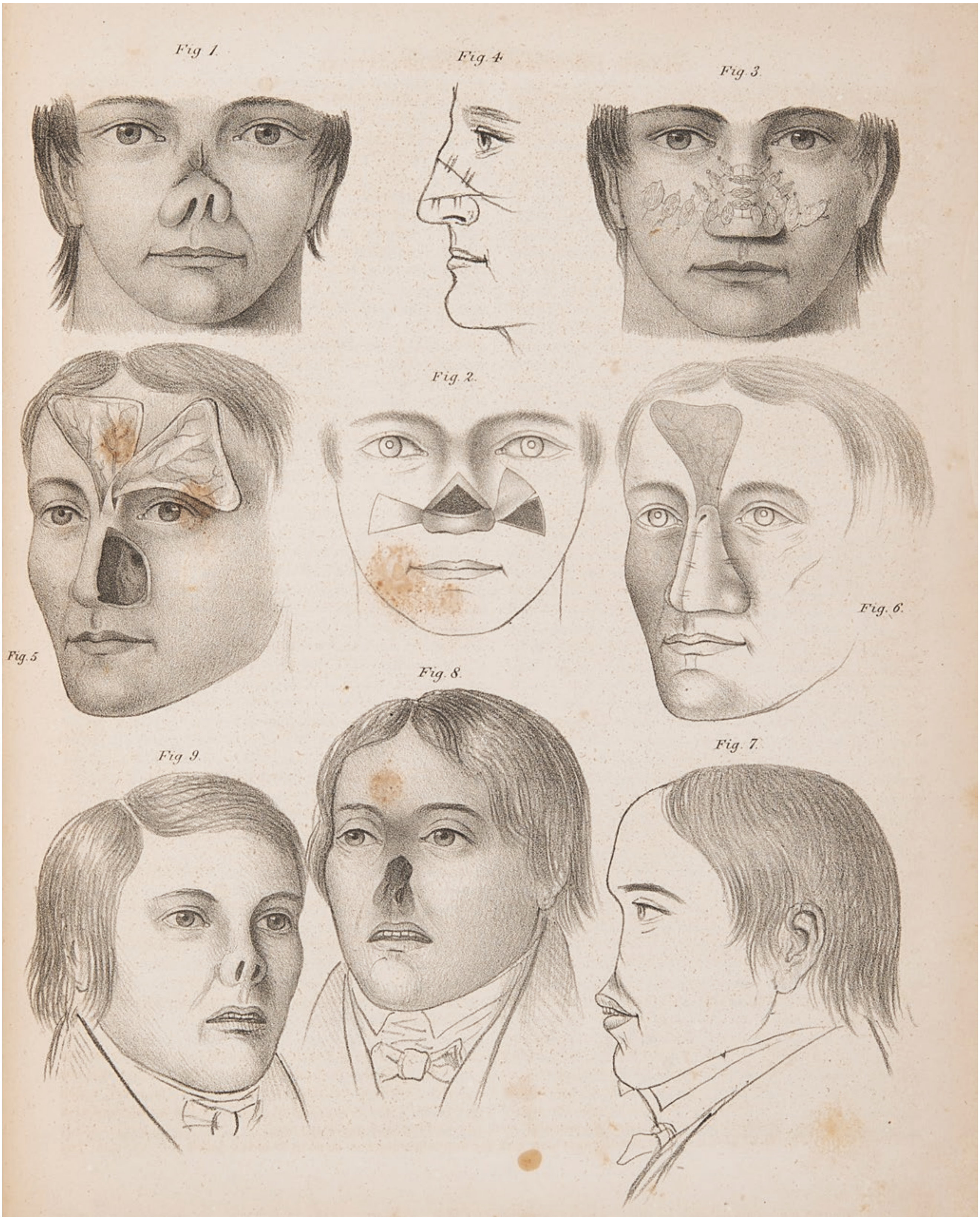


Fig. 5.59 J. Pancoast: repair of a nasal defect with skin harvested either from the cheek or from the forehead. (From: Pancoast J. *A Treatise on Operative Surgery*. Philadelphia, Carey and Hart, 1844)

5.2.8.4 David Prince

David Prince (1816–1889) was a very able reconstructive surgeon. He graduated from the Medical College of Ohio and established himself in Jacksonville (Illinois). He served as a brigade surgeon during the American Civil War treating a large number of prisoners [6, 119].

In 1867, he issued *Plastics* [123], an overview of the different plastic surgical procedures performed at that time, for scar correction; nasal reconstruction; ear, upper and lower lid, and lip repair; sequelae of burns of the face; and neck correction.

5.2.8.5 Gurdon Buck

Gurdon Buck (1807–1877) was born in New York and studied medicine at Columbia University. In 1830, when he obtained his medical degree, he visited Vienna, Paris, and Berlin, where he remained for almost 3 years to improve his surgical knowledge. Upon his return to the United States, he established himself in New York, becoming one of the leading surgeons at New York Hospital [119]. He was the first physician to use pre- and postoperative photographs in his publications. He served in the Civil War (1861–1865) as a military surgeon. A pioneer in reconstructive procedures, he published the first textbook in this field in the United States. He died in New York in 1877, aged 70.

Contributions to Reparative Surgery [124] is the first American work entirely devoted to reconstructive plastic surgery. The text, well-illustrated with pre- and postoperative woodcuts based on photographs, begins with the description of basic reconstructive procedures for covering defects, using skin approximation or flap transfer. In Part One, Buck describes cases of severe facial injuries treated with local flaps. In Part Two, he shows congenital anomalies including uni- or bilateral harelip, macroglossia, and hemangiomas. In Part Three, he illustrates sequelae of burns of the face, limbs, and axillae (Fig. 5.60).

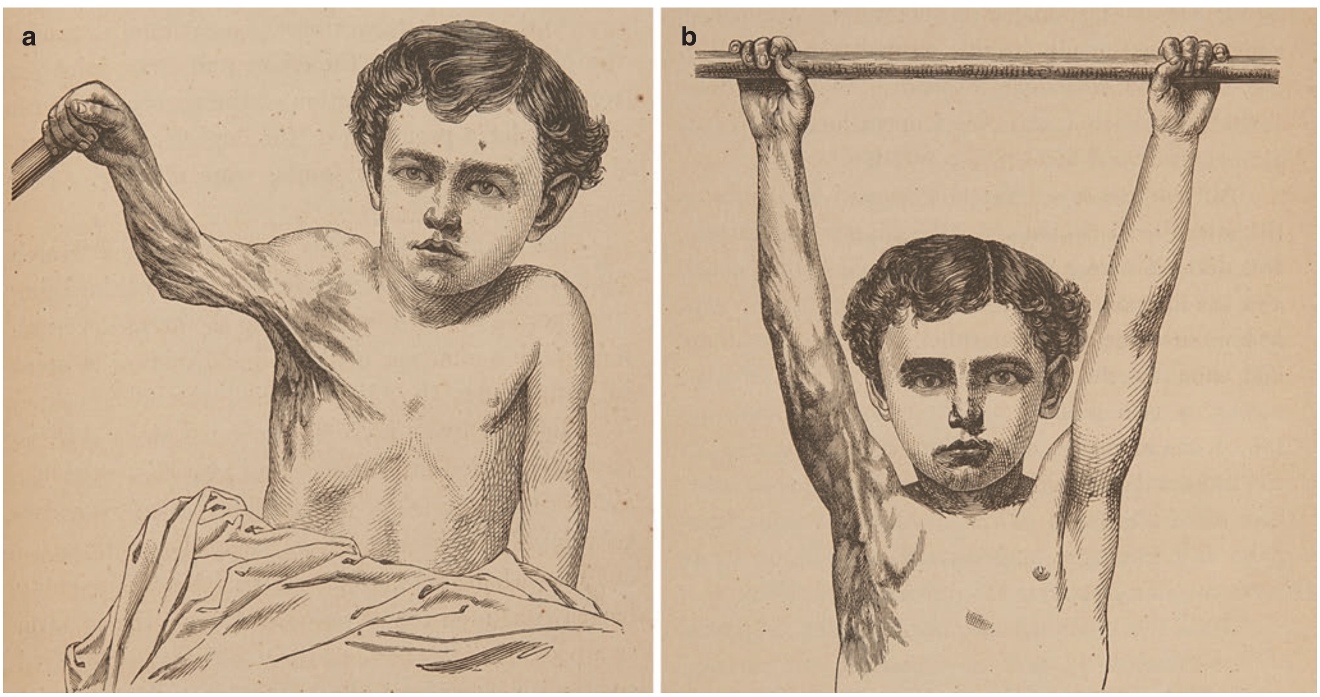


Fig. 5.60 (**a**, **b**) Scar contractures of the right arm and axilla in a 6-year-old child. (*Left*): Preoperative situation. *Right*: Result after 15 months and three operations. (From: Buck G. *Contributions to Reparative Surgery*. New York, D. Appleton, 1876)

5.2.8.6 Jonathan Mason Warren

Jonathan Mason Warren (1811–1867), the son of the surgeon **John Collins Warren** (1778–1856), studied medicine at Harvard Medical School. Having obtained his medical degree in 1832, he too visited European surgeons in Paris, Berlin, London, and Edinburgh, observing Dupuytren, Roux, and Dieffenbach. Upon his return to the United States in 1835, he established himself in Boston, joining his father's extensive practice. In 1843, he performed the first operation for hard palate closure, known as uranoplasty, whereas for soft palate he carried out over 100 cases of mucosal approximation, most of them very successful, according to Roux. On October 16, 1846, he was present at the famous *Ether Day* at Massachusetts General Hospital, the first public demonstration of the use of anesthesia in surgery, for the excision of a facial hemangioma performed by **John Collins Warren** [6, 119, 125].

During the Civil War, **Mason Warren** treated numerous injured soldiers at the Massachusetts General Hospital where he was one of the surgeons. From these cases, and from his previous 30-year experience in practice, he derived the textbook *Surgical Observations with cases and operations*, issued in 1867 [126]. Cases were presented according to the regions of the body. Chapters 2 and 3 were devoted to face and neck operations. Of particular relevance to plastic surgery are rhinoplastic procedures for the restoration of nasal defects either with forehead flap or with arm flap. He also described a successful full-thickness skin graft antedating the work of Wolfe [127], the use of the nasolabial flap to repair an alar defect, lower eyelid repair by rotation and advancement flaps, as well as closure of lower lip defects after cancer, the so-called cheiloplasty. He emphasized the importance of the deviated septum (p. 62): *We seldom observe in books on surgery any reference to the question of the treatment of this affection; it being principally noticed in connection with the differential diagnosis of polypus and mucous thickening of the nasal cavities. It is, however, an affection of some importance, and one in consequence of which patients often apply for treatment*. His method of treatment was: *by inserting a small bougie into the obstructed nostril, keeping it upon the floor of the cavity, so as to prevent its penetrating either in an upward or lateral direction*. Patients were instructed to repeat the procedure daily at home. Having observed Dieffenbach and Roux directly during his European trip, Mason Warren treated harelip and cleft palate closure. Among the group of vascular tumors, he considered hemangiomas and reported the case history of a 23-year-old man with a vascular ulcerated tumor of the lower lip, mouth, face, and neck. He decided to ligate both carotid arteries obtaining a favorable result in terms of ulceration and swelling improvement (Fig. 5.61). Finally, Chapter 14 is on anesthetics. The author traced the history of the use of ether in surgery, starting from *Ether Day*, in 1846. Mason Warren died in 1867, aged 56, the year his book appeared.

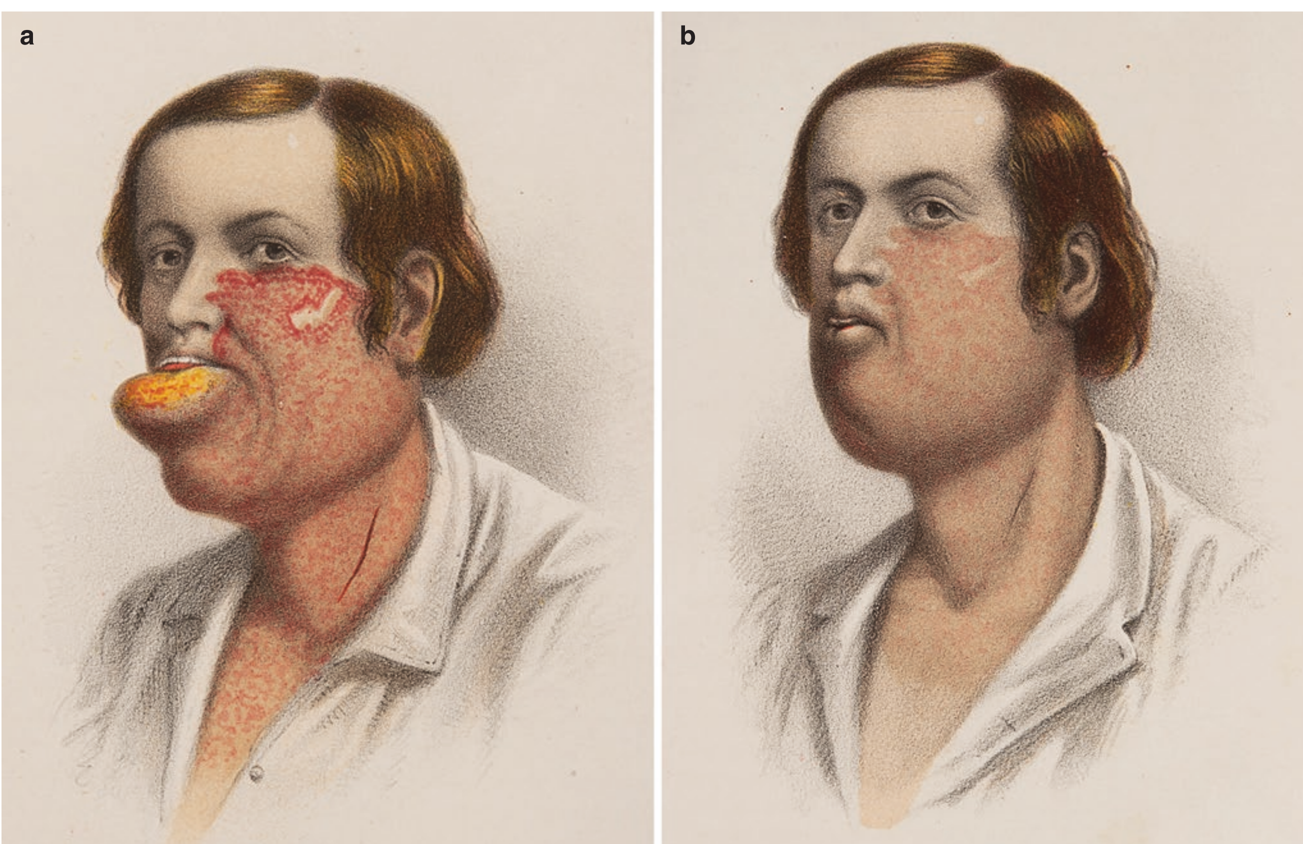


Fig. 5.61 (**a**, **b**) Ulcerated hemangioma of the lower lip, oral cavity, face, and neck. *Left*: Preoperative situation. *Right*: Result after ligation of both carotid arteries. (From: Warren JM. *Surgical Observations, with cases and operations*. Boston, Ticknor and Fields, 1867)

5.2.8.7 George Howard Monks

George Howard Monks (1853–1933) was born in Boston in 1853, the son of an Irish immigrant. He graduated from Harvard Medical School in 1880 and then visited surgeons in Vienna, Dresden, Leipzig, and Paris. In 1884, upon his return to the United States, he established a practice in Boston, where he was appointed District Physician to the Boston Dispensary. Being particularly interested in anatomy, he became prosector and lecturer in operative surgery at the Harvard Medical School. For 40 years, he taught surgical pathology and surgery at the Harvard Dental School, and from 1910 to 1926 he was appointed Professor of Oral Surgery. He showed great interest in plastic and reconstructive surgery as well as in aesthetic plastic surgery, as documented by the numerous papers he published. He retired from active practice in 1914, but still lectured until 1926. He was also an excellent sculptor. He died in 1933, aged 79 [119, 128].

Monks was a very prolific writer. His contributions to plastic surgery were partly the result of his interest in head and neck surgery, from aesthetics to reconstruction. He was among the first authors to publish on aesthetic rhinoplasty [129] (see Sect. 7.2.3.1 on "George Monks").

In 1898, Monks illustrated a *new method* for restoring the lower eyelid. He outlined a forehead skin flap, based on the anterior branch of the superficial temporal artery, and transposed it, along with its long nourishing vascular pedicle, to the lower eyelid to close a defect, following the excision of a carcinoma, through a tunnel made in the temple. The end result was favorable. *The eyelid did not slough, but healed kindly in its new bed*, he wrote. The donor site was primarily closed—the first example of island flap in the literature [130] (see Sect. 6.1.1.3) (Fig. 5.62).

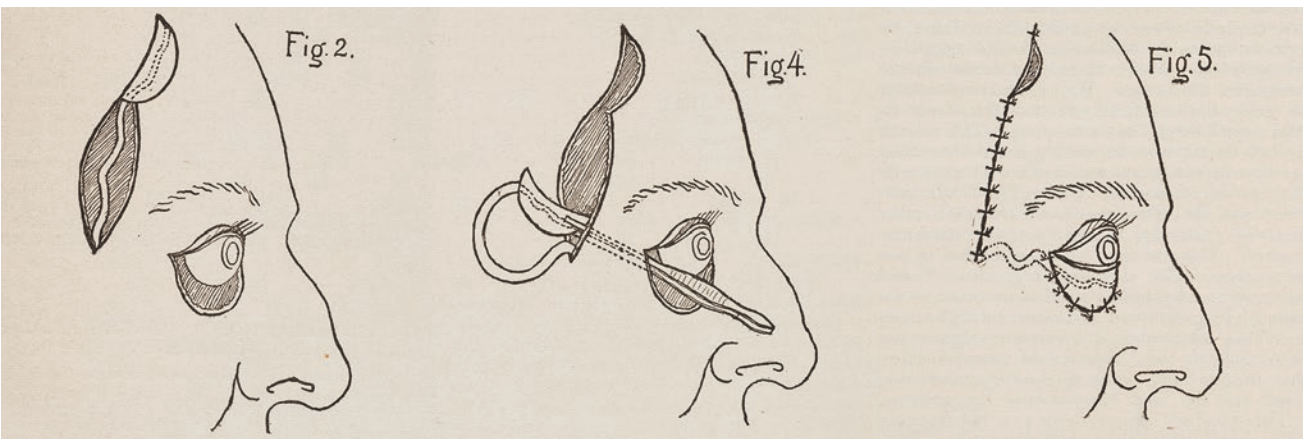


Fig. 5.62 The different stages of lower eyelid reconstruction by transposition of a scalp island flap based on the superficial temporal artery. *Left*: Preoperative situation. *Middle*: The flap, with its long vascular pedicle, is transposed to the lower eyelid defect through a tunnel made in the temple. *Right*: Final result. First example of an *island flap* in the literature. (From: Monks GH. The Restoration of a lower Eyelid by a new Method. *Bost. Med Surg J.* 1898; 139: 385–387)

5.3 The Origins of Free Skin Grafts: Development and Applications

Throughout history, numerous attempts to transplant free skin, tissues, or even organs (e.g., an entire nose) have been made. The literature is replete with these "unique" episodes, all of them with a high rate of unsuccessful result. However, once understood, correctly systematized, and applied, the principles of free grafting constitute one of the greatest advances of nineteenth-century plastic surgery.

5.3.1 Giuseppe Baronio

We owe a debt to the Italian **Giuseppe Baronio** (1759–1811) for the first demonstration that skin transfer in the same individual is possible—and successful [6, 131]. In 1804, he published *Degli Innesti Animali* (On Grafting in Animals), an epoch-marking account of experimental autologous skin transplantation in a ram [132].

Giuseppe Baronio was born in Milan in 1759. He studied medicine at Pavia University, a historic city 20 miles south of Milan, as Milan had no university at that time. One of his teachers was **Lazzaro Spallanzani** (1729–1799), Professor of Natural History, well-known for his studies on regeneration and reproduction of animal parts. In 1780, Baronio graduated in medicine and philosophy with a thesis on regeneration of limbs in warm- and cold-blooded animals. This might have had an influence on his future research. The following year he became an intern physician at *Ospedale Maggiore* of Milan. Due to his lack of interest in politics and particularly in the French government, which was dominating Milan in that period, he did not advance in his career. Although he tried numerous times to obtain a better position, he never succeeded. His applications were constantly rejected.

In 1807, Baronio was affected by gout and his physical condition deteriorated slowly. He died in 1811 in his home city, aged 52, alone and completely forgotten. He never married.

Baronio had numerous scientific interests and published his observations extensively. His works were recognized for their scientific value, so it was possible for him to become a member of various scientific societies.

Degli Innesti Animali, Baronio's most influential publication, is a 78-page book, issued in 1804 in Milan by Tipografia del Genio (Fig. 5.63). It is divided into seven parts and includes three engraved illustrations. The first one is a portrait of Count Carlo Anguissola, to whom the work is dedicated, who sponsored the publication and who provided animals and stables to make Baronio's experiments possible.

In Parts One to Five, Baronio traces the origin of nasal reconstruction by quoting the Brancas of Sicily, Tagliacozzi's arm flap, and the Indian forehead flap procedure, illustrated by an engraved plate. He explains the transplantation of teeth in human beings, a procedure first reported by the renowned Scottish surgeon **John Hunter** (1728–1793), the grafting of spur and *other animal parts into the cock's comb*, and the use of certain balms, as suggested by some charlatans for the healing of severed skin parts. Part Six, the most important section of the book, deals with the original Baronio studies on skin graft in a ram. He carried out three types of experiments on the farm of Count Anguissola's estate at Albignano, in the surroundings of Milan. In doing this, Baronio was supported by two Milanese surgeons **Giovanni Battista Monteggia** (1762–1815) and **Giovanni Battista Palletta** (1748–1832).

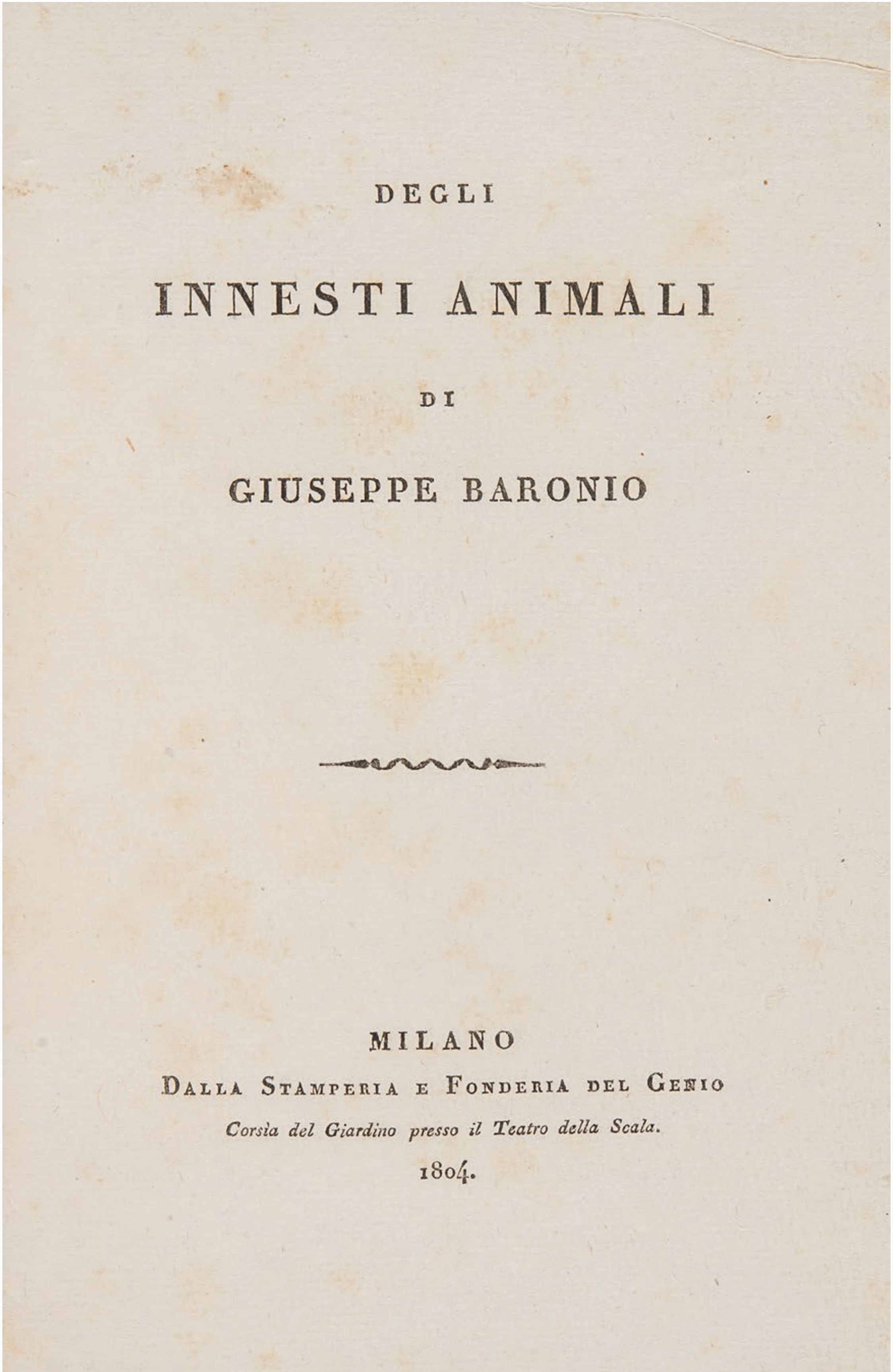
In the first experiment, he excised a piece of skin from the dorsum of a ram and grafted it immediately on the opposite side without suturing it, but attaching it with an adhesive. After 8 days the graft took perfectly, *without even the slightest separation*. In the second experiment, on the same ram, the time lapse was 18 min. Baronio noticed that the graft had some difficulties in taking, healing with only little suppuration (Note: probably superficial necrosis, as occurs in full-thickness skin grafts). In the third experiment, always on the same ram, the time lapse was longer and the graft did not take. He concluded that the shorter the time for transplantation, the better in terms of survival rate. A beautiful engraved illustration of a ram with skin grafts positioned along its dorsum accompanies the text (Fig. 5.64). Regrettably, Baronio made a mistake. He was not aware that the thickness of the skin was the most important factor for a skin graft to take. Very possibly, in the third experiment, he harvested the skin with the underlying adipose tissue, thus jeopardizing the graft's survival.

In the last section of the book, Part Seven, he created wounds on different animals (goat, dog, sheep) and covered them with aluminum paste to isolate wounds from the air to avoid potential contamination. He noticed that this method facilitated wound healing.

How did Baronio come to this great idea? In explaining the rationale for his investigations, he affirms: *I want to verify tissue regeneration and healing process in wounds*. It is certainly a legacy of the period he spent at Pavia University with Lazzaro Spallanzani, his teacher, who dedicated his whole life to studying regeneration and reproduction of animal parts.

Degli Innesti Animali was translated into German in 1819, but it had little impact on followers and was almost completely ignored. We must be grateful to **Robert Goldwyn** (1930–2010) who translated it into English, making the text available to the plastic surgery scientific community [133].

Other surgeons including **Christian H. Bünger** (1782–1842), **Johann Friedrich Dieffenbach** (1794–1847), and **Alfred Armand Velpeau** (1795–1867) tried to reproduce the skin grafting technique using different methods. However, most of these authors reported a high rate of failure.



DEGLI

INNESTI ANIMALI

DI

GIUSEPPE BARONIO

MILANO

DALLA STAMPERIA E FONDERIA DEL GENIO

Corsìa del Giardino presso il Teatro della Scala.

1804.

Fig. 5.63 Title page of Giuseppe Baronio (1759–1811) *Degli Innesti animali* (On grafting in animals), published in Milano, 1804

Fig. 5.64 Illustration of Baronio's experiments with free skin graft in a ram. (From: Baronio G. *Degli Innesti Animali*. Milano, Stamperia e Fonderia del Genio, 1804)

5.3.2 Christian H. Bünger

In 1823, to restore a missing nose in a 30-year-old woman, **Christian H. Bünger** transplanted a piece of skin harvested from the upper lateral area of the thigh and sutured it to the freshened nasal stump with some subcutaneous fat tissue attached. Part of the skin necrotized, whereas the border took successfully and also some kind of hairs from the donor site appeared on the graft. He concluded that: *although the end result was not quite satisfactory, yet, from a physiological point of view it was most remarkable* [20, 134].

The likely explanation was that transfer of a full-thickness piece of skin has greater difficulties in being revascularized compared to a split-thickness piece of skin. Infection was another negative factor in skin graft taking.

5.3.3 Paul Bert

The French physiologist **Paul Bert** (1833–1886) in particular repeated some of Baronio's experiments 59 years later and described them in his doctoral thesis, *De la Greffe Animale* (On Grafting in Animals), published in 1863. He reached the same conclusions [135].

5.3.4 Jacques Louis Reverdin

It took 65 years after the publication of *Degli Innesti Animali* before the Swiss-born surgeon **Jacques Louis Reverdin** (1842–1929) reported the healing of large open wounds in man by transplanting thin and small portions of autologous skin from a healthy area of the same individual. The operation was performed at Hôpital Necker in Paris in 1869.

Born in Geneva in 1842, Jacques Reverdin studied medicine in Paris, as Geneva had no medical faculty at that time. In 1865, he became *Interne des Hôpitaux*, worked at the Hôpital Necker under the direction of **Félix Guyon** (1831–1920), and was appointed Professor of Urology at the Paris Faculty in 1876. Shortly after the publication of his epochal account on skin grafting in 1869, the Franco-Prussian war (1870–1871) arose. Although Swiss by nationality, Reverdin collaborated with the French army as the head of the "Swiss Ambulance" in Paris, treating many wounded soldiers. Back in Geneva 2 years later, he was nominated Chief Surgeon at the Hôpital Cantonal de Genève and the second professor of surgery in the newly created Faculty of Medicine. He was the first Swiss surgeon to recognize the importance of Lister's antiseptic method and introduced it in the Geneva hospital. In 1884, he wrote a book on surgical antisepsis and asepsis and in 1910 a book on war surgery. During his 34 years of professorship, he published numerous papers, mainly on surgery of goiters, an area in which he had acquired a great deal of experience. He is credited with being the first to have noticed, before Theodor Kocher, another Swiss surgeon from Bern, the symptoms of hypothyroidism after extensive thyroidectomy and gave it the name myxedema, suspecting an endocrine function of the gland. In 1908, he was invited to present his experience and observations on this subject at a major surgical meeting in Chicago, but in 1909, it was Kocher who was awarded the Nobel prize for his work on thyroid.

For cleft palate surgery, Reverdin created a needle for sutures which bears his name and is still commonly used in Europe. In 1881, with two other colleagues, he founded the *Revue Médicale de la Suisse Romande*, which he then edited for 38 years. He retired from the University and the practice of surgery in 1910 and started a new career as a lepidopterologist (the study of butterflies), founding the *Swiss Society of Lepidopterology* and publishing 49 papers on this subject until his death in 1928, aged 87 [136, 137].

As a resident in surgery, he was involved in the treatment of a 35-year-old man who presented an open wound on his forearm after an injury. When the wound was sufficiently covered by granulation tissue, Reverdin remembered that islands of epithelium may be formed in the center of the granulation tissue. *I have read in the surgical lessons of Billroth that sometimes islets of cicatrization can develop at a distance from the wound borders in burns or varicose ulcers* (…). *The idea to initiate such a process surged in my mind. I asked myself could we not, by placing small fragments of living epidermis on the surface of a granulating wound, stimulate the creation of islets of cicatrization? Would these small pieces of epidermis adhere? There was only one means to know; it was to attempt the experiment. I made this attempt the next morning. I detached with a lancet on my own leg two to three fragments of skin as thin as possible and placed them on a granulating wound of one of my patients. I secured it with tape and a dressing and waited for the result with anxiety. After a few days, my previsions had been totally confirmed; not only had the small pieces taken and were solidly adherent, but around them new skin was forming, growing day after day at a distance from the borders of the wound*.

This is Reverdin's report of the procedure, read on December 9, 1869, to the members of the *Société de Chirurgie*: ***On November 24****, I tried the following experiment: I removed with the point of a lancet from the right arm of the patient three small slivers of epidermis. I placed my two epidermic slivers in the middle of the wound, their deep surface in contact with the granulations and I supported them with some diachylon (ointment) bandelettes, which served as a dressing for the patient.* ***On December 1****, the skin slivers had united and formed a little pale white plaque; there had evidently grown a small epidermic zone around each of them. In the days that followed, this pale border extended more and more to form a little pale and thin islet quite analogous to the epidermic border which had formed along the edges of the wound.* ***Today, December 8****, it is observed that the islet is notably enlarged and the wound practically healed*. The members did not respond too enthusiastically to Reverdin's report. Numerous criticisms arose. However, despite the reluctant response, the free skin graft, as proposed by Reverdin, seemed to have been widely adopted around Paris. It was not until months later that the news of the invention spread in other countries. The delay was mainly due to the Franco-Prussian war (1870–1871) [136, 138].

As he promised, Reverdin undertook a series of research studies, performing more than 50 skin grafts in humans and studying experimental grafting in animals in the same laboratory as **Paul Bert**, the medical experimental lab of the *Collège de France*, directed by **Claude Bernard** (1813–1878), the founder of experimental and scientific medicine. For his 69-page memoir, issued in the *Archives générales de Médecine* [139, 140], Reverdin was awarded the *Prix Amussat* of the Academy. In November 1872, Claude Bernard himself presented Reverdin's memoir at the *Academy of Science* [136, 137]. Curiously, Reverdin, who published four papers on skin grafting between 1869 and 1872, did not write any more on this subject after 1872.

When Reverdin had finished his training in Paris, in 1872, before returning to Geneva, he toured Europe to promote his invention, receiving at the same time the overdue honors. In London, he met **George David Pollock** (1817–1897), a surgeon at St. George's Hospital and consulting surgeon at Great Ormond Street Hospital for Children. Having heard about skin grafting, Pollock had used the technique and reported the achieved success before the *Clinical Society of London*, largely contributing to its diffusion in other countries such as Germany, Austria, Russia, the United States, and Scandinavia.

The main purpose of skin grafting, as advocated by Reverdin, was to accelerate the healing process in skin defects. Indications were sequelae of limb amputations, chronic ulcers of the lower leg, and burns. However, it was soon understood that other indications were possible, such as palpebral insufficiency leading to ectropion. Simple instruments were used: a needle to raise the skin and a forceps-scissors to cut skin grafts—and occasionally a scalpel to cut skin fragments [140]. Regarding the dimensions, Reverdin's first grafts were small, about 1 mm^2 [138]. Later, he started to use fragments of about 3–4 mm [139]. Surgeons were positively impressed by the phenomenon of epithelium formation around the grafts and were particularly surprised that the epithelium was growing mainly in the direction of other grafts. As a comparison, the edges of the grafted ulcers changed, losing their pale color and induration, whereas the edges of non-grafted ulcers did not change [140].

5.3.5 George Lawson

In 1870, 2 years after the epoch-marking Reverdin demonstration of his transfer of fragments of skin, **George Lawson** (1831–1903), a surgeon at the Middlesex Hospital in London, successfully performed the first transplantation of two full-thickness pieces of skin, as large as the size of three- and four-penny piece (about 22 mm and 16 mm, respectively) [141], antedating **Wolfe's** [142] and **Krause's** [143] papers by some years. The technique was carried out for several years, but curiously Lawson never mentioned it again. Detractors used this argument against him, supposing that something went wrong with the operation.

5.3.6 John Reissberg Wolfe

This is the reason why, when **John Reissberg Wolfe** (1824–1904), a native of Breslau (Wroclaw, Poland) who had studied medicine at Glasgow University, becoming a surgeon at the Glasgow Ophthalmic Institute and lecturer in ophthalmic surgery at Anderson University, published his operation in the *British Medical Journal* in 1875 as a new procedure, credit was given to Wolfe and no objection was raised [140, 142]. He reported the case of a 25-year-old woman with a sequela of an injury to the face as a result of a gunpowder explosion. To correct the severe scar retraction of the lower eyelid, he used three full-thickness skin grafts harvested from the forearm, with a successful outcome. In publishing his paper, he emphasized that he was the first to use the technique. However, someone objected that the *method was the same that Lawson had described in 1871* (4 years earlier). Wolfe immediately sent a letter to the editor of the Lancet saying that his operation differed from Lawson's *in principle and practice*. The quarrel ended in favor of Wolfe and nowadays his name is attached to these types of grafts (Wolfe grafts).

5.3.7 Fedor Krause

A few years later, the technique of full-thickness skin graft was considerably improved by **Fedor Krause** (1856–1937), who graduated from Berlin University in 1879 and received his surgical training under the famous **Richard von Volkmann** (1830–1889) at the University of Halle. Krauss dedicated himself to the excision of the Gasserian ganglion for the treatment of *tic douloureux*. In 1893, having perfected the technique, he presented his experience of more than 100 cases of large (20 × 7 cm) full-thickness skin grafts to the members of the *Deutsche Gesellschaft für Chirurgie* (*German Society of Surgery*) for different applications, greatly contributing to the spread of this type of graft, when the Ollier-Thiersch transplantation had proved inadequate due to its tendency to retract [140, 143].

A review of the origins and evolution of skin grafting would not be complete without acknowledging the landmark contribution of two of the most influential personalities in this field: **Ollier** and **Thiersch**.

5.3.8 Louis Xavier Édouard Léopold Ollier

Louis Xavier Édouard Léopold Ollier (1830–1900) was born in Vans (Ardèche, France) and studied natural science in Montpellier and medicine in Lyon. He was an *Interne des Hôpitaux* in Lyon and received his medical degree in 1856 in Montpellier. Then he moved to Paris to study the osteogenic properties of the periosteum with **Claude Bernard**. In 1860, aged 30, Ollier was appointed head surgeon at Hôtel-Dieu in Lyon and later Professor of Surgical Clinic at Lyon University. He died in Lyon in 1900, aged 70.

Ollier was an international authority not only for his techniques of bone resection and regeneration following periosteum transplantation but also for his pioneering work on skin graft.

He was greatly attracted by Reverdin's studies and publications. However, instead of transplanting seeds of epithelium in a granulating bed, he successfully grafted large pieces of skin (4–8 cm^2) including not only the superficial layers but also a very thin portion of the dermis and issued his epoch-marking contribution *Greffes cutanées ou autoplastiques* (Cutaneous or autoplastic grafts) in 1872 [140, 144]. He performed complete excision of scar tissue and its replacement by these large skin grafts.

5.3.9 Carl Thiersch

Carl Thiersch (1822–1895) was born in Munich and studied medicine at the University of Munich where he received his medical degree in 1843. In 1848, he was appointed prosector of the pathological institute of that city. He then trained in surgery with **Georg Friedrich Stromeyer** (1804–1876) and in 1850 served as a military surgeon during the war against Denmark. In 1854, he was called to Erlangen University where he became Professor of Surgery, and in 1867, he moved to Leipzig as Professor of Surgery. At the onset of the Franco-Prussian War (1870–1871), he was a consultant surgeon to the armies of Saxony. Upon his return to Leipzig, he dedicated himself to research, teaching, and surgery. He remained the Chair of Surgery until his death in 1895, aged 73.

Thiersch was a great supporter of the antisepsis advocated by Lister and was the first German surgeon to recognize the importance of Lister's methods and introduced them in his clinic. His contributions to the medical literature were numerous. First of all, in the field of epithelial cancer, he published *Der Epithelialkrebs namentlich der Haut* (Epithelial Cancer, in particular of the Skin) in Leipzig in 1865. Then in wound healing *About the fine Anatomical changes after soft tissue lesions* [145] was issued in 1867 representing an important contribution to the understanding of the wound healing process. Thiersch described the different stages of repair with great detail: the role of the vascular component, the macro- and microscopic findings, the repair by primary or secondary intention with or without suppuration, and the principles of granulation tissue and scar formation. Finally, on skin grafting, having read the publications by Reverdin, he issued an epoch-marking paper in 1874: *On the fine Anatomical changes in the healing of Skin over Granulation* [140, 146]. Being an expert microscopist, he focused his attention on the healing of grafts. He examined numerous biopsies of grafted skin at different stages after transplantation and studied the formation of new blood capillaries in the graft and the inosculation between the graft and the recipient bed and categorized the different phases of graft taking. He categorized the technique, recommending use of a razor for cutting the skin from the donor site: split-skin grafts should always be obtained from the patient himself, and finally the grafts should cover the entire skin defect. Two years later, in 1886, he presented to the 15th Congress of the *German Society of Surgery* the perfected method of skin grafting, the same as Ollier's, but without mentioning Ollier's work. Wound healing was intensively studied by numerous Thiersch co-workers and pathologists of the period, including **Max Jungengel** (1863–1918) [147], who illustrated the microscopic findings of skin grafting at different postoperative stages (from 24 to 84 h), and **Felix Marchand** (1846–1928) [148] who issued a comprehensive 528-page textbook on wound healing in 1901, with more than 40 pages of bibliographical references.

5.4 The Role of the Periosteum. The Axiom: Periosteum Forms Bone

Understanding the role of the periosteum in bone formation, in regeneration, and in callus formation began in the eighteenth century.

5.4.1 Henri L. Duhamel de Monceau

As we have anticipated in Chapter 4.1.4, it was first brought forth by **Henri L. Duhamel de Monceau** (1700–1781), who published his research in *Mémoires de l'Académie des Sciences* in 1743 [149, 150].

5.4.2 Michael Troja

In 1775, the Italian **Michele Troja** (1747–1827), during the period when he was in Paris with a fellowship granted by the University of Naples, carried out important experimental research on bone regeneration, demonstrating that excision of a piece of tibia in an animal repairs in full, thanks to the osteogenic capacity of the periosteum. He also demonstrated that if a foreign body is introduced into the marrow cavity of a long bone, the bony cylinder dies and new bone formation occurs, thanks to the osteogenic potential of the periosteum [151]. Troja graduated in medicine from the University of Naples becoming a student of the celebrated anatomist **Domenico Cotugno** (1736–1822).

5.4.3 Barthélémy Vigarous

Barthélémy Vigarous (1725–1790) from Montpellier graduated in medicine in that city. He was then appointed surgeon at the city hospital, becoming well-known very soon for the complex operations he was able to carry out. In 1755, he was nominated first as head surgeon at Hôpital St. Eloi, one of the most important of France, and later as Professor of Surgery. Although Vigarous did not carry out experimental research personally on bone regeneration, as did Duhamel du Monceau and Michele Troja, he applied the results of their studies to different clinical cases. In his *Opuscules sur la Régénération des Os* (Essays on Bone Regeneration), issued in 1788 [152], he described the case of a young soldier, aged 21, who suffered from a pathological fracture of the tibia following an abscess. With accurate trephination, he removed the carious and necrotic bone from the upper and lower stump until healthy bone was detectable. Maintaining the periosteum, Vigarous was able to achieve bone regeneration, obtaining ossification between the fragments. Complete healing occurred 2 months after surgery, and the soldier could leave the hospital 8 months later without the aid of a crutch. The conclusion drawn from this and other observations was that periosteum is capable of stimulating bone regeneration: *le périoste est l'agent immédiat de la régénération des os* (periosteum is the immediate causative factor of bone regeneration).

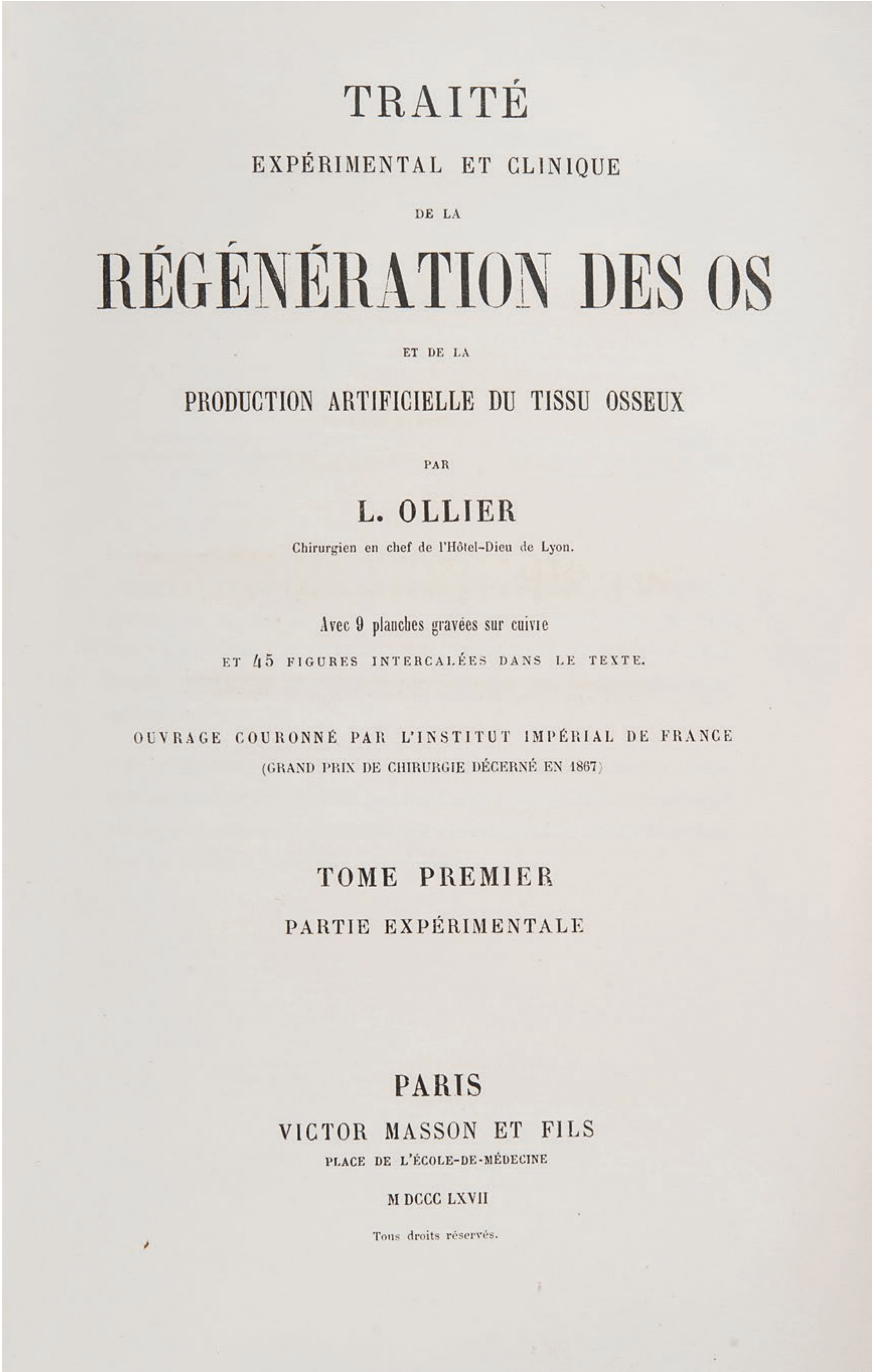
5.4.4 Marie Pierre Flourens

In the nineteenth century, the Frenchman **Marie Pierre Flourens** (1794–1867) repeated Duhamel de Monceau's experiments using alizarin and came to the same general conclusion regarding the importance of the role of the periosteum in bone production [149, 153]. To understand the mechanism of callus formation, he also repeated the experiments of **Michele Troja**, giving credit to him for the accuracy of his studies: *sont les expériences de Troja qui me l'ont fourni. On connait ces grandes et belles expériences* (the experiments of Troja offered me the idea. We are aware of the excellent studies he has done). He noted that as the bone grew with the increment of new bone formation from periosteum, there was an accompanying resorption of the medullary layers [151].

5.4.5 Louis Xavier Édouard Léopold Ollier

In his two-volume book, *Traité Expérimental et Clinique de la Régénération des Os et de la Production Artificielle du Tissu Osseux* (An Experimental and Clinical Treatise on Bone Regeneration and on the Artificial Production of Bony Tissue), issued in 1867 [11, 144, 154] (Fig. 5.65), **Louis Xavier Édouard Léopold Ollier**, after a detailed review on the previous studies on bone regeneration made by Duhamel de Monceau, Troja, Vigarous, Flourens, and others, reported his own experiments to demonstrate the osteogenic properties of periosteum. He transplanted a pedicled flap of periosteum from the tibia of a young rabbit over the deep flexor muscles of the leg. After 6 weeks, the periosteal flap had become solid bone. In another experiment, he transplanted free grafts of periosteum to the subcutaneous tissues of the thigh and on the rabbit forehead (Fig. 5.66). Also in these cases, he noticed bone formation.

He proposed numerous clinical applications in man either by transplanting periosteum or bone for re-establishing the cranial vault, for reconstructive rhinoplasty, and for palatal defects. This was fundamental work to support the key role of the periosteum on bone growth and regeneration leading to his axiom *le perioste fait l'Os* (periosteum forms Bone). For Ollier's fundamental contribution to skin grafting see Sect. 5.3.8.



TRAITÉ

EXPÉRIMENTAL ET CLINIQUE

DE LA

RÉGÉNÉRATION DES OS

ET DE LA

PRODUCTION ARTIFICIELLE DU TISSU OSSEUX

PAR

L. OLLIER

Chirurgien en chef de l'Hôtel-Dieu de Lyon.

Avec 9 planches gravées sur cuivre

ET 45 FIGURES INTERCALÉES DANS LE TEXTE.

OUVRAGE COURONNÉ PAR L'INSTITUT IMPÉRIAL DE FRANCE

(GRAND PRIX DE CHIRURGIE DÉCERNÉ EN 1867)

TOME PREMIER

PARTIE EXPÉRIMENTALE

PARIS

VICTOR MASSON ET FILS

PLACE DE L'ÉCOLE-DE-MÉDECINE

M DCCC LXVII

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Fig. 5.65 Title page of LXÉL Ollier (1830–1900) *Traité Expérimental et Clinique de la Régénération des Os* (An experimental and clinical Treatise on Bone Regeneration). Published in Paris, 1867

Fig. 5.66 Experimental bone production on the forehead of a rabbit after free autologous transplantation of periosteum, harvested from the tibia. (From: LXÉL Ollier *Traité Expérimental et Clinique de la Régénération des Os* (An experimental and clinical Treatise on Bone Regeneration). Paris, Victor Masson, 1867)

5.5 Evolution of Modern Surgery: Two Crucial Discoveries

In the nineteenth century, two crucial events contributed to the evolution of modern surgery: the introduction of anesthesia and the development of antiseptic methods. However, the introduction of anesthesia grew from the occasional observation that the action of certain drugs caused temporary insensibility in man. On the contrary, control of infection was the result of long-lasting studies, specifically directed to achieve this purpose.

5.5.1 Anesthesia

With the exception of opium and its derivatives, all the drugs used by the ancients to induce insensibility, starting with the juice of mandragora of the Alexandrian school, to the *spongia soporifera* (soporific sponge) of the Renaissance, had shown ineffective results.

5.5.1.1 Gardner Quincy Colton

On December 10, 1844, an itinerant American lecturer in chemistry, **Gardner Quincy Colton** (1814–1898), exhibited the exhilarating properties of laughing gas at the Union Hall in Hartford, Connecticut. The dentist **Horace Wells** (1815–1848) was present and became attracted by this message. He applied it in his dental work; however, a fatal case caused Wells to withdraw from practice and eventually commit suicide.

5.5.1.2 William Thomas Green Morton

Prior to this, a young dentist in Boston, **William Thomas Green Morton** (1819–1868), at the suggestion of **Charles Thomas Jackson** (1805–1880), a noted chemist who publicized the anesthetic properties of the sulfuric ether vapors, decided to experiment with ether on September 30, 1844, inhaling its vapors personally until insensibility was induced. On awakening, Morton was favorably impressed and administered ether vapors with anesthetic effects to a patient before tooth extraction.

5.5.1.3 John Collins Warren

The news spread rapidly and on October 16, 1846, Morton was invited by **John Collins Warren** (1778–1856), surgeon at the Massachusetts General Hospital, to administer ether to a patient for the excision of a large vascular tumor of the face and neck. The mass was dissected and removed by Warren in 5 min. The outcome was successful: no pain. At the end of the operation, the patient, conscious again, exclaimed: *Gentlemen, this is no humbug*. Details about the event were published in a textbook by **Mason Warren**, at that time a young doctor at the Massachusetts General Hospital, who personally attended the event [126]. The procedure was repeated on other occasions until a certain number of major operations were performed. October 16, 1846, became a memorable day for medicine and surgery: *Ether Day* or *Death of pain* [11, 37]. The consequences of this discovery were incalculable. The nightmare of operations, causing patients terrible suffering and pain, ceased immediately. Before that, patients faced the operation as if it were an execution. Surgeons who had to rush to reduce the length of every procedure, always struggling against patients' distress, could now operate under completely different conditions, taking the necessary time to perform surgical interventions taking more care of the details. New operations, impossible to consider in the pre-anesthetic era, could now develop. This opened the way to modern surgery.

5.5.1.4 Robert Liston

Information about pain control reached England by December of 1846 and was soon attempted by **Robert Liston** in London for a lower limb amputation. Soon famous surgeons **Cheselden**, **Fergusson**, **Langenbeck**, **Pirogov**, **Velpeau**, and numerous others introduced ether anesthesia into their current practice.

5.5.2 Antisepsis

5.5.2.1 Louis Pasteur and Robert Koch

Owing to the genius of **Louis Pasteur** (1822–1895) and **Robert Koch** (1843–1910), bacteriology advanced considerably in the 1880s. These scientists changed the course of medical thinking completely.

5.5.2.2 Ignaz P. Semmelweis

With pain control induced by anesthesia, surgeons started to cut deeper into the human body. However, despite the great advantages achieved by anesthesia, elective surgery was limited in its scope and application by the danger of postoperative complications arising with great frequency. Wounds seldom healed without pus formation. Hospital gangrene, pyemia, septicemia, and erysipelas were routinely seen. The increase of these dramatic consequences started in 1847. The Hungarian **Ignaz P. Semmelweis** (1818–1865) recognized puerperal fever as the cause of septicemia, which contributed to significantly augment the mortality rate of the First Obstetrical Clinic in Vienna. To prevent contagion and diffusion of puerperal fever, he urged surgeons to wash and disinfect their hands. With this hand-washing program, the mortality rate dropped by 10% [155].

5.5.2.3 Joseph Lister

The Englishman **Joseph Lister** (1827–1912), appointed Professor of Surgery at Glasgow University in 1859, was much impressed by the post-surgery mortality rate seen in his unit at the Royal Infirmary. He applied Pasteur's principles and research to surgery, performing antiseptic surgery in 1865. The results of his studies were published in the *Lancet* in 1867, in an epoch-making contribution to surgery, where the term antisepsis appeared for the first time [156]. His incorrect assumption was that the germs of surgical infection came from the air, but this did not diminish the glory of his achievements. He considered it fundamental that surgeons should wash their hands before and not after surgery, discard their old dirty gowns used in the operating room, replete with blood and pus, and wear clean linen suits instead and carefully wash surgical instruments. He used a bactericidal substance, carbolic acid, to disinfect dressings in contact with wounds and also treated chronic abscesses, particularly those of tubercular origin, with carbolic acid. He started to use absorbable sutures exposed to a prolonged carbolic acid sterilization, avoiding the use of contaminated silk. By the application of Pasteur's discoveries for the control of septicemias, erysipelas, hospital gangrene, and wound infections decreased significantly. However, despite the statistical evidence presented, Lister's methods were not quickly accepted, if not violently opposed.

Theodor Billroth in Vienna, **Carl Thiersch** in Leipzig, and **Ernst von Bergmann** in Berlin were among the first surgeons to adopt the aseptic principles in their hospitals.

Lister ranks among the founders of modern surgery. The results of his studies were epochal. Prevention of sepsis, healing of infected wounds, and improvements in the management of hospital gangrene were great changes and innovations. Personal achievements, honors, and gratifications in numerous countries marked Lister's life. In 1883, Queen Victoria bestowed a baronetcy upon him. His work, along with the control of pain, stimulated surgeons to achieve new endeavors.

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6 The Birth of Modern Plastic Surgery

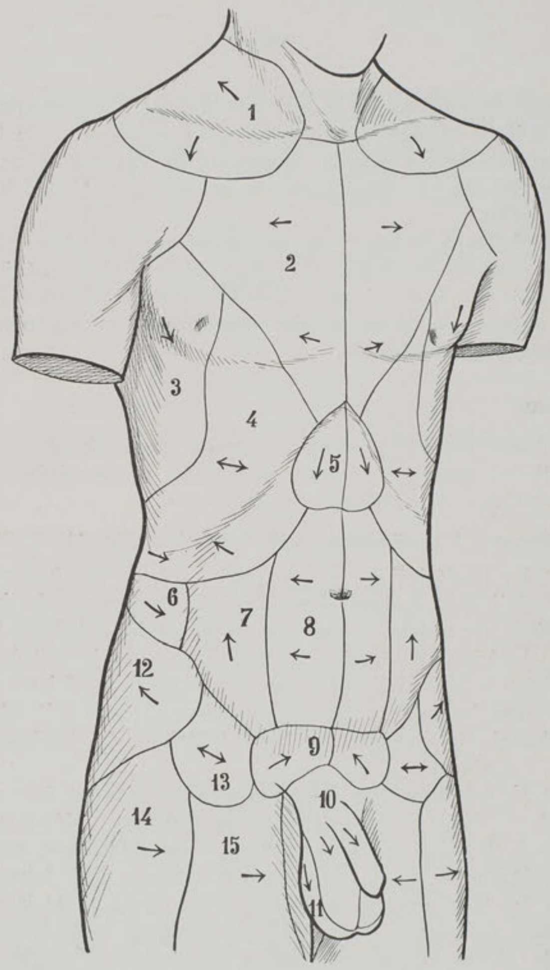

Figure 64.

Territoires artériels cutanés du tronc.

Vue antérieure.

1. Artères cervicale transverse et sus-scapulaire. — 2 et 5. A. mammaire interne (2 branches directes. — 5. A. épigastrique superficielle supérieure). — 3. A. mammaire externe et scapulaire inférieure. — 4. Rameaux perforants des artères intercostales. — 6. Rameaux perforants des artères lombaires. — 7. A. épigastrique superficielle inférieure. — 8. A. épigastrique profonde. — 9. A. honteuse externe supérieure. — 10. A. honteuse externe inférieure. — 11. A. honteuse interne. — 12. A. circonflexe iliaque superficielle. — 13. A. fémorale primitive. Branches directes. — 14. Grande artère du vaste externe. — 15. A. fémorale superficielle.

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The Twentieth Century: Salient Events in Plastic Surgery

- World War I (WWI) 1914–1918—modern plastic surgery rapidly develops new effective treatments for devastating facial disfigurements, the so-called *Les gueules cassées* (The Facial Cripples).
- First use of the tubed flap, the most important reconstructive solution in the pre-microsurgical era.
- Carl Manchot in 1889 and Michel Salmon in 1936 map the skin territories vascularized by a single vessel—the basis for microsurgery.
- First musculocutaneous flap, the latissimus dorsi, is described by Iginio Tansini in 1906.
- Systematization of bone grafting.
- Systematization of cartilage grafting.
- Systematization of fat grafting—fat injection develops; first fat injection to the breast in 1910 by Eugene Holländer.
- The team approach of cooperating plastic and oral surgeons for the management of severe facial injuries is advocated by Hippolyte Morestin.
- In 1918, Johannes Esser publishes the cheek rotation technique to cover defects of the lower eyelid and lateral nasal region, anticipating John Mustardé who describes the same type of flap in 1966.
- Esser identifies arterialized flaps, which he names biological flaps, and publishes a comprehensive work on this topic in 1935.
- In 1915, Harold Delf Gillies visits Val-de-Grâce military hospital in Paris. He is much impressed by Hippolyte Morestin's reconstructive work for wounded soldiers and, on his return to England, organizes the first unit in the world devoted to the treatment of face and jaw injuries at Queen's Hospital, Sidcup (Southeast London).
- The battle of the Somme, July 1, 1916—one of the bloodiest events in history, where British and allied troops suffer almost 500,000 casualties, with more than 6000 facial mutilations treated at Sidcup by Gillies and his team.
- At Sidcup, the anesthesiologist Ivan Magill develops nasal and endotracheal intubation.
- In 1919, John S. Davis issues *Plastic Surgery*: *Its Principles and Practice*, the first textbook on plastic surgery published in the USA.
- The first training programs in plastic surgery are organized in different parts of the world: in England in Sidcup with Harold Gillies, in France in Paris with Fernand Lemaitre, in the USA at Johns Hopkins University with John Davis, and in St. Louis at Washington University with Vilray Blair.
- In 1931, the Belgian Maurice Coelst establishes and edits the *Revue de Chirurgie Plastique*, the first journal entirely devoted to the new discipline, with an international editorial board that includes the most prestigious plastic surgeons of the period, publishing high-quality papers and the proceedings of the American Society of Plastic Surgery. The *Revue* lasts 8 years, ceasing publication in 1938 with the advent of WWII.
- Constitution of the *American Association of Oral and Plastic Surgeons* in 1921 by Truman Brophy (1848–1928)—the first scientific society of plastic surgery advocating close cooperation between oral and plastic surgeons; membership requires both MD and DDS degrees.
- The first Plastic Surgery Society in Europe, the *Société Française de Chirurgie Réparatrice Plastique et Esthétique*, is established in 1930 by Charles Claoué (1897–1957) from Bordeaux and Louis Dartigues (1869–1940) from Paris; it only lasts for 2 years.
- In 1931, Jacques Maliniak (1889–1976) establishes the *American Society of Plastic Surgeons.*
- In 1941, Vilray Blair organizes the *American Board of Plastic Surgery* (ABPS) to certify plastic surgeons.
- Before the advent of WWII, official recognition of the discipline as an independent specialty is settled.

6.1 The Twentieth Century

The beginning of the twentieth century is characterized by the advent of World War I (WWI) (1914–1918) with dramatic consequences for many soldiers who suffered major facial disfigurement. It was impossible for them to step back into society and rejoin their families. The great number of maxillofacial injuries sustained during the war constituted a new and dramatic social problem. Rapid and effective solutions for treating the devastating facial wounds were required. The Great War opened up an entirely new era in reparative surgery and played a fundamental role in the development of reconstructive techniques. Transfer of skin flaps, use of skin grafts, or grafts of other tissue such as cartilage, bone, or fat, became common reconstructive procedures. By the end of WWI, plastic surgery had reached unexpected heights. The social role played by this new discipline soon appeared evident.

Aesthetic surgery, started at the turn of the century, developed extensively in the interwar period.

6.1.1 Skin Flaps

In the late nineteenth century and in the early part of the twentieth century, the goal of plastic surgery widened rapidly. Skin flaps were employed to cover tissue loss mainly of the face, but also to restore skin defects after extensive burns of the neck. Flap donor sites and their vascular supply were considered important factors in choosing the ideal reconstructive procedure. The principles of flap surgery were soon established, laying down the basis of this modern discipline.

6.1.1.1 Cutaneous Flaps

Cutaneous flaps, variously termed and classified over the years as sliding or advancement, twisted or rotation, and folding, have precarious, ill-defined, subdermal vascularization. Most skin flaps belong to this category. Nowadays, they are referred to as *random*. Depending on their location, flaps were called *local* if outlined close to the defect to be repaired, or *distant* if far from the tissue loss. The great innovation of the early twentieth century was the so-called *tubed flap*. Three surgeons, **Vladimir Filatov** (1875–1956), ophthalmologist at the Novorossiysk Eye Clinic in Odessa [1], **Hugo Ganzer** (1879–1960) oral surgeon at the Charlottenburg Hochschule Hospital in Berlin [2], and Major **Harold Gillies** (1882–1960) at Queen's Hospital, Sidcup [3], share priority of the procedure.

The technique was as follows: the sides of the flap were incised using two parallel incisions along the margins of the cutaneous flap. The skin was undermined from the subcutaneous tissues, above the surface of aponeurosis and underlying muscle. The flap based on subdermal circulation was then tubed by simply suturing the skin margins together with interrupted stitches. Any excess fat protruding from the edges of the flap was trimmed away. The advantages of the tubed flap were numerous. Tubed flaps were prepared in areas distant from the wound (*donor site*), such as the abdomen, chest, or dorsum, where much skin was available. Using the arm as a carrier, the tubed flap was then transferred to any part of the body (*recipient site*), usually the face or the neck, with the specific purpose of repairing complex and dramatic tissue loss resulting from WWI injuries. The tubed flap could overcome the problem the majority of skin flaps had, when transferred over an unepithelialized undersurface, that is, continuous exudation of serum and blood—a potential open door to infections. The disadvantage of the tubed flap was the long period of time necessary from flap preparation to its transfer and refinement with skin thinning to reduce bulkiness. Usually four operations were necessary, although under local anesthesia. Gillies used to say that the direct flap method, instead of the tubed flap, was to be preferred whenever possible because it reduced the number of necessary operations, and hospitalization was shortened. However, in a pre-microsurgical era, the tubed flap represented a great improvement for solving problems of lack of skin in the recipient site.

With the experience derived from clinical practice, surgeons learned how to plan a flap correctly and minimize the risk of complications. They observed that the distal part of the flap often necrotized due to insufficient vascularization. In particular, if a flap was too long, relative to the base width, the risk of necrosis was higher. Knowledge and systematizing the length-width ratio is part of more recent plastic surgery, and beyond the scope of the present work [4, 5].

To improve perfusion of the pedicled flaps, twentieth-century pioneers noticed that if two parallel incisions were carried out along the edges of the flap, and the skin undermined from the underlying tissue before their transfer, a beneficial effect of vascularization was achieved. This procedure was called "delayed transfer" by **Vilray Blair** (1871–1955), or simply "delay" [6]. The rationale was to "instruct" pedicled flaps to decrease the blood flow to a point where the flap becomes ischemic, but not necrotic, thus inducing the formation of collateral circulation, permitting its survival with less blood flow than would normally be required, and ensuring its safety, before transfer [7]. Empirically known since time immemorial, the technique was first illustrated by Tagliacozzi in 1597 (*see* Fig. 3.63a).

6.1.1.2 Cutaneous Vascularization

Carl Manchot

Cutaneous vascularization was first described by **Carl Manchot** (1866–1932), the son of a pastor, born in Wipkingen near Zürich. Soon after his birth, the family moved to Germany and settled first in Bremen and then in Hamburg. In 1885, aged 19, Carl began his medical studies at Kaiser Wilhelm University in Strasbourg. At that time, Strasbourg, indeed the whole of Alsace-Lorraine at the conclusion of the Franco-Prussian war, became part of the German Empire.

He entered the Anatomical Institute in Strasbourg directed by Professor **Gustav Schwalbe** (1844–1916), a well-known neuroanatomist. For a period of 2 and a half years, Manchot studied the course of skin arteries, mapping the topography of cutaneous circulation of the entire human body. Two years later, he graduated with a thesis on the origin of true aneurysms, published in Berlin in 1890. At the completion of his studies, he returned to Hamburg and established a private practice. He died in Switzerland in 1932, aged 66.

In 1889, Manchot issued an epoch-marking monograph *Die Hautarterien des menschlichen Körpers* (The Cutaneous Arteries of the Human Body). After injecting the arteries, Manchot was able to map the different skin territories vascularized by a single vessel and to establish their boundaries. This work constitutes the foundation of microsurgery [8] and was illustrated with nine colored plates. Seven of them indicated the course of the different arteries which nourish the overlying skin, whereas the last two summarized the cutaneous arterial territories (Fig. 6.1a, b).

Despite the essay being awarded the prize of the Medical Faculty of Strasbourg, it was not fully understood by Manchot's contemporaries and remained almost completely unknown for numerous decades. It was eventually quoted by **Jacques Joseph** (1865–1934) in his *Nasenplastik* (1931) [9] to demonstrate the vascular supply of the thoracic skin flap, where he described covering large neck defects.

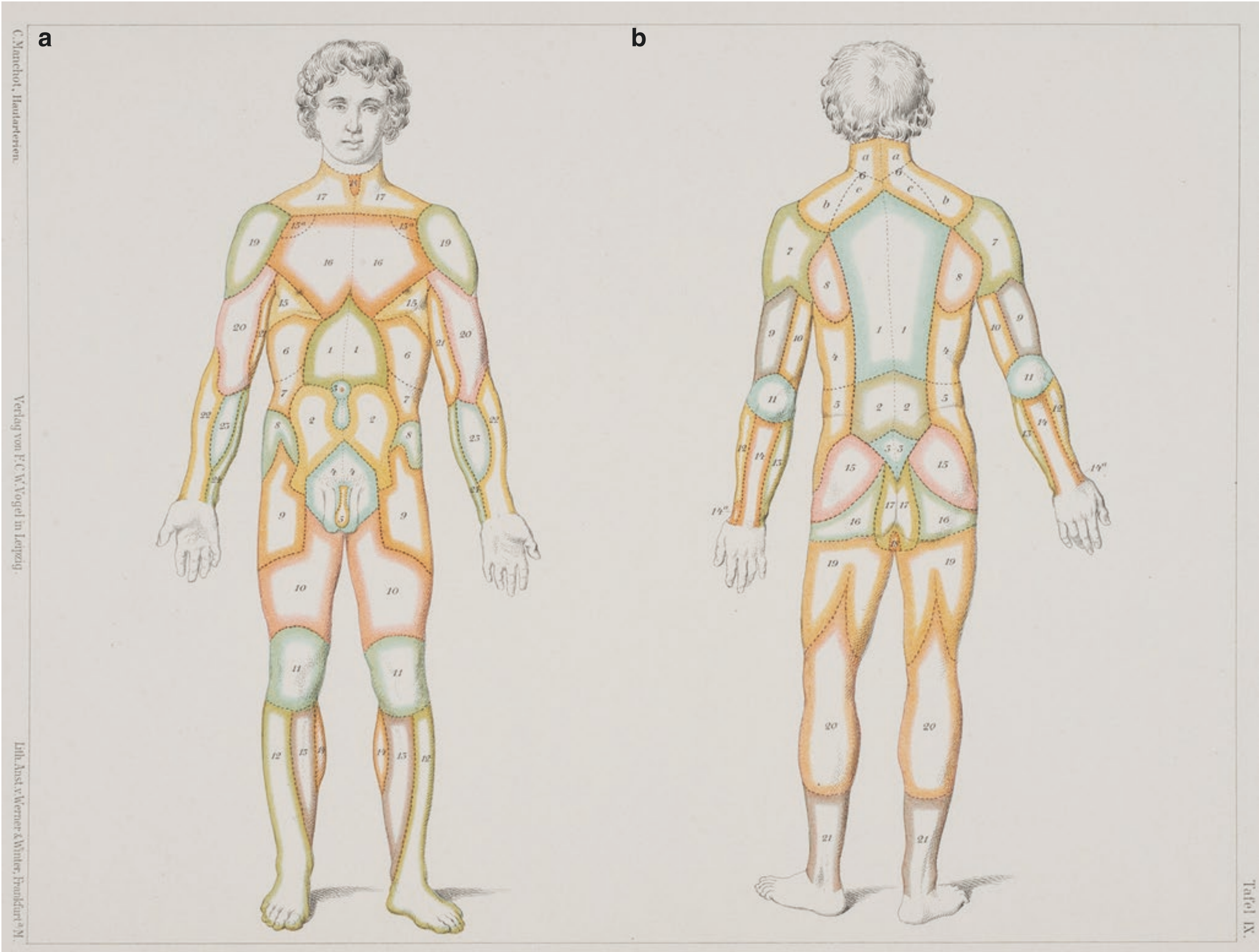


Fig. 6.1 The skin territories of the human body vascularized by a single vessel. (**a**) front; (**b**) rear. (From: Manchot C. *Die Hautarterien des menschlichen Körpers*. Leipzig, F.C.W. Vogel, 1889)

Michel Salmon

Michel Salmon (1903–1973), a surgeon and anatomist from Marseille, repeated Manchot's studies in the thirties, with the only difference being that he injected the vessels with a contrast medium. This was useful for defining arterial course with more detail using Roentgen X-rays that had been introduced in clinical practice in 1896. He was able to detect vessels much smaller than those of Manchot to establish the presence of intra-muscular anastomoses and to show a detailed vascular supply to the overlying skin. In 1936, he published the results of his findings in *Artères de la peau* (Arteries of the Skin), significantly contributing to the understanding of skin vascularization [10] (Fig. 6.2).

On examining Carl Manchot's work carefully, one realizes that the vascular territories he mapped on the cadaver and drew on the manikin illustrating his book exactly overlap those used in current microsurgical clinical practice: the area of cervical skin, delto-pectoral, submental, antero-lateral thigh, radial forearm, superficial inferior epigastric, and others—witness that nowadays we often rediscover the wheel.

Manchot's essay was resurrected 94 years after its original publication, translated into English, and re-published in 1983. In the introduction to the translation, **William D. Morain** points out that had Manchot published his work in English, "the entire history of plastic surgery would have been immensely altered"—an example of "plastic surgery's missed opportunity" [11].

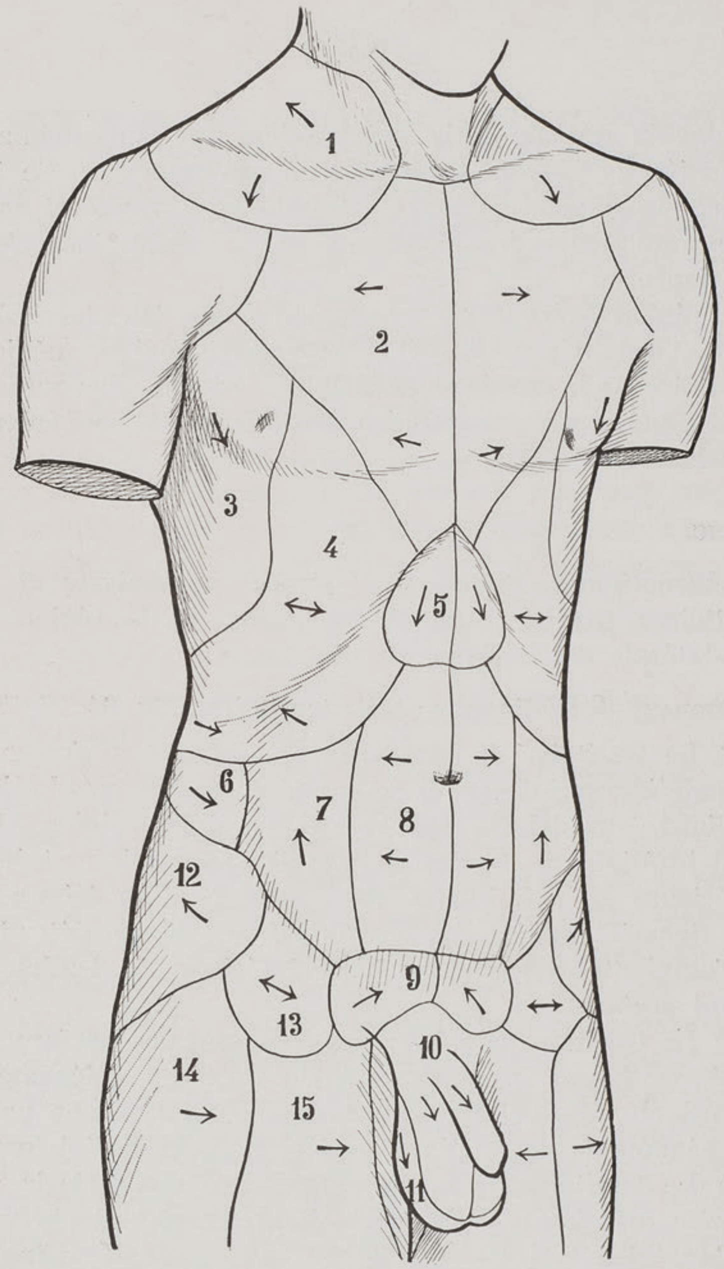


Figure 64.

Territoires artériels cutanés du tronc.

Vue antérieure.

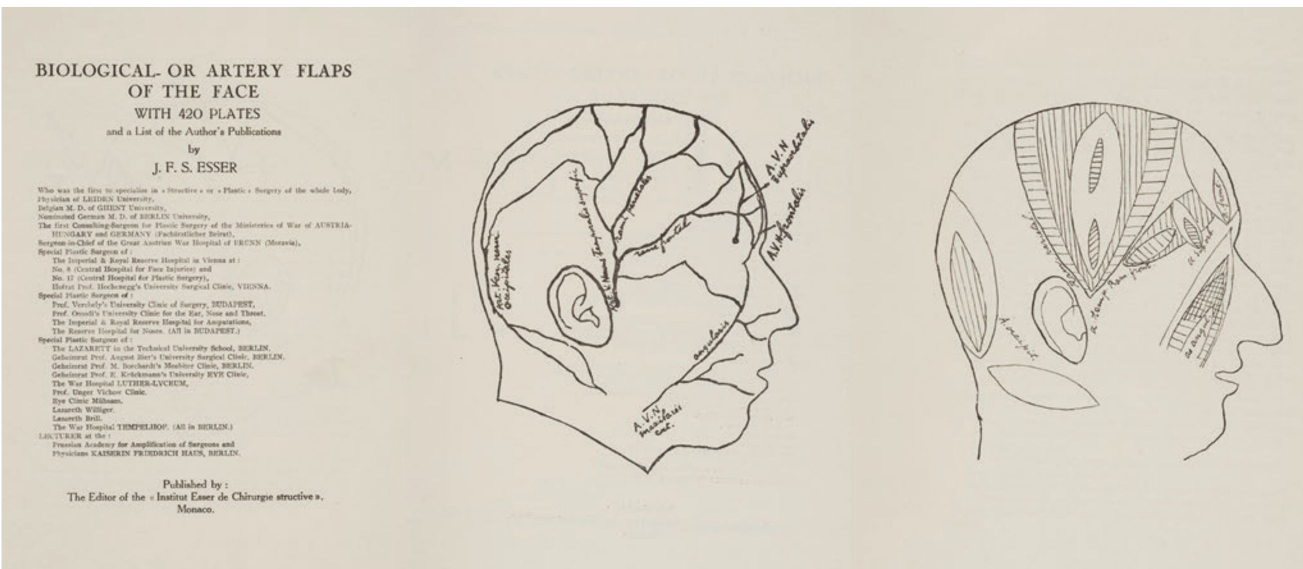
1. Artères cervicale transverse et sus-scapulaire. — 2 et 5. A. mammaire interne (2 branches directes. — 5. A. épigastrique superficielle supérieure). — 3. A. mammaire externe et scapulaire inférieure. — 4. Rameaux perforants des artères intercostales. — 6. Rameaux perforants des artères lombaires. — 7. A. épigastrique superficielle inférieure. — 8. A. épigastrique profonde. — 9. A. honteuse externe supérieure. — 10. A. honteuse externe inférieure. — 11. A. honteuse interne. — 12. A. circonflexe iliaque superficielle. — 13. A. fémorale primitive. Branches directes. — 14. Grande artère du vaste externe. — 15. A. fémorale superficielle.

Fig. 6.2 The vascular skin territories of the human body. Front view of the trunk. (From: Salmon M. *Artères de la Peau*. Paris, Masson et C. ie, 1936)

6.1.1.3 Arterial Flaps

Arterial flaps include a direct cutaneous artery within the longitudinal axis of the flap (nowadays called *axial pattern* flaps) [4]. Historically, the paramedian forehead flap, based on the supratrochlear artery employed for nasal reconstruction, represents the first example of an arterial flap. The full-thickness labial flap, reported by Sabattini [12] and Estlander [13] based on the coronary artery, constitute other examples. A particular type of arterial flap was described by **George Howard Monks** (1853–1933) (see Sect. 5.2.8.7). He outlined a skin flap, based on the anterior branch of the superficial temporal artery and, through a tunnel made in the temple, transposed it, along with its long nourishing vascular pedicle, to the lower eyelid, to close a cutaneous defect, following the excision of a carcinoma—the first example of what is nowadays called an *island flap*. The donor site was primarily sutured [14] (*see* Fig. 5.62).

Use of arterial and island flaps culminated in 1935 with the comprehensive publication of *Biological or Artery Flaps of the Face* by the Dutchman **Johannes F. S. Esser** (1877–1946) in which more than 100 cases of arterial or island flaps, outlined for repairing different defects of the face, most of them resulting from WWI injuries, were illustrated. Esser defined biological flaps as an amount of skin containing tissues such as muscle, fat, bone, or cartilage and outlined the territory of selected arteries and their branches, with the accompanying veins. It was mandatory to establish the precise course of the artery before raising the flap [15] (Fig. 6.3, *left*, *middle*, *right*).



BIOLOGICAL OR ARTERY FLAPS
OF THE FACE
WITH 420 PLATES
and a List of the Author's Publications
by
J. F. S. ESSER

Who was the first to specialise in « Structive » or « Plastic » Surgery of the whole body,
Physician of LEIDEN University,
Belgian M. D. of GHENT University,
Nominated German M. D. of BERLIN University,
The first Consulting-Surgeon for Plastic Surgery of the Ministeries of War of AUSTRIA-HUNGARY and GERMANY (Fachärztlicher Beirat),
Surgeon-in-Chief of the Great Austrian War Hospital of BRUNN (Moravia),
Special Plastic Surgeon of :
The Imperial & Royal Reserve Hospital in Vienna at :
No. 8 (Central Hospital for Face Injuries) and
No. 17 (Central Hospital for Plastic Surgery),
Hofrat Prof. Hochenegg's University Surgical Clinic, VIENNA.
Special Plastic Surgeon of :
Prof. Verebely's University Clinic of Surgery, BUDAPEST,
Prof. Onodi's University Clinic for the Ear, Nose and Throat,
The Imperial & Royal Reserve Hospital for Amputations,
The Reserve Hospital for Noses. (All in BUDAPEST.)
Special Plastic Surgeon of :
The LAZARETT in the Technical University School, BERLIN,
Geheimrat Prof. August Bier's University Surgical Clinic, BERLIN,
Geheimrat Prof. M. Borchardt's Moabiter Clinic, BERLIN,
Geheimrat Prof. E. Krückmann's University EYE Clinic,
The War Hospital LUTHER-LYCEUM,
Prof. Unger Virchow Clinic,
Eye Clinic Mühsam,
Lazareth Williger,
Lazareth Brill,
The War Hospital TEMPELHOF. (All in BERLIN.)
LECTURER at the :
Prussian Academy for Amplification of Surgeons and Physicians KAISERIN FRIEDRICH HAUS, BERLIN.

Published by :
The Editor of the « Institut Esser de Chirurgie structive »,
Monaco.

Fig. 6.3 (*Left*) The title page of Esser's publication; (*middle*) course of the facial arteries; (*right*) various skin and island flaps, named biological flaps by Esser, outlined on the facial arteries; (From: Esser JFS. *Biological or Artery Flaps of the Face.* Monaco, Institut Esser de Chirurgie Structive, (1935))

6.1.1.4 Musculocutaneous Flaps

Flaps that include the skin, muscle fascia, or subcutaneous fat, and are based on one or more arteries, are called *musculocutaneous*. The skin is vascularized by perforator vessels that pierce the surface of the muscle and spread in the overlying cutaneous and subcutaneous tissues.

In 1906, the Italian **Iginio Tansini** (1855–1943) (Fig. 6.4), a pioneer in surgical oncology and Professor of Clinical Surgery at Pavia University, published *Sopra il mio nuovo processo di amputazione della mammella* (On my New Procedure for Breast Excision), in *Gazzetta Medica Italiana* [16] where he illustrated the technique of transposing the latissimus dorsi musculocutaneous flap for covering defects on the anterior chest wall, following excision of breast carcinoma. Originally, the flap outlined on the dorsum was merely cutaneous. However, due to vascularization problems in its distal third, Tansini asked Professor Sala, an anatomist at Pavia University, to perform an anatomical study of the blood supply to the flap. The answer was: *The skin flap must include the underlying dorsalis muscle* (i.e., latissimus dorsi) *so as to preserve the perforator vessels*. This was the first example of musculocutaneous flap in history (Fig. 6.5). However, Tansini's dorsalis flap, considered too invasive, was seldom quoted, apart from the US surgeon **John S. Davis** (1872–1946) in his book *Plastic Surgery* (1919) [17] and became obsolete. In 1976, **Neven Olivari** (1932–2018), unaware of Tansini's work, independently published the use of the latissimus dorsi musculocutaneous flap for closing thoracic defects after excision of breast carcinomas, opening a new era in reconstructive breast surgery [18]. Not until 1980 was Tansini's original paper rediscovered, translated into English, and published by **Patrick Maxwell** [19].

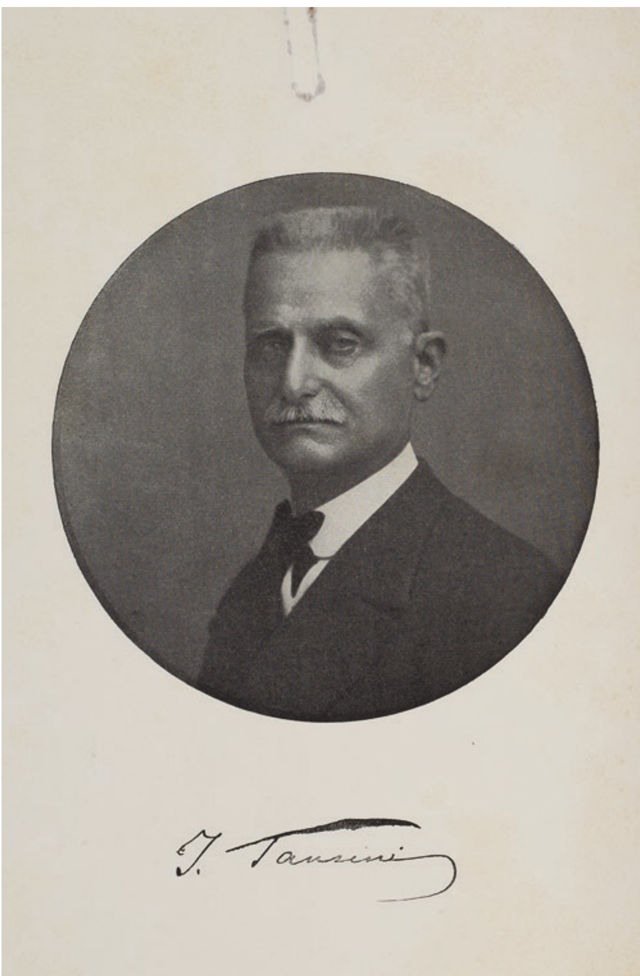


Fig. 6.4 Portrait of Iginio Tansini (1855–1943). (From: Tansini I. *Scritti Medici*. Milano, A. Wasserman & C, 1935)

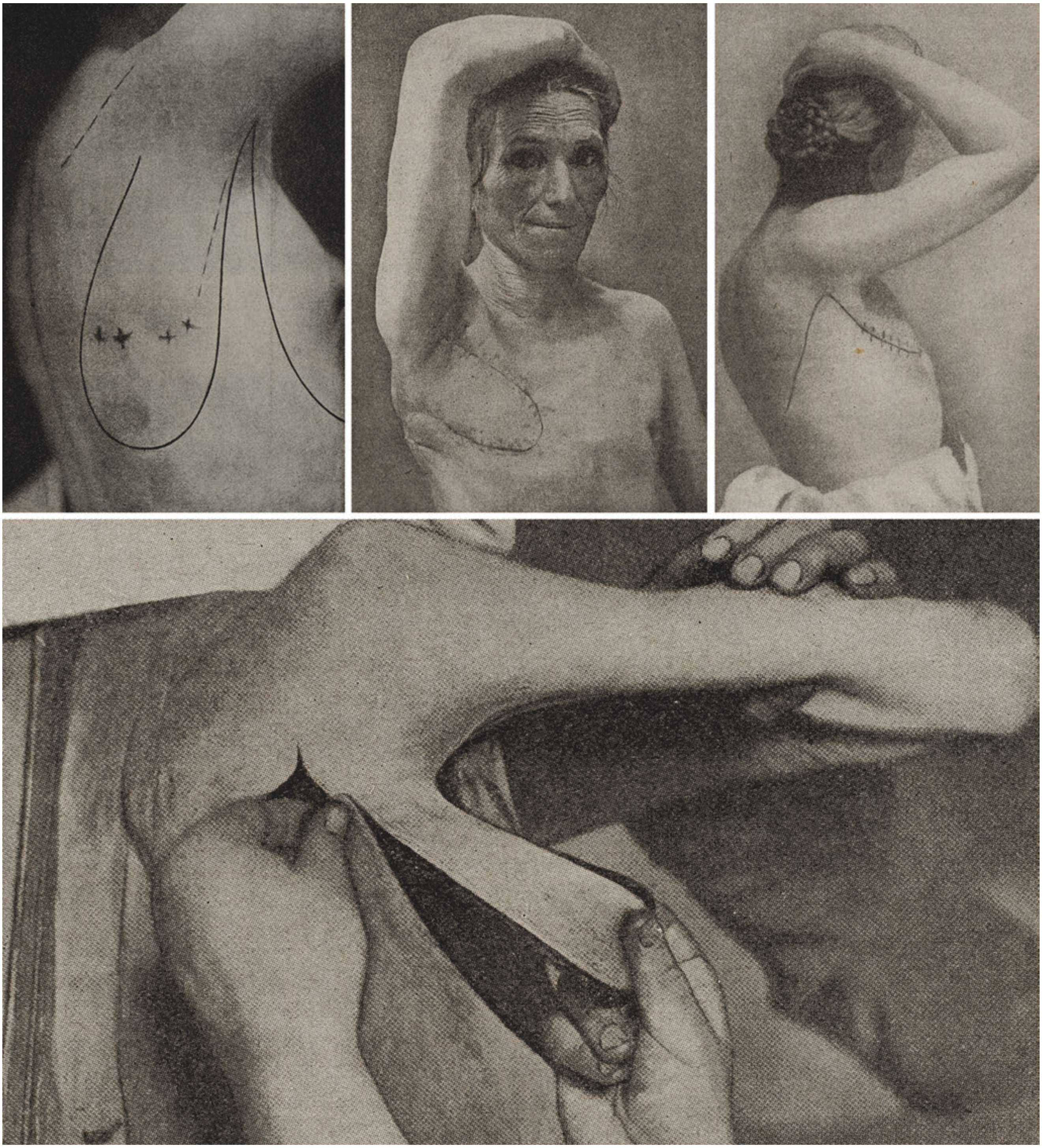


Fig. 6.5 The latissimus dorsi musculocutaneous flap as reported in Tansini's original publication. The different steps of the procedure. (From: Tansini I. *Sopra il mio nuovo processo di amputazione della mammella*. *Gazz Med It*. 1906; 57:141)

6.1.2 Skin Grafts

During the end of the nineteenth century and the first two decades of the twentieth century, skin grafting lost much of its popularity in favor of skin flaps. Despite this, the technique largely improved. Use of general anesthesia became routine and an armamentarium of cutting instruments for skin harvesting, or dermatomes, became commercially available.

New indications for skin grafts were found. One of them was the *epithelial inlay*, largely used to cover a raw cavity, such as the eye socket, the vagina, or to widen a retracted cavity like the labial fornix. A skin graft was wrapped around a mold and positioned into the cavity to be treated. **Johannes F. S. Esser,** having learned the technique from dentists, had the idea of using an inlay to cover raw surfaces of cavities [20]. He employed a malleable compound, developed by the English dentist **Charles Thomas Stent** (1807–1885). Once the mold had formed the template of the cavity to be covered, Esser wrapped the skin graft around it and positioned it in the cavity. In this way, the success of the graft take was almost predictable. He applied it not only in the raw cavity or for fornix formation, but also in the orbital socket, retracted vagina and in other parts of the body. This apparently simple and safe procedure was a considerable improvement compared to previous techniques. Immobilization, constant, well-distributed pressure, and prevention of hematoma formation were the secrets of success. Once the graft had taken, he reopened the cavity and introduced a specially made prosthesis to maintain the obtained sulcus, thus avoiding possible retraction. Esser published his technique on several occasions. He summarized his 25-year experience, derived from treating a considerable number of injured patients from WWI, in a well-documented atlas, *Esser-Inlay*, issued in Leiden (The Netherlands) in 1940 [21].

6.1.3 Grafting of Tissues Other Than Skin

During the first two decades of the twentieth century, numerous tissues were freely transplanted for use in plastic surgery: bone, cartilage, and fat.

6.1.3.1 Bone Grafting

van Meekeren

In 1682, **van Meekeren** [22] (*see* Sect. 4.1.4.1) first described a bone graft from animal (dog) to man. Since then the literature on bone grafting has been the subject of intense investigation over the years.

Louis Xavier Édouard Léopold Ollier

The experimental work of **Louis Xavier Édouard Léopold Ollier** formed the basis of all future studies (*see* Sect. 5.4.5). In his *Traité Expérimental et Clinique de la Régénération des Os* (an experimental and clinical treatise on bone regeneration), issued in 1867 [23], he advocated that in bone graft surgery, the entire graft remained viable and that periosteum was of greatest importance in maintaining the life of the graft. He illustrated numerous clinical applications in man, either by transplanting periosteum or bone for re-establishing the defective cranial vault, for reconstructive rhinoplasty, or for closing palatal defects.

Arthur Barth

On the contrary, **Arthur Barth** (1858–1927) demonstrated that bone graft degenerates completely following transplantation and is replaced by new bone, the so-called *creeping substitution*, nowadays termed *osteoconduction* [24].

Georg Axhausen

The role of periosteum in bone graft survival was contradicted by the studies of **Georg Axhausen** (1877–1960), a pioneer in bone grafting. He showed that periosteum does not undergo necrosis, but it is important for the viability of the transplant. The bony tissue itself degenerates, dies, and is eventually replaced [25].

Dallas B. Phemister

Dallas B. Phemister (1882–1951) basically agreed with Barth's views. In his paper on the fate of bone grafting, published in 1914, he demonstrated that either periosteum or endosteum was necessary for bone resorption and regeneration of the central necrotic part of the graft, with new bone formation [26].

Fred H. Albee

In 1915, the American surgeon **Fred H. Albee** (1876–1945) issued the first textbook on *Bone-graft Surgery* [27]. In the preface, Albee emphasized that bone, *being one of the simple connective tissues, lends itself favorably to transplantation and to the repair of skeletal deficiencies and is the most reliable means of internal bone fixation. Instead of antagonizing Nature by attempting to introduce a foreign substance, the surgeon, by using autogenous material, is following Nature's own method*. Successful bone graft is the result of a series of important details: (1) the recipient site must have adequate blood supply; (2) bone to bone contact should be established between recipient bone and the graft. This may facilitate the so-called *creeping substitution*; (3) immobilization should be maintained during the healing phase to avoid any resorption tendency; (4) bone graft should be positioned in healthy tissue only, avoiding potential infected areas.

By the end of WWI, bone graft became a routine procedure in plastic surgery for nose reconstruction, jaw repair, cranioplasty, depressions of the forehead sequelae of injuries, and other indications.

6.1.3.2 Cartilage Grafting

Cartilage graft, currently practiced in aesthetic surgery of the nose and face, had received little attention in the past. The first attempts at cartilage grafts were not encouraging.

Wilhelm Zahn

In 1878, the pathologist **Wilhelm Zahn** (1845–1904) [28] came to the conclusion that degenerative phenomena occurred in the graft, leading to its absorption, independent of the site where it was transplanted.

E. Fischer

On the contrary, a few years later, in 1882, **E. Fischer** [29] supported the theory that the survival of a cartilaginous graft was dependent on the presence of the perichondrium. Cartilage transplanted with the perichondrium showed no changes in its structure.

Friedrich von Mangoldt

Friedrich von Mangoldt (1859–1909), Professor of Surgery in Dresden, and a pioneer in cartilage grafts, did significant research in this field, writing on transplanting rib cartilage graft to the neck to close a laryngeal defect and to treat laryngeal stenoses [30]. The following year, he published a similar paper, to which he added an important contribution: the first report of a cartilage graft to the nose to correct a saddle nose deformity, resulting from syphilis. He claimed that cartilage may survive for a long period of time when transplanted under the skin. *On June 21, 1899, a piece of costal cartilage with perichondrium was excised from the right 7th costal area. A small incision was made across the glabella, the skin undermined down to the nasal tip and the cartilage graft inserted so that it would hold the tip forward. The small forehead wound was closed with sutures. In this way, the not-perichondrium covered side of the cartilage was placed under the skin. Two wide, but thin, cartilage tongues were then introduced into the nostril walls through small incisions in both nasolabial folds.* (…) *On the whole, these cartilages healed without complication.* (…) *Through the operations undertaken, the saddle nose and the loose nostrils were corrected.* (…) *On the basis of these experiences, I believe that costal cartilage will be valuable to use in some plastic operations and I would like to recommend the procedure to you* [31].

6.1.3.3 Fat Grafting

Fat, readily available, was considered the ideal tissue to fill in depressions and contour deformities.

Gustav Neuber

In 1893, the German surgeon **Gustav Neuber** (1850–1932), known for the first attempts at the use of antisepsis in his surgical practice, first harvested adipose tissue from the arm and transferred it to the orbital region to correct adherent scar sequelae from osteomyelitis [32].

Viktor Czerny

Shortly afterward, in 1895, another German, **Viktor Czerny** (1842–1916), transferred a lipoma to the breast to re-establish symmetry, following unilateral partial mastectomy for fibrocystic mastitis [33].

Erich Lexer

The healing potential of fat was empirically noticed by those surgeons who were confronted with the management of the terrible disfigurements caused by World War I. Fat was inserted into the wounds either to promote the healing process or to correct uneven scars from gunshot wounds of soldiers injured on the battlefields. The German maxillofacial surgeon **Erich Lexer** (1867–1937) first used fat in combination with local flaps and cartilage graft to reconstruct the eye socket so as to accommodate a prosthesis in a facially disfigured soldier (Fig. 6.6). His experience with fat grafting soon became vast. In 1919, he published a two-volume book, *Die freien Transplantationen* (free transplantations), in which all the different types of free grafts available at that time were critically and histologically evaluated [34]. More than 300 pages were devoted to fat grafting, with an incredible range of clinical applications, from the correction of contour deformities for sequelae of facial traumas to hemifacial microsomia, microgenia, breast asymmetry, post-traumatic hand stiffness, and Dupuytren's disease to restore the gliding tissue around the tendons [35]. The source of adipose tissue was usually the lateral thigh.

Fig. 6.6 Reconstruction of the eye socket with local flaps, cartilage graft, and fat grafting to accommodate a prosthesis in a facially disfigured soldier. (*Left*) pre-; (*right*) post-operative view. (From: Lexer E. *Die freien Transplantationen*. Stuttgart, Enke, 1919–1924)

Hippolyte Morestin
About the same time, **Hippolyte Morestin** (1869–1919), Surgeon-in-Chief at the military hospital Val-de-Grâce in Paris, and an experienced war surgeon, used fat grafts to improve severe facial scars from gunshot wounds in soldiers wounded in World War I, with favorable results [36, 37].

Harold Gillies
In England, **Harold Gillies** (1882–1960) devoted his skill to the repair of facial disfigurements. In his book, *Plastic Surgery of the Face* published in 1920, he showed numerous cases of soldiers from WWI with dramatic facial wounds treated by fat grafting with amazing outcomes [3] (Fig. 6.7).

Initially, surgeons enthusiastically favored the technique of en bloc fat grafting, alone or in combination with skin flaps, as it often represented the only possibility to solve major problems in a simple way. Fat was inserted into the face in cases of Romberg's disease, or into the breast to correct sequelae of mastectomy, or into the pharynx to reduce nasal air escape in cases of cleft palate surgery [38]. However, by the 1930s, with growing experience, clinicians realized that the encouraging early results worsened over the long term because of an unpredictable reabsorption rate and the tendency to form oily cysts. Fat graft, initially pliable, gradually modified, turning hard and fibrotic [39]. Due to these considerations, fat grafting to the face gradually fell from favor, and the procedure became almost obsolete.

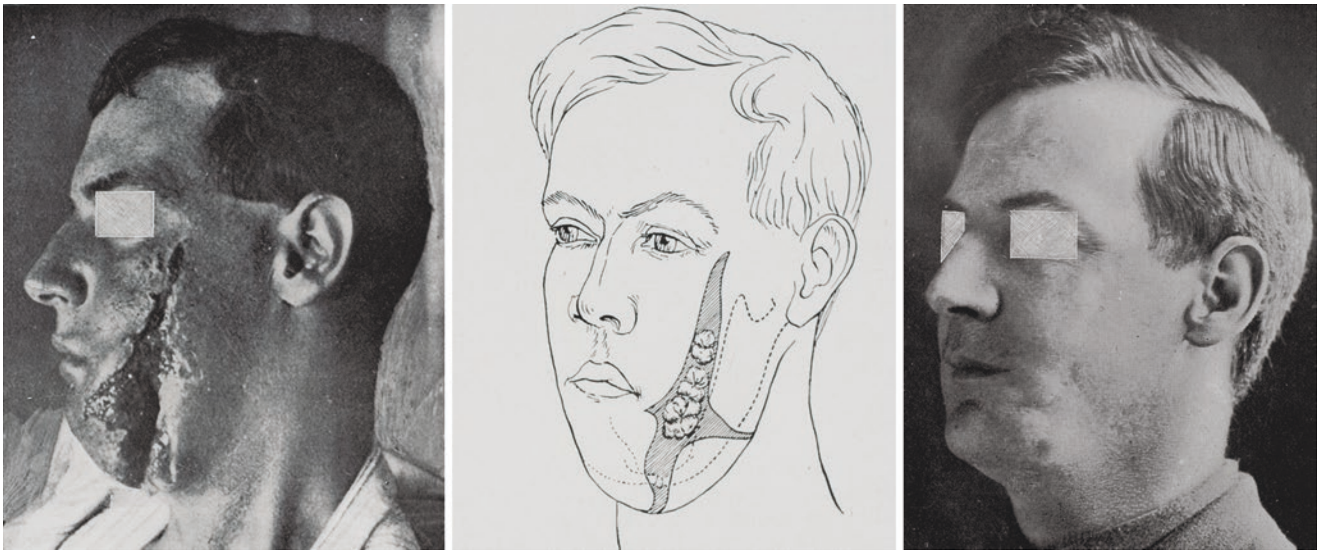


Fig. 6.7 Use of fat to improve wound closure. *Left:* Facial wound from World War I. *Middle*: fat flaps rolled into the wound to facilitate its closure; *right*: final result. (From: Gillies HD. *Plastic surgery of the face*. London, Frowde, Hodder, Stoughton, 1920)

6.1.3.4 Fat Injection

At the end of the nineteenth century and early twentieth century, the use of paraffin to improve sunken noses resulting from syphilis, the so-called saddle nose, was very popular [40] (*see* Sect. 7.2.3.6).

Eugene Holländer

To contrast the typical paraffin complications, such as hard local swellings called paraffinomas, migration tendency, and pulmonary embolism [41], the German surgeon **Eugene Holländer** (1867–1932) had the idea of injecting fat, which he considered a more natural filler [42]. Adipose tissue was obtained from healthy patients. To minimize its reabsorption rate, the main drawback of fat transplantation, Holländer mixed it with a harder type of fat, harvested from a ram. The blend of human and ram fat was moderately heated until it became fluid, suitable to be introduced into the body at blood temperature with a syringe, so as to improve asymmetries, deformities, depressions, facial atrophy (Fig. 6.8), post-mastectomy scars (Fig. 6.9), and other alterations. In his detailed report, Holländer said that patients suffered a painful rash for about 2 to 3 days, but then the post-injection course was uneventful. The technique was published in 1910 and 1912 [43, 44].

Fig. 6.8 Facial atrophy, treated by fat injection. *Upper:* preoperative view of a patient; *lower*: post-operative view of the same patient after fat injection. (From: Holländer E. *Über einen Fall von fortschreitenden Schwund des Fettgewebes und seinen kosmetischen Ersatz durch Menschenfett. Münch Med Wochenschr* 1910; 57:1794–5)

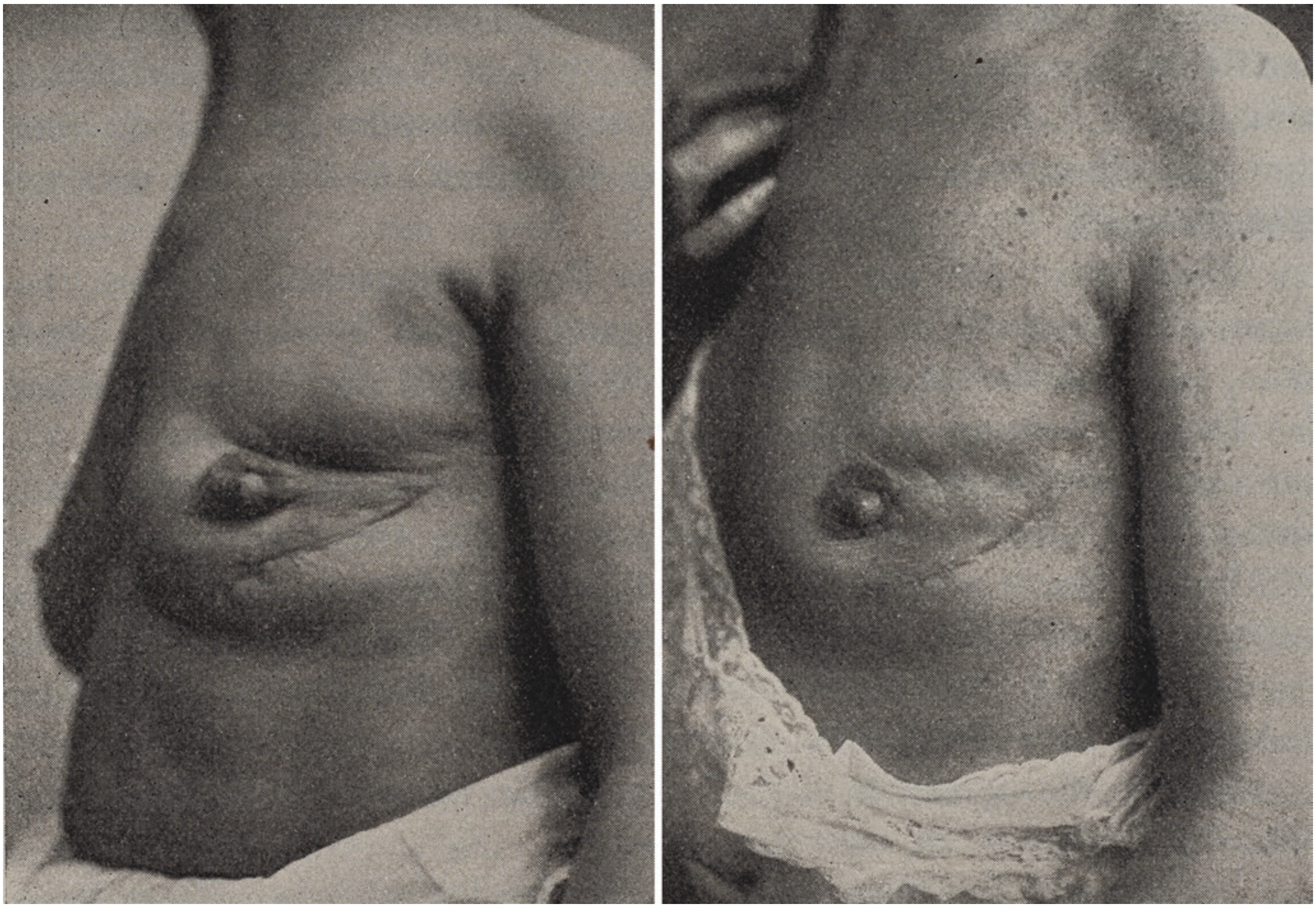


Fig. 6.9 Postmastectomy scars treated by fat injection. First report of fat injection into the breast in the medical literature. *Left:* preoperative view of a patient; *right:* post-operative view of the same patient after fat injection. (From: Holländer E. *Über einen Fall von fortschreitenden Schwund des Fettgewebes und seinen kosmetischen Ersatz durch Menschenfett. Münch Med Wochenschr* 1910; 57:1794–5)

Charles C. Miller

In 1926, **Charles C. Miller** (1880–1950) from Chicago, one of the first US cosmetic surgeons, called either "the father of modern cosmetic surgery" or "an unabashed quack" issued *Cannula Implants*, a textbook on fillers with the goal of modifying featural imperfections [45]. Besides using subcutaneous injections of rubber and gutta percha, ground in a mill, to correct nasolabial folds, crow's feet, and saddle noses, he suggested the use of fat grafting. He harvested parcels of adipose tissue from the abdomen, inserted them into a powerful screw piston syringe, and injected the obtained material subcutaneously to fill in depressions (Fig. 6.10).

Curiously, fat injection was seldom employed until the advent of liposuction in the 1980s. Instead, for many years paraffin remained the solution of choice for nose and breast augmentation, despite its dramatic consequences.

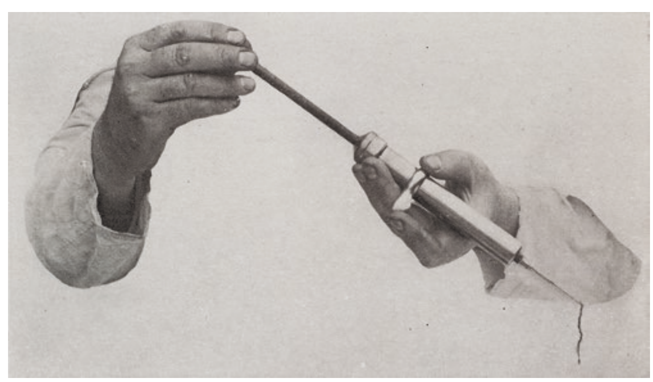


Fig. 6.10 The syringe, with a special screw piston, devised by Miller, to inject fat subcutaneously to fill in depressions. (From: Miller CC. *Cannula Implants and Review of Implantation Technics in Esthetic Surgery. In Two Parts*. Chicago, Oak Press, 1926 p. 66–71; 25–30)

6.1.3.5 Fat Grafting, Current Application

Nowadays, fat grafting has evolved considerably. It ranks among the most popular procedures of modern plastic surgery, replacing many procedures currently performed, such as flap reconstruction or skin grafting for wound closure. It provides the surgeon with an incredible range of aesthetic and reconstructive clinical applications with amazing outcomes in the repair of damaged or missing tissues or in the treatment of difficult wounds, possibly related to the regenerative potential of adipose derived stem cells included in fat grafts.

6.2 Plastic Surgery and WWI

World War I (WWI) was largely fought in trenches. Created for shielding purposes, they actually protected the soldier's lower body and trunk. However, peering over the trenches with only a helmet for protection, the face and neck remained exposed to enemy fire, with dramatic consequences. Soldiers with major maxillofacial mutilations found it impossible to return home and to step back into society. This resulted in a new social problem. Associations were established all over the world to help these poor individuals. The most famous was *Les gueules cassées* (The Facial Cripples), founded in France in 1921 by two former facially wounded patients treated at Val-de-Grâce military hospital, **Albert Jugon** and **Bienaimé Jourdain**, under the presidency of Colonel **Yves Picot** [46] (Fig. 6.11). Treatment of these devastating facial wounds urged the development of a new discipline, no longer ablative, but reparative or plastic instead. Initially, during the first two decades of the twentieth century, a novel generation of surgeons, not yet trained in this innovative field, arose. They came from a variety of backgrounds (general surgery, orthopedics, and otolaryngology) and had to deal with the reconstruction of a huge number of facially disfigured soldiers, roughly estimated as 60,000 British and 450,000 French [46].

The key to success was the cooperation between plastic surgeons, trained in soft-tissue defect management using the abovementioned solutions with grafts and flaps, and oral surgeons, expert in stabilizing mandibular and maxillary fractures, using dental appliances.

The birth of modern plastic surgery is the result of choral work more than the effort of a single man. Surgeons from different backgrounds, training, education, and nationalities came together with their own organization, technicians, and nurses to create a new way to manage facial injuries resulting from the war, in an attempt to return patients back to their families and to society—basically, the social role of the new art.

Fig. 6.11 Image of the *gueules cassées*, the facial injured soldiers from WWI

6.2.1 France

6.2.1.1 Hippolyte Morestin

The importance of such a team approach was first realized by **Hippolyte Morestin** (1869–1919), a pioneer in facial reconstructive surgery. The son of a physician, Morestin was born in Martinique, at Basse-Pointe. At the age of 15, he moved to Paris where he studied medicine, becoming *Interne des Hôpitaux* of Paris in 1890 and graduated 4 years later. A disciple of **Aristide Verneuil** (1823–1895) and **Jean-François-Auguste Le Dentu** (1841–1926), he worked in different Parisian hospitals, Tenon and St. Antoine, before being appointed head of the unit at Hôpital St. Louis. In the meantime, he became Associate Professor of Anatomy at the Medical Faculty of Paris and Associate Professor of Surgery. During WWI, from 1914 until his death, he dedicated himself to the treatment of facially injured soldiers at Val-de-Grâce where he worked with the dentist **Charles Auguste Valadier** (1873–1931) [46], and at Hôpital Rotschild, operating on thousands of individuals. However, he didn't disregard cosmetic procedures, such as facelifting and correction of prominent ears [47]. He had numerous well-known disciples, among them **Raymond Passot** (1886–1933), **Suzanne Noêl** (1878–1954), and **Léon Dufourmentel** (1884–1957). In 1918, he was awarded the Legion of Honor. He died a year later in 1919, aged 50, as a consequence of the Spanish flu, just before being promoted to Professor. Morestin was a prolific writer, publishing more than 600 scientific papers [47].

6.2.1.2 Léon Dufourmentel

Léon Dufourmentel (1884–1957) was *Interne des Hôpitaux* of Paris, a disciple of Hippolyte Morestin, and the son-in-law of the anatomist and surgeon **Pierre Sebileau** (1860–1953). During WWI, he also took care of the *gueules cassées.* He described a bipedicled hairbearing vascularized scalp flap, transferred to cover defects of the chin, a procedure that bears his name. His most important publication was a textbook, *Chirurgie réparatrice et correctrice des téguments et des formes* (Reparative and Corrective Surgery of the Skin and Contour Defects), issued in 1939 [48].

6.2.1.3 Maurice Virenque

Maurice Virenque (1888–1946) was born in Paris and graduated in medicine from the University of Paris in 1914. Appointed *Interne des Hôpitaux*, he worked at Hôpital du Mans, where his interest in maxillofacial surgery began. From 1921 to 1946, he provided exceptional care to soldiers with severe face and skull injuries with the cooperation of his stomatologist, **J. Lebedinsky** (1873–1933). He largely used osteo-periostic grafts for facial and mandibular reconstructions [46]. For a certain period of time, he was Paul Tessier's chief—when **Paul Tessier** (1917–2008), the well-known cranio-facial surgeon, attended at Hôpital du Mans. He strongly supported the importance of aesthetic surgery, developed in the interwar period. Due to his great knowledge of facial anatomy and maxillofacial surgery, Virenque occupies an important place among the forerunners of facelifting (see Sect. 7.6.5.1). He died in 1946, aged 58.

In 1940, Virenque published *Chirurgie Réparatrice Maxillofaciale* (Reconstructive maxillofacial surgery) where the repair of facial traumas, mainly sequelae of WWI, was illustrated [49]. Divided into three parts, the work is well-illustrated by numerous drawings and documented by pre- and post-operative views of patients. Part One describes the basic techniques of facial repair: sutures, free grafts, and skin flaps. Part Two deals with the different types of autoplasty: cheiloplasty and genioplasty. Part Three explains the management of severe maxillary and mandibular traumas, the *gueules cassées*. Virenque insisted on the importance of reconstruction by layers: skin, mucosa, and bone. To achieve good occlusion and an acceptable aesthetic result, he considered immobilization of the different fragments essential.

6.2.1.4 Albéric Pont

Albéric Pont (1870–1960), a stomatologist, established one of the first French centers for maxillofacial surgery in Lyons, where remarkable reconstructive facial operations were carried out [46].

6.2.2 England

In 1915, the New Zealand-born British otolaryngologist **Harold Delf Gillies** (1882–1960) (Fig. 6.12) was working in France on behalf of the Red Cross when he visited Val-de-Grâce military hospital. He was much impressed by the reconstructive work of Hippolyte Morestin. Valadier strongly recommended that Gillies begin to take care of facial disfigurements [50]. At the end of 1915, upon his return to England, Gillies persuaded the army's chief surgeon, **William Arbuthnot-Lane** (1856–1943), to create a ward for the management of facial injuries. The ward was initially established at the Cambridge Military Hospital, Aldershot, but the facility soon proved insufficient and a new hospital devoted to the treatment of face and jaw injuries opened in June 1917 at Queen's Hospital, Sidcup. With its convalescent unit of more than 1000 beds, it was the largest and most important hospital in the world for jaws and plastic work. Treatment was provided to British and allied soldiers wounded in the Battle of the Somme in France, one of the bloodiest events in history, where British and allied troops suffered almost 500,000 casualties, with more than 6000 facial mutilations, between July 1 and the November 28, 1916 end of the battle. At Queen's Hospital, Gillies and his team performed more than 11,000 operations on over 5,000 patients, mostly soldiers with facial injuries, usually from gunshot wounds. The multi-disciplinary approach included **William Fry** (1889–1963) and **Henry Percy Pickerill** (1879–1956) as dental surgeons [51] (Fig. 6.13), a qualified group of anesthesiologists, among them **Ivan Magill** (1888–1986) who developed nasal and endo-tracheal intubation, and finally numerous surgeons coming from all over the world. Gillies systematized new reconstructive procedures, such as the tubed flap described by the Russian **Vladimir Filatov** (1875–1956) [1] and the German **Hugo Ganzer** (1879–1960) [2], a technique that offered the possibility of wide skin defect coverage. However, apart from tubed flaps, other reconstructive techniques such as cutaneous flaps and grafts of bone, cartilage, fat, and skin were also used. Queen's Hospital became the referral center for reconstructive surgery in Europe. At the end of WWI, Gillies retired into private practice and a new surgeon, Captain **Thomas Pomfret Kilner** (1890–1964), was associated with the unit, a partnership that lasted until 1930.

Gillies reported his experience in *Plastic Surgery of the Face*, issued in 1920, a milestone publication in the history of plastic surgery [3] (Figs. 6.14 and 6.15). The first part of the book described the treatment modalities of facially disfigured patients from WWI. In the second part, the repair of different facial areas such as cheek, lip, eyelid, and nose were presented with unique, detailed photographic documentation. In the interwar period, Gillies developed an important private practice, shared with **Rainsford Mowlem** (1902–1986) and Gillies' cousin **Archibald McIndoe** (1900–1960). McIndoe considerably improved management and rehabilitation of severely burned patients.

Gillies treated many famous patients and travelled worldwide lecturing, teaching, and promoting the most advanced techniques. In 1930, he was knighted by King George V for his outstanding contributions in the management of injured soldiers. He was among the founding members of the *Société Européenne de Chirurgie Structive*, the first supranational society, created in 1936 by the Belgian **Maurice Coelst** (1894–1963) (Fig. 6.16) with the aim of gathering annually all those international specialists interested in this new discipline. The term *structive* was coined by **Johannes Esser** (1877–1946) as he considered it more appropriate than "plastic" to emphasize the concept of repairing [52].

At the outbreak of the Second World War (WWII), there were four full-time plastic surgeons in the UK: **Gillies, Kilner, McIndoe,** and **Mowlem**, known universally as the "big four." The plastic surgery they practiced ranked among the most influential in Europe, covering all the different facets of the specialty, including reconstruction, burns, congenital malformations, and aesthetics, and they maintained this leadership for many years. During WWII, Gillies worked at Park Prewett Hospital treating injured soldiers—always with great enthusiasm and using the most advanced techniques available. With the cooperation of **Thomas Pomfret Kilner**, he was continuously involved in the progress of the specialty.

With the Swedish plastic surgeon, **Tord Skoog** (1913–1976), Gillies was among the founding members of the *International Confederation of Plastic Surgeons*, IPS, with the aim to *concentrate on the repair of the ghastly war wounds of 1914–1918 and again 1940–1945*, but also showing recent acquisitions of the specialty in the field of aesthetic surgery. IPS held its first Congress in 1955 in Stockholm with Gillies serving as Honorary President. He died in 1960, aged 78.

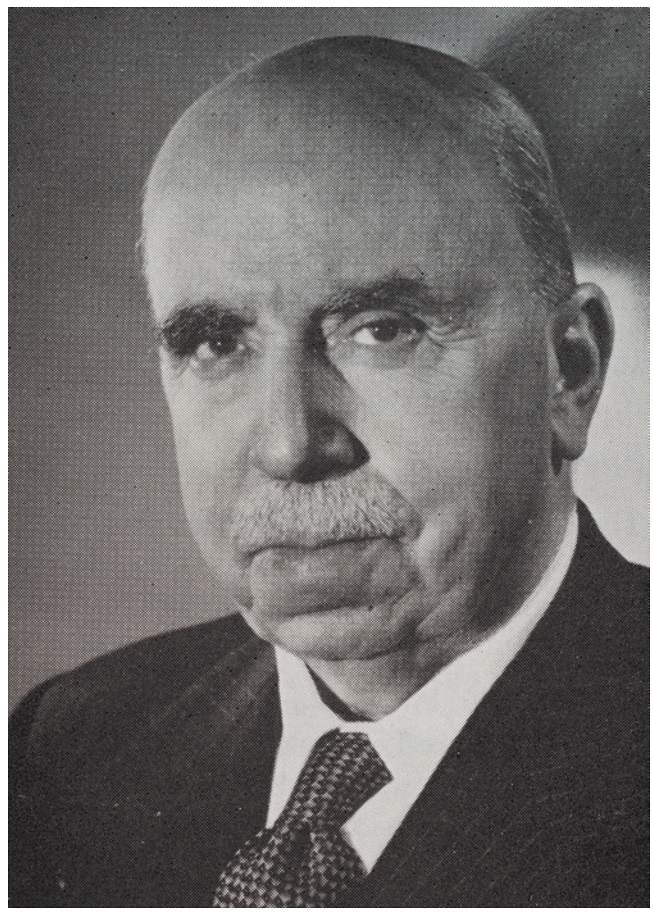


Fig. 6.12 Portrait of Sir Harold D. Gillies (1882–1960)

Fig. 6.13 Facially disfigured soldiers from WWI. (From: Pickerill HP. *Facial Surgery*. Edinburgh, E&S Livingstone, 1924)

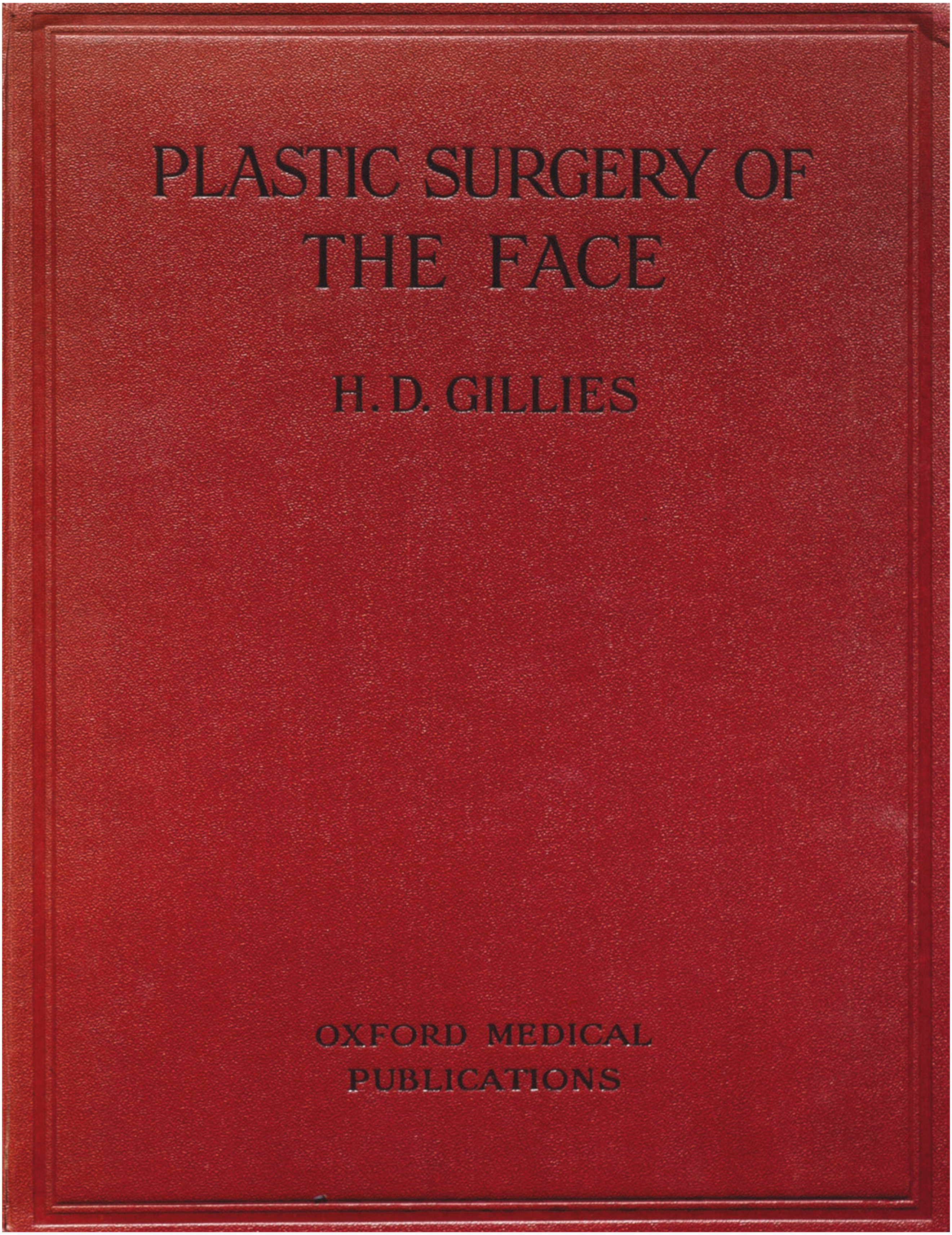


Fig. 6.14 The textbook *Plastic Surgery of the Face* by Harold D. Gillies issued in 1920

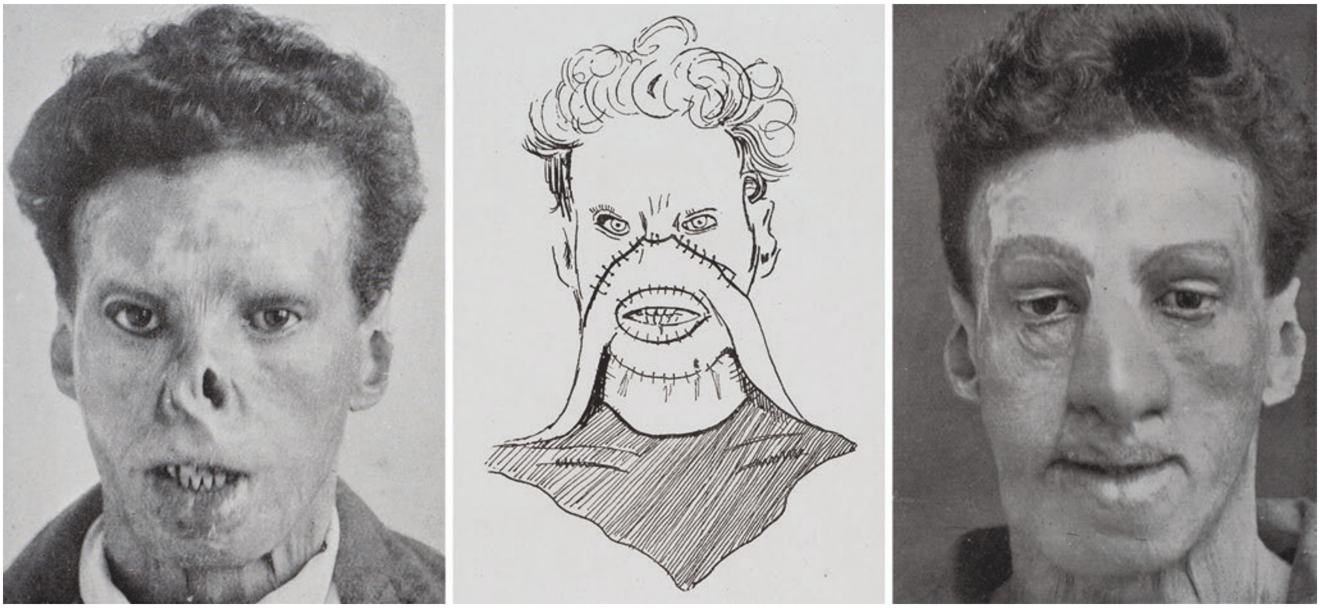


Fig. 6.15 Extensive facial reconstruction for sequela of burn, operated by H. Gillies at Queen's Hospital, using the tubed flap. *Left:* pre-operative situation; *middle*: the tubed flap into position before its defatting; *right*: final result. (From: HD. Gillies. *Plastic Surgery of the Face.* London, H. Frowde, Hodder and Stoughton, 1920)

Fig. 6.16 The founding members of the *European Society of Structive Surgery*. (From left to right: H. Gillies, J. Esser, M. Coelst, P. Kilner, G. Sanvenero-Rosselli. Brussels, October 1936)

6.2.3 Germany

6.2.3.1 Erich Lexer

Erich Lexer (1867–1937) was probably the best known German surgeon of the period (Fig. 6.17). During WWI, he was an Admiral in the navy, but he also organized a center for maxillofacial surgery in Flanders. When the war ended, he became the head of the University Surgical Clinic at Freiburg from 1919 to 1928. Besides *Die freien Transplantationen* (Free Transplantations), where he strongly advocated the use of fat grafting (see Sect. 6.1.3.3), he published a textbook on reconstructive surgery, *Wiederherstellungschirurgie* (Reconstructive Surgery) in 1920, documenting numerous pre- and post-operative photographs of soldiers and thus demonstrating the amazing results obtained by plastic surgery to correct the dramatic facial disfigurations of WWI [53] (Fig. 6.18). In 1931, he published the two-volume fully illustrated *Die gesamte Wiederherstellungschirurgie* (The Entire Reconstructive Surgery), and concurrently the second edition of the 1920 *Reconstructive Surgery*, one of the first textbooks on general plastic surgery issued in Europe [54]. It covered congenital anomalies, sequelae of facial injuries from WWI, sequelae of burns, but also cosmetic operations that will be described in Chap. 7.

In 1928, Lexer was nominated Professor of Surgery in Munich. A skilled orthopedist and plastic surgeon, he is considered the founder of modern plastic and maxillofacial surgery in Germany. He was a very authoritative personality and at times even rude. Chronicles reported that he wanted to be alone in the OR before starting a reconstructive procedure: *Ich will allein sein in der Wunde* (I want to be alone in the wound). He quoted *Prometheus* by Johann Wolfgang von Goethe: *Ich sitze hier und forme Menschen* (I sit here and shape people).

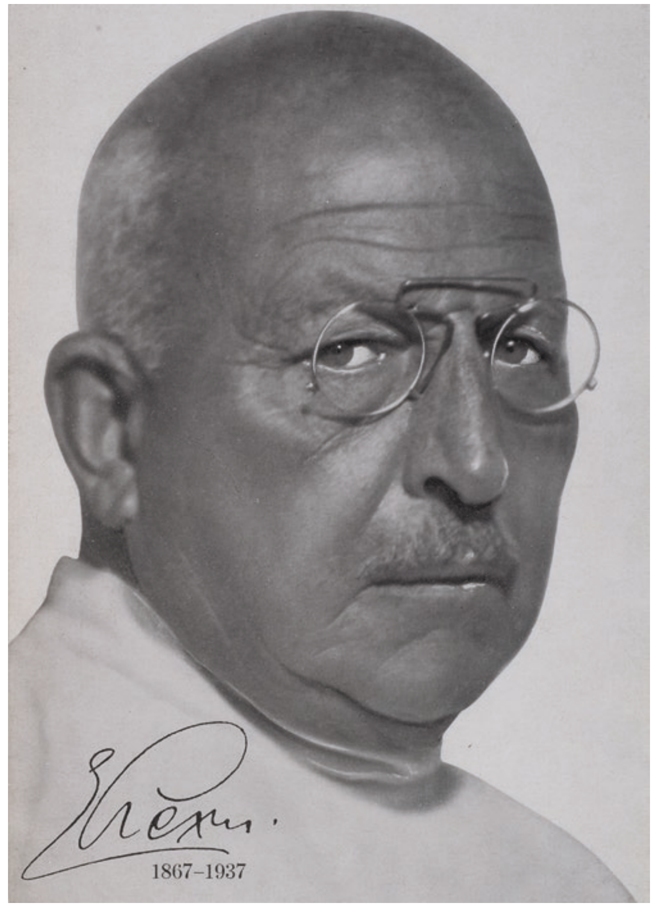


Fig. 6.17 Portrait of Erich Lexer (1867–1937)

Fig. 6.18 Reconstruction of the upper lip with a hairbearing temporal flap. (From: Lexer E. *Wiedeherstellungschirurgie*. Leipzig, A. Barth, 1920)

6.2.3.2 Jacques Joseph

Despite being universally best known for aesthetic nasal surgery, for which he is rightly considered the father of modern rhinoplasty (see Sect. 7.2.3.2), **Jacques Joseph** (1865–1934) took care of the facially disfigured from WWI at the Charité Hospital in Berlin. The results of his reconstructions, using innovative procedures, were published in 1916 [55] and in 1931 [9]. In 1919, he was granted the title of Professor by the Ministry of Science, Art and Culture for his involvement in reconstructive procedures, obtaining a long overdue reward [56].

6.2.4 The Netherlands

Without any doubt, the Dutchman **Johannes Fredericus Samuel Esser** (1877–1946) should be considered one of the most talented, influential, multi-faceted, multi-lingual, and controversial personalities of the twentieth century (Fig. 6.19). He was first of all a plastic surgeon, but also a ship's physician, art collector, businessman, and last but not least, a chess champion. Born in Leiden in 1877, he studied medicine at Utrecht and Leiden, from where he graduated as a dentist in 1903, and in medicine at the end of the same year. He began his career as a family doctor and started his surgical training in Utrecht. However, dissatisfied with the slow progress of his training, in 1914 he went to Paris with his family where he visited **Pierre Sebileau** (1860–1953), an outstanding head and neck surgeon, and the otorhinolaryngologist **Fernand Lemaître** (1880–1958). But the main reason for Esser's stay in Paris was to meet **Hippolyte Morestin** (1869–1919). He remained with him for 6 months at Hôpital St. Louis and Val-de-Grâce. Upon his return to Rotterdam, in 1914, he was associated at the Coolsingel Hospital as a plastic surgeon. During WWI, he worked as a military surgeon initially at Brünn (now Brno) in Czechoslovakia, then in Vienna, and in Budapest, where he was nominated Chief Surgeon at the Imperial Reserve Hospitals No. 8 and No. 17 in 1916 and 1917, and later at Tempelhof Hospital, Berlin, from 1917 to 1925. He became a resident of Berlin, practicing at Tempelhof Hospital and in the Clinic of Professor **Karl August Bier** (1861–1949).

During this period, Esser performed numerous innovative reconstructive operations on war wounded soldiers. His contributions to the progress of plastic surgery were significant, among them cheek rotation, a technique he developed in 1918 to cover defects of the cheek, lower lid, and lateral nasal area [57] (Fig. 6.20). Credit for cheek rotation and its reconstructive advantages was wrongly attributed to **Jack C. Mustardé** (1916–2010), a plastic surgeon from Aberdeen, Scotland, who published and popularized the same procedure for the correction of cheek and lower eyelid defects in 1966, 48 years later [58]. Other innovations included the bilobed flap [59], still used in facial reconstruction, and wrongly attributed to **Zymany** [60] and the epithelial inlay (*Esser-inlay*) for deepening the buccal fornix in edentulous patients, using a mold of dental compound material (Stent), wrapped around a split skin graft and inserted into a pocket created in the shallow buccal sulcus [20, 21]. Finally, the biological or arterialized flaps, probably Esser's greatest contribution, are currently employed in clinical practice [15] (Fig. 6.3). In the early twenties, he began to perform aesthetic operations such as mastopexies, abdominoplasties, and face lifts. **Gustav Aufricht** (1894–1980), who later became a leading plastic surgeon in New York, and a founder of the *American Society of Plastic Surgeons* (ASPS), was a student of Esser's in 1921–1922.

Esser amassed a considerable fortune and owned an important personal collection of modern art with more than 800 paintings. In Berlin, he invested his revenues in numerous apartments and estates. In 1925, he decided to move to France. In 1934, he established the Esser Institute of *Chirurgie Structive* (Plastic Surgery) in Monaco with the aim of performing aesthetic operations. However, his dream was to create a center for aesthetic surgery on an extraterritorial/neutral island. He unsuccessfully tried to obtain an island either from the Greek or the Italian government. In March of 1934, he met *il Duce* in Mussolini's personal office, the famous *Sala del Mappamondo* (Globe Room) at Palazzo Venezia in Rome, the headquarters of the fascist government, but, *il Duce* declined Esser's request [61]. In 1936, he was a co-founder of the *European Society of Plastic Surgery* [52] (*see* Fig. 6.16). In 1940, at the onset of WWII, he left Europe for the USA and established himself in Chicago. He died there alone in 1946 after a fascinating, restless life. A comprehensive Esser biography was written in 1983 by Barend Haeseker for his doctoral thesis [61]. Esser is little known in The Netherlands, largely because he had spent most of his working life outside his native country.

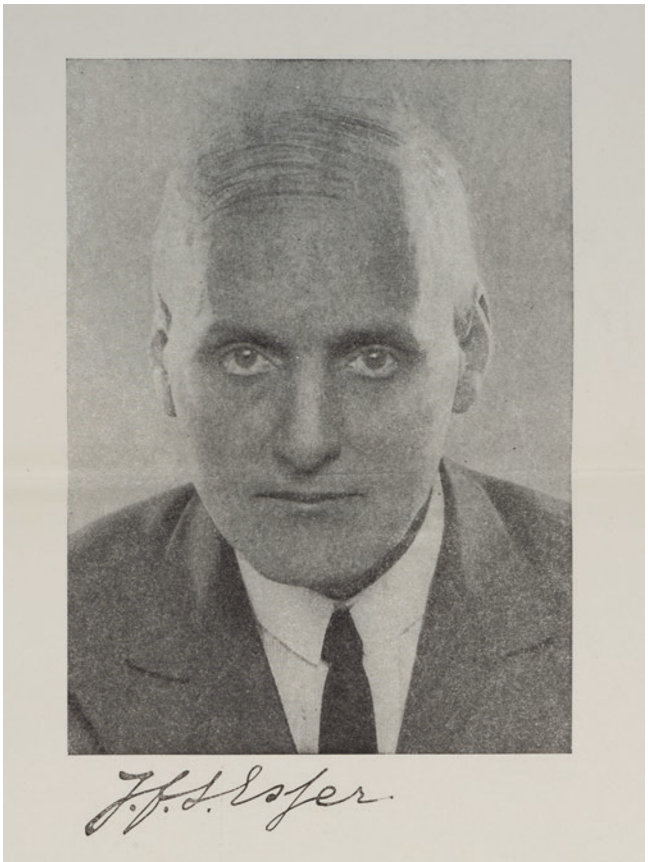


Fig. 6.19 Portrait of Johannes Esser (1867–1937)

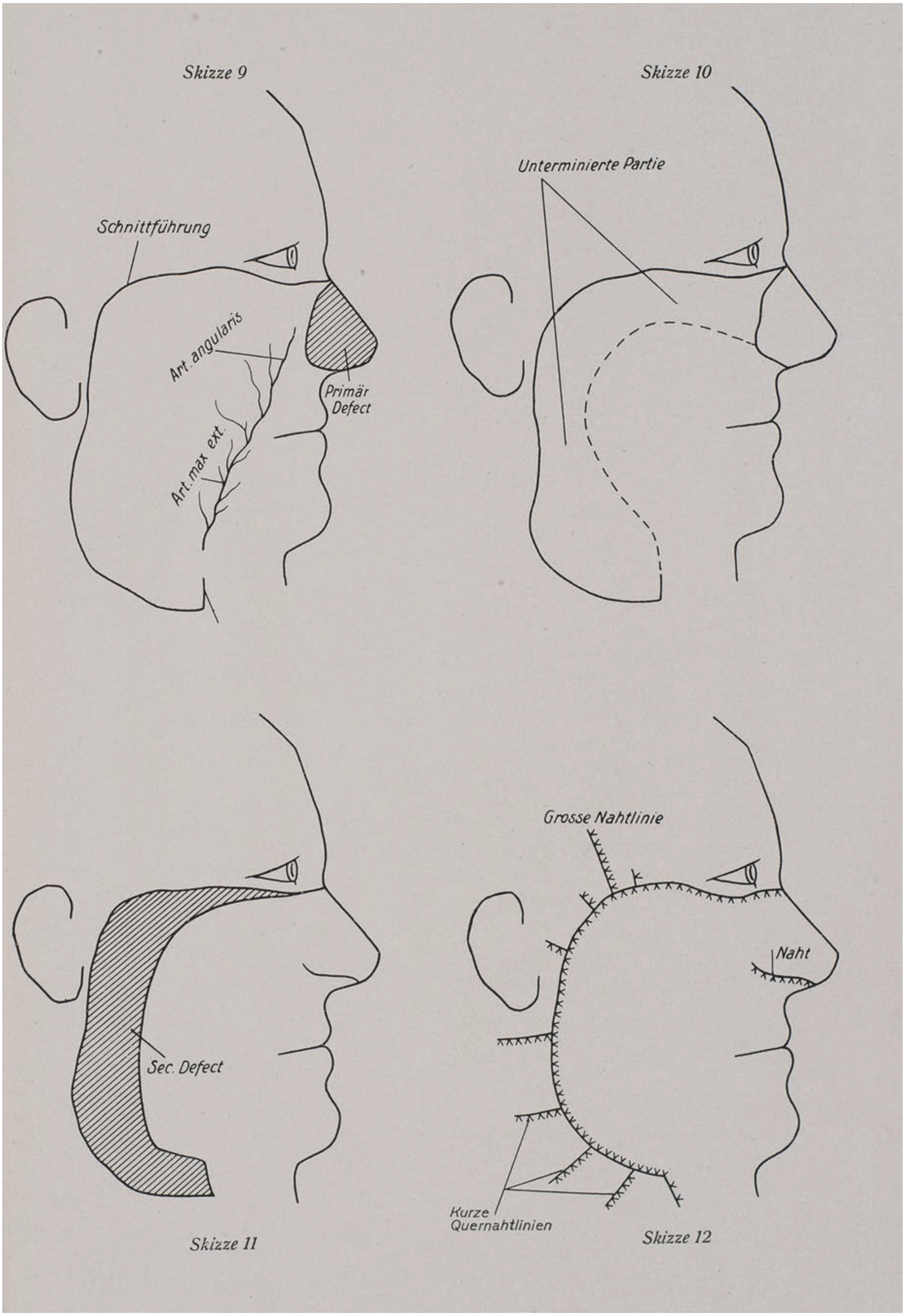


Fig. 6.20 Surgical scheme of cheek rotation. (From: Esser JFS. *Die Rotation der Wange und allgemeine Bemerkungen bei chirurgischer Gesichtsplastik*. Leipzig, F.C.W. Vogel, 1918)

6.2.5 Belgium

For many years during the interwar period, **Maurice Coelst** (1894–1963) was the only Belgian plastic surgeon [62] (Fig. 6.21). He graduated as an ENT surgeon in 1922 from the Université Libre de Bruxelles. In 1925, he worked as an assistant to Professor **Pierre Sébileau** (1860–1953) at the Hôpital Lariboisière in Paris. In 1926, he visited **Jacques Joseph** (1865–1935) in Berlin, **Charles Claoué** (1897–1957) in Bordeaux, and **Harold Gillies** (1882–1960) in London with the aim of improving his knowledge of aesthetic surgery. He built a private clinic in his home in Brussels and was always very active in promoting and supporting the specialty, despite having no university or hospital connections. In 1931, he founded the first journal for plastic surgery, the *Revue de Chirurgie Plastique* [52] (*see* Fig. 6.32). In 1936, he created the *Société Européenne de Chirurgie Structive*, the first supranational society of plastic surgery (*see* Fig. 6.16), which held its first meeting in Brussels. The second was in London (Fig. 6.22) and the third in Milan (Fig. 6.26) [52].

Fig. 6.21 Portrait of Maurice Coelst (1894–1963)

Fig. 6.22 The gala dinner at the second meeting of the *Société Européenne de Chirurgie Structive*, held in London

6.2.6 Italy

In Italy, the most relevant plastic surgeon of the twentieth century was **Gustavo Sanvenero-Rosselli** (1897–1974) (Fig. 6.23). Born in Savona (near Genoa on the Italian Riviera), he studied medicine at the University of Genoa and specialized in otolaryngology [63]. Having obtained a fellowship abroad to expand his knowledge of surgery, he attended the 2-year full immersion course of the International Clinic of Facio-Maxillary School of **Fernand Lemaitre** in Paris in 1927–1928 (see Sect. 6.3.1.2) (Fig. 6.24). Upon his return to Italy in 1929, he was appointed head of the *Padiglione per i Mutilati del Viso* (Pavilion for Facial Cripples) in Milan (Fig. 6.25) which became one of the European referral centers for treating injured soldiers from WWI, and was visited by surgeons from all over the world. Later the *Padiglione per i Mutilati del Viso* turned into one the leading institutions in Italy for reconstructive surgery, particularly oriented to the management of congenital anomalies and cleft lip and palate. In 1934, Sanvenero-Rosselli published the first modern Italian textbook on cleft lip and palate, *La divisione congenita del Labbro e del Palato* (The Congenital Cleft of the Lip and Palate) [64]. In 1938, he organized the third meeting of the *Société Européenne de Chirurgie Structive* in Milan, with important international participation (Fig. 6.26). The fourth meeting was scheduled in 1939 in Paris, but due to the onset of WWII it was canceled and the society ceased its activities. In 1964, when Sanvenero-Rosselli obtained the Chair of Plastic Surgery in Milan, the *Padiglione* became the seat of the School of Specialization in Plastic Surgery of the University of Milan. In October 1967, Sanvenero organized the fourth quadrennial meeting of the IPRS (*International Confederation for Plastic and Reconstructive Surgery*), the former IPS, in Rome with more than 3000 delegates from all over the world. An avid book collector, he assembled an important rare book library focused on plastic surgery. He died in Milan in 1974, aged 77.

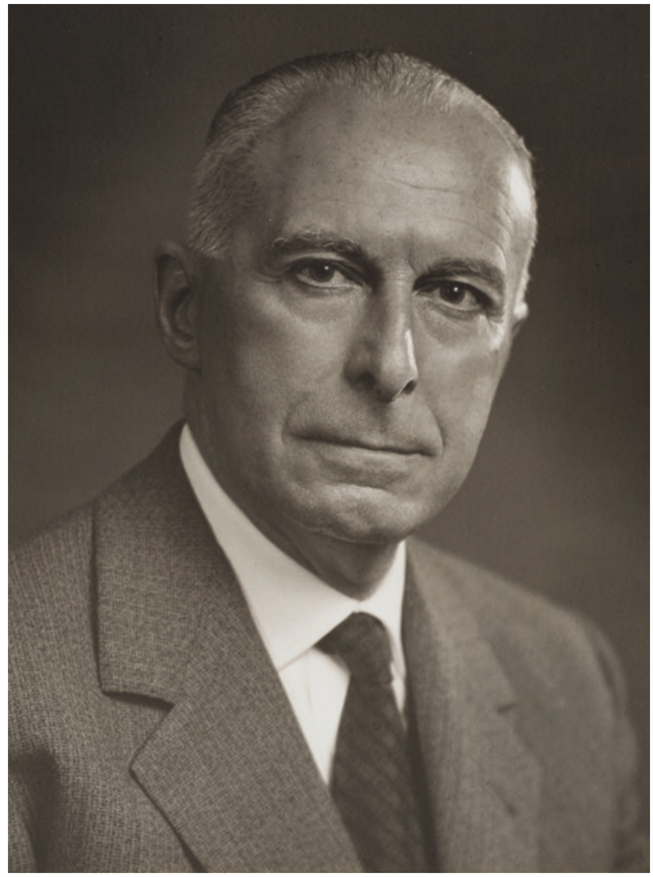


Fig. 6.23 Portrait of Gustavo Sanvenero-Rosselli (1897–1974)

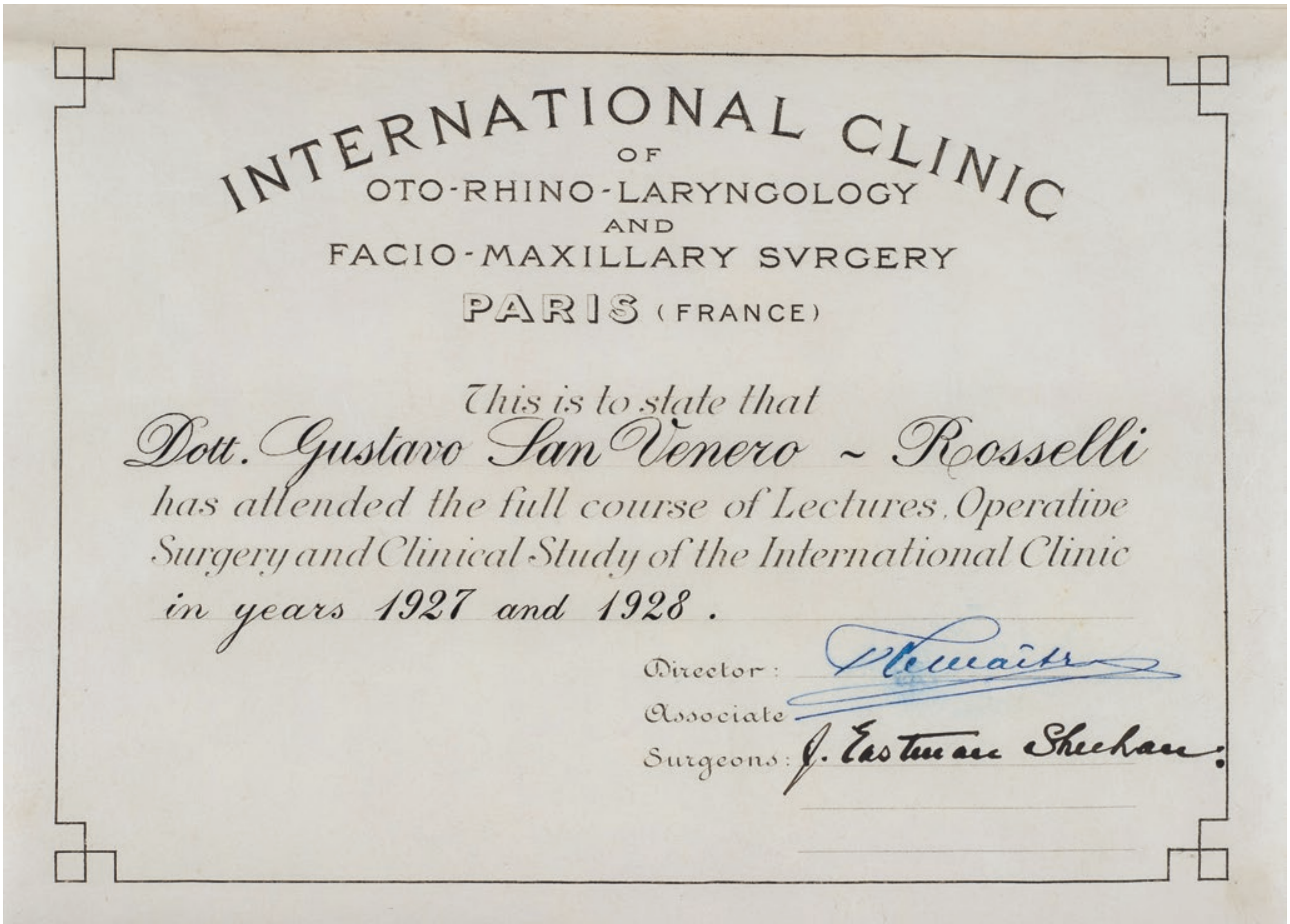
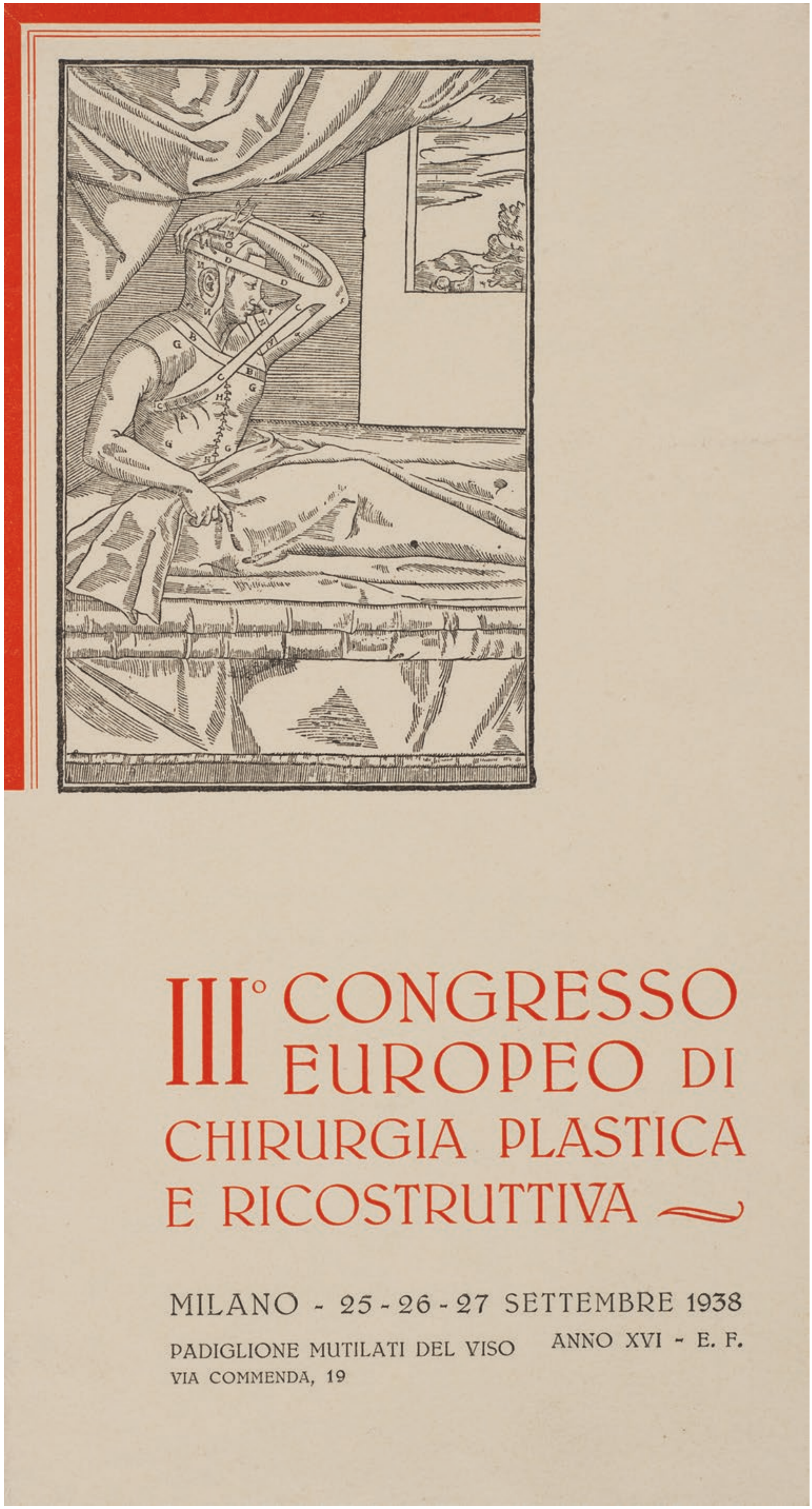


Fig. 6.24 Certificate of attendance of G. Sanvenero-Rosselli from the International Clinic of Facio-Maxillary surgery in Paris in 1927 and 1928. The certificate was signed by Fernand Lemaitre and Eastman Sheehan, course directors

Fig. 6.25 The *Padiglione Mutilati del Viso* in Milano established for the management of injured soldiers from WWI

Fig. 6.26 Scientific program of the 3rd Congress of the *Société Européenne de Chirurgie Structive*, held in Milano in 1938 and organized by Sanvenero-Rosselli



6.2.7 Czechoslovakia

Plastic surgery in Czechoslovakia (now Czech Republic) is related to the name of its initiator and founder, **František Burian** (1881–1965) (Fig. 6.27) who studied medicine at Charles University in Prague. After graduating, he spent 2 years as a military surgeon in the Balkan Wars (1912–1913). He was in charge of a 400 bed ward in Sofia, Bulgaria, taking care of dramatic defects not only of the face, but of other parts of the body, particularly the extremities. In 1914, when WWI broke out, Burian was responsible for the military reserve hospital in Prague, and in 1916, he became the head surgeon of the military hospital in Timisoara (Romania). When the war ended in 1918, he transported the wounded Czech soldiers from Timisoara to Prague to complete their reconstructive procedures. He largely used tube flaps to close the tissue losses in the middle third of the face, but also rib grafts to reconstruct bony defects. In 1927, he opened one of the first units of plastic surgery in the world at the Jedlička Institute which became the most important reference center for plastic surgery in Prague with thirty-five plastic surgery beds and was visited by the most renowned plastic surgeons of the period including **Gillies, Kilner, Skoog, Sanvenero-Rosselli,** and **Converse**. Besides reconstructive work, he dedicated himself to the management of cleft lip and palate. In 1937, he moved to a new sixty-bed pavilion. He died in 1965, aged 84. His activity was summarized in a three-volume *Atlas of Plastic Surgery* posthumously issued in 1967 [65, 66].

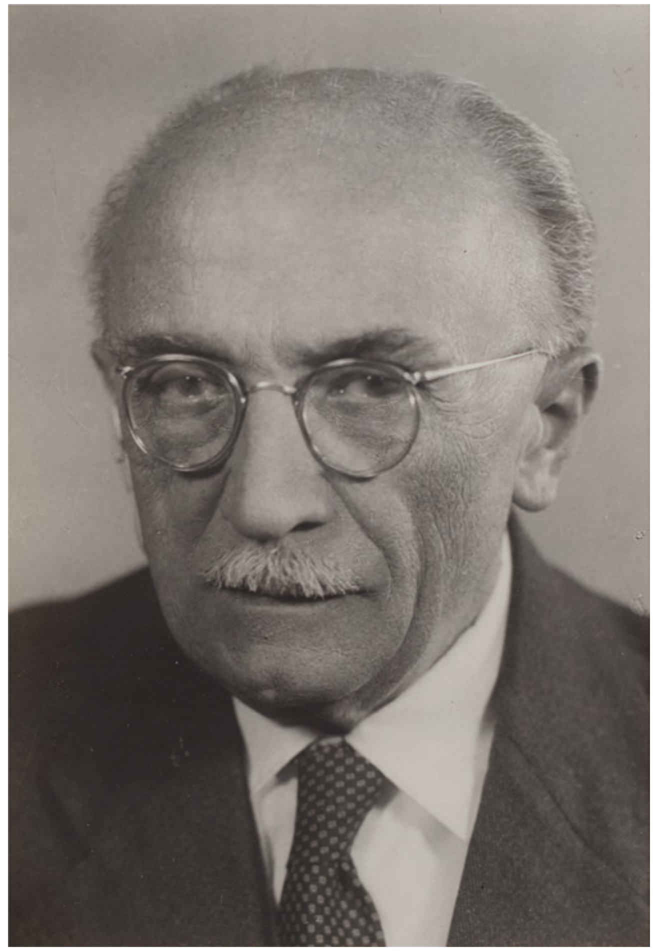


Fig. 6.27 Portrait of František Burian (1881–1965)

6.2.8 Hungary

6.2.8.1 Johann von Ertl

Johann von Ertl (1880–1951) was one of the leading plastic surgeons in Hungary [67]. During WWI, he began his work at Reserve Hospital No.6, one of the most important centers for the treatment of wartime facial injuries, located in Budapest. He was later appointed Surgeon-in-Chief of this unit, taking care of the immediate repair and secondary reconstructive procedures of injured soldiers, with many innovative operations. Tissue regeneration was Ertlt's major concern and the basis of his philosophy of surgery. In *Die Chirurgie der Gesichts und Kieferdefekte* (Surgery of Face and Jaw Defects), he described advanced techniques devoted to the management of the horrific war-related ballistic traumas [68]. He used advanced techniques for cranioplasty repairing the defective bone by layers. He covered the missing dura and the lamina interna of the cranial vault raising flaps from the pericranium with pedicles facing the edge of the cranial defect. He turned these flaps into the wound and approximated their margins. The lamina externa was restored by flexible periosteal-cortical transplants harvested from the tibia, to mimic the cranial curvature [68]. For jaw reconstruction, he advocated concurrent oral surgeons' cooperation with teeth fixation to stabilize bone grafts.

However, von Ertl deserves recognition for having introduced the concept of regenerative surgery more than 80 years ago. The principles of biological regenerative surgery were published in the textbook: *Regeneration: Ihre Anwendung in der Chirurgie mit einem Anhang Operationslehre* (Regeneration: Its Application in Surgery with an Appendix of Surgical Theory) [69] (Fig. 6.28). Regeneration derives from tissue transplantation, as bone covered by the periosteum or fat. Fat transplantation was extensively used by von Ertl for the treatment of WWI facial injuries. He identified three different clinical situations: (a) the transplanted fat dies and becomes liquid; (b) the transplanted fat evolves into scar tissue; (c) the transplanted fat may regenerate into its original tissue structure. To avoid fat necrosis, he advocated the transplantation of minimal amounts of tissue as large amounts will inevitably result in death of the graft. Due to its revascularization from the surrounding tissues, the transplanted fat could form a structure very similar to the original one. At the end of his textbook, he shows several regenerative plastic reconstructive cases.

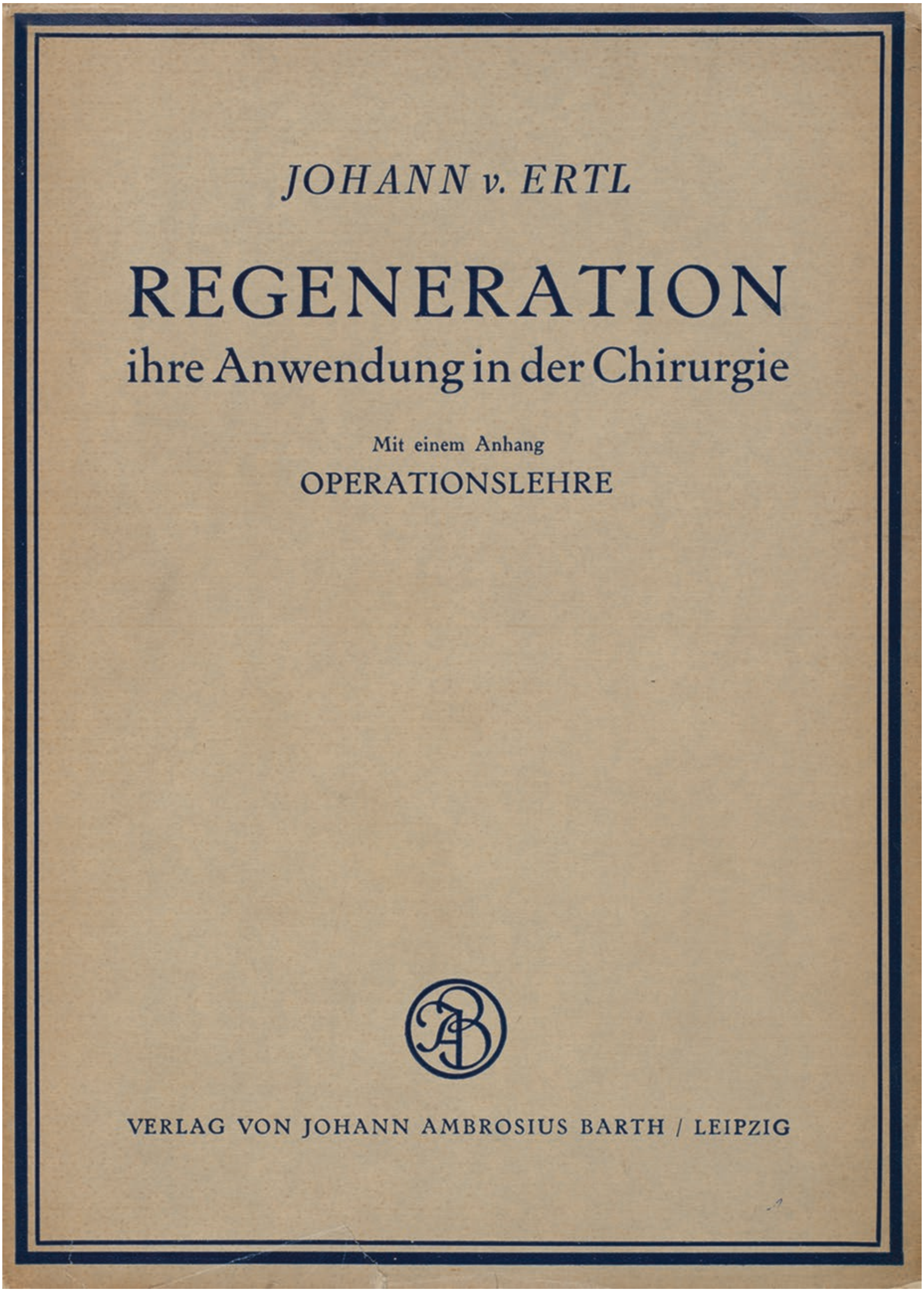


Fig. 6.28 The textbook *Regeneration. Ihre Anwendung in der Chirurgie, by* J. von Ertl. Leipzig, J. Ambrosius Barth, 1939

6.2.8.2 Josef Imre, Junior

Josef Imre, Junior (1884–1945), the son of Josef Imre, Senior, an eminent ophthalmologist, continued on the path traced by his father, becoming an internationally renowned ophthalmologist [67]. He studied medicine in Kolozsvar (Cluj-Napoca, Romania) and Budapest. After graduation, he spent 2 years (1909–1910) in Freiburg at the Axenfeld Clinic. In 1918, he became Professor at the Eye Clinic in Pozsony. During the war, he moved to Budapest. When the University of Pécs was established in 1924, Imre joined the faculty and in 1928 was elected the Rector. In 1939, he obtained the Chair of Ophthalmology in Budapest. Imre gained an international reputation during his career as a visiting Professor in the USA on different occasions and was elected an Honorary Member of the *American Society of Plastic Surgeons*.

His most important publication was *Lidplastik und plastische Operationen anderer Weichteile des Gesichts* (Blepharoplasty and Plastic Operations of Other Soft Tissues of the Face), first issued in Hungarian in 1926 and translated 2 years later into German. The text, scholarly presented, explains how to deal with complicated cases of facial soft tissue defects, mainly located in the periorbital area [70]. Imre illustrated the *arch plasty*, a sliding cheek flap, moving in a circular way, for restoring the lower eyelid in case of ectropium, or for covering tissue loss after excision of lower eyelid tumors (Fig. 6.29). He also described the transposition of the frontonasal flap for covering the inner canthal angle.

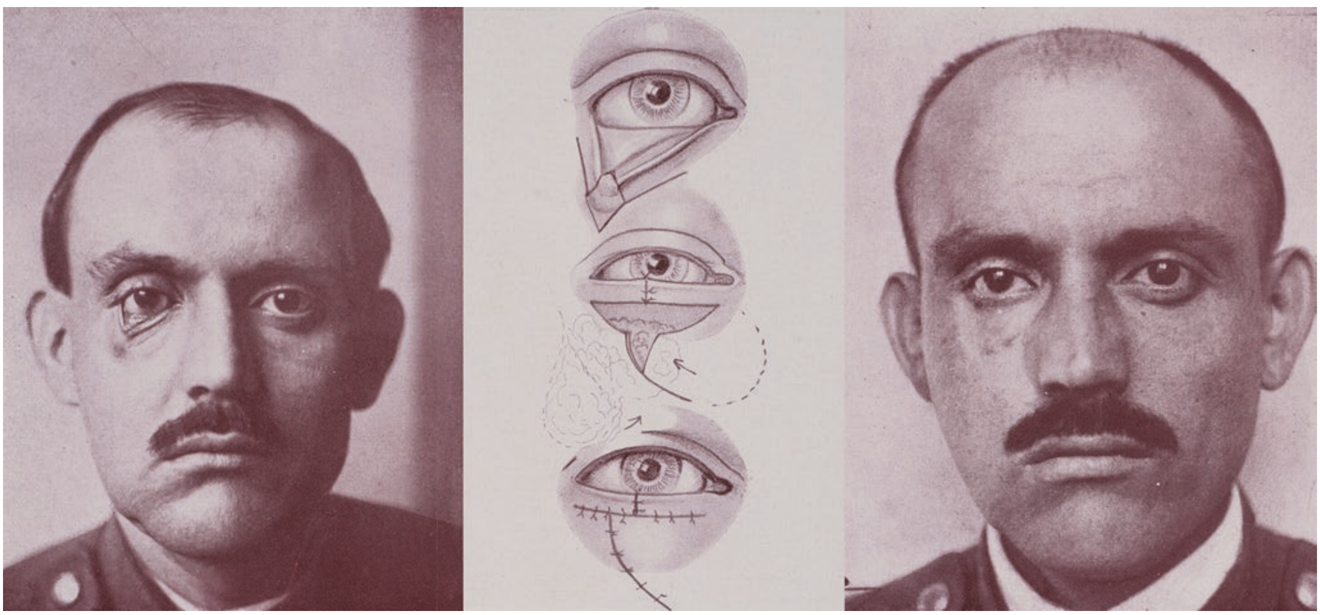


Fig. 6.29 The archplasty Imre's procedure for lower eyelid defect closure. *Left:* pre-operative view of a patient; *middle*: the flap design; *right*: final result. (From: Imre J. *Lidplastik und plastische Operationen anderer Weichteile des Gesichts.* Budapest, Studium, 1928)

6.2.9 Spain

Pere Gabarrò i Garcia (1889–1980) studied medicine at the University of Barcelona from where he graduated in 1924 and was appointed Associate Professor of Anatomy. In 1939, during the Spanish Civil war, he emigrated to Great Britain and established himself in Manchester. He worked at Sidcup with Harold Gillies for 3 years, becoming interested in plastic surgery. He was among the founding members of the *British Association of Plastic Surgeons* in 1946. In 1947, Gabarrò returned to Barcelona where he created a plastic surgery unit at *Hospital de la Santa Creu i Sant Pau* (declared a UNESCO World Heritage site in 1977), taking care of facially disfigured soldiers, repairing burn injuries, and also performing aesthetic surgery. He wrote numerous scientific publications, in particular on a new method of mesh skin grafting. He was a member of various international scientific societies. As a side interest, he was a professional rock climber. He died in 1980, aged 91.

6.2.10 Sweden

In 1936–1937, in the interwar period, **Allan Ragnell** (1901–1983) [71] was trained in plastic surgery in England under **Harold Gillies** and **Thomas Pomfret Kilner** before returning to Sweden. In 1940, he obtained a consultative appointment in plastic surgery at Serafimer Hospital and Karolinska Hospital in Stockholm, and supervised a unit for reconstructive surgery in Finland for the management of war casualties. During the war, plastic surgery in Sweden made consistent progress, particularly in skin grafting and skeletal repair. In 1944, Ragnell became Chief of Plastic Surgery at Serafimer Hospital in Stockholm, the first department of its kind in Scandinavia. His influence spread and he later directed a larger plastic surgery and burn unit created at the Karolinska Institute. In 1950, an associate professorship was established for him at Karolinska. After the war, numerous units opened in Sweden: in 1951 at Uppsala; in 1951 at Gothenburg; in 1952 at Malmö. Surgeons from Denmark, Norway, Belgium, Italy, and Turkey obtained excellent training in plastic surgery at Serafimer, which permitted them to specialize in reconstructive surgery in their own countries.

6.2.11 The USA

To report on twentieth-century US plastic surgeons in detail would require a volume in itself. Our historical review relates only to those surgeons who managed facial injuries during WWI, who thus strongly contributed to innovation in the discipline, and ends with the outbreak of WWII.

6.2.11.1 John Staige Davis

John Staige Davis (1872–1946) was born in Norfolk, Virginia, and graduated in medicine from Johns Hopkins School of Medicine in 1899. Attracted by the newly born specialty of plastic surgery, he began his professional career in 1909 as an Associate Professor of Surgery (Plastic Surgery), at Johns Hopkins University School of Medicine. During World War I, he served as a captain in the US Army Medical Corps, making important contributions to the treatment of the facially disfigured from WWI. During WWII, Davis was appointed as a member of a committee to organize plastic surgery units for the Army Medical Corps. He was considered the first surgeon who devoted his career to the development and advancement of plastic surgery in the USA.

In 1919, Davis was appointed the first Professor of Plastic Surgery in the USA at Johns Hopkins University School of Medicine. In the same year, he issued the first textbook on plastic surgery published in the USA, *Plastic Surgery*: *Its Principles and Practice* [17]. After a historical review on the origin of the specialty, Davis explained the meaning of this emerging discipline. He emphasized the basic principles of skin graft, tissue transplantation, skin flaps, wound care, management of scars and keloids, and treatment of congenital anomalies. The work described the application of plastic surgery to the different regions: eyelids, ear, nose, lips, cheek, neck, and upper and lower extremities. Exhaustive photographic documentation of reconstructive operations makes this book a milestone in the history of plastic surgery. Davis published seventy-eight papers dealing with different plastic surgery subjects. He tried to establish a Division of Plastic Surgery, but he encountered strong opposition from **W. S. Halsted** (1852–1922) who discouraged the development of plastic surgery as an independent specialty. Davis was the first to establish a formal training program in plastic surgery in 1926, and was the first Chairman of the *American Board of Plastic Surgery* (ABPS).

6.2.11.2 Vilray Blair

Vilray Blair, born in St. Louis, Missouri, in 1871, graduated in medicine from Washington University in 1893. He started his professional career as an Instructor and then as an Associate Professor of Anatomy. In 1912, he was appointed Clinical Professor of Surgery at Washington University, and in 1918 he joined Harold Gillies at Queen's Hospital, Sidcup, taking care of wounded soldiers. Gillies acknowledged Blair's invaluable cooperation and assistance in the preface to his *Plastic Surgery of the Face* (1920).

Upon his return to the USA, Blair established a long-lasting partnership with **Robert Ivy** (1881–1974), a dental surgeon, for the treatment of soldiers with dramatic jaw injuries. He formed one of the largest US multi-disciplinary teams for the care of complex maxillofacial injuries at Walter

Reed Hospital, then in Washington, DC, and the first Plastic Surgery Unit at Barnes Hospital in St. Louis, part of the Washington University Medical School. Besides post-traumatic reconstruction, of which he was an internationally recognized leader, he dedicated himself to the treatment of cleft lip and palate with his assistant **James Barrett Brown** (1899–1971). He was Professor of Clinical Surgery and Professor of Oral Surgery (1927–1941), Founding Member of *the American Association of Plastic Surgeons* in 1921, and Founding Member of the *American Board of Plastic Surgery* in 1941. He was indeed one of the pioneers of US Plastic Surgery—and a very prolific writer. He died in 1955, aged 84. A comprehensive biography of Vilray Blair was written by Jerome P. Webster in 1977 [72].

6.2.11.3 Joseph Eastman Sheehan

Joseph Eastman Sheehan (1885–1951) was born in Dublin, Ireland, graduated in medicine from Yale University in 1908, and moved afterwards to Europe to expand his knowledge. Upon his return to the USA, he established himself in New York, where he practiced general surgery and otolaryngology, obtaining ENT Board Certification. At the end of WWI, he worked at Sidcup with Gillies and became interested in plastic surgery. His academic positions included Professor of Plastic Surgery at New York Polyclinic Hospital and Clinical Professor of Surgery at Columbia University. He had a major role in developing formal training programs in France and Spain and taught at the training courses in facio-maxillary surgery organized by **Fernand Lemaitre** (1880–1958) in Paris in 1925–1927 (Fig. 6.30). In 1928, he was invited to Spain on behalf of King Alphonso XIII to treat wounded soldiers and to teach young surgeons reconstructive techniques. During the Spanish Civil War, Generalissimo Franco asked Sheehan to organize reconstructive hospitals and to train plastic and reconstructive surgeons, which he did as an honorary Colonel. In 1935–1936, he was President of the *American Association of Plastic Surgeons*, and in 1941, one of the founding members of the *American Board of Plastic Surgery*. He was a prolific writer [73, 74]. He died in 1951 as a consequence of a stroke, aged 66 [75, 76].

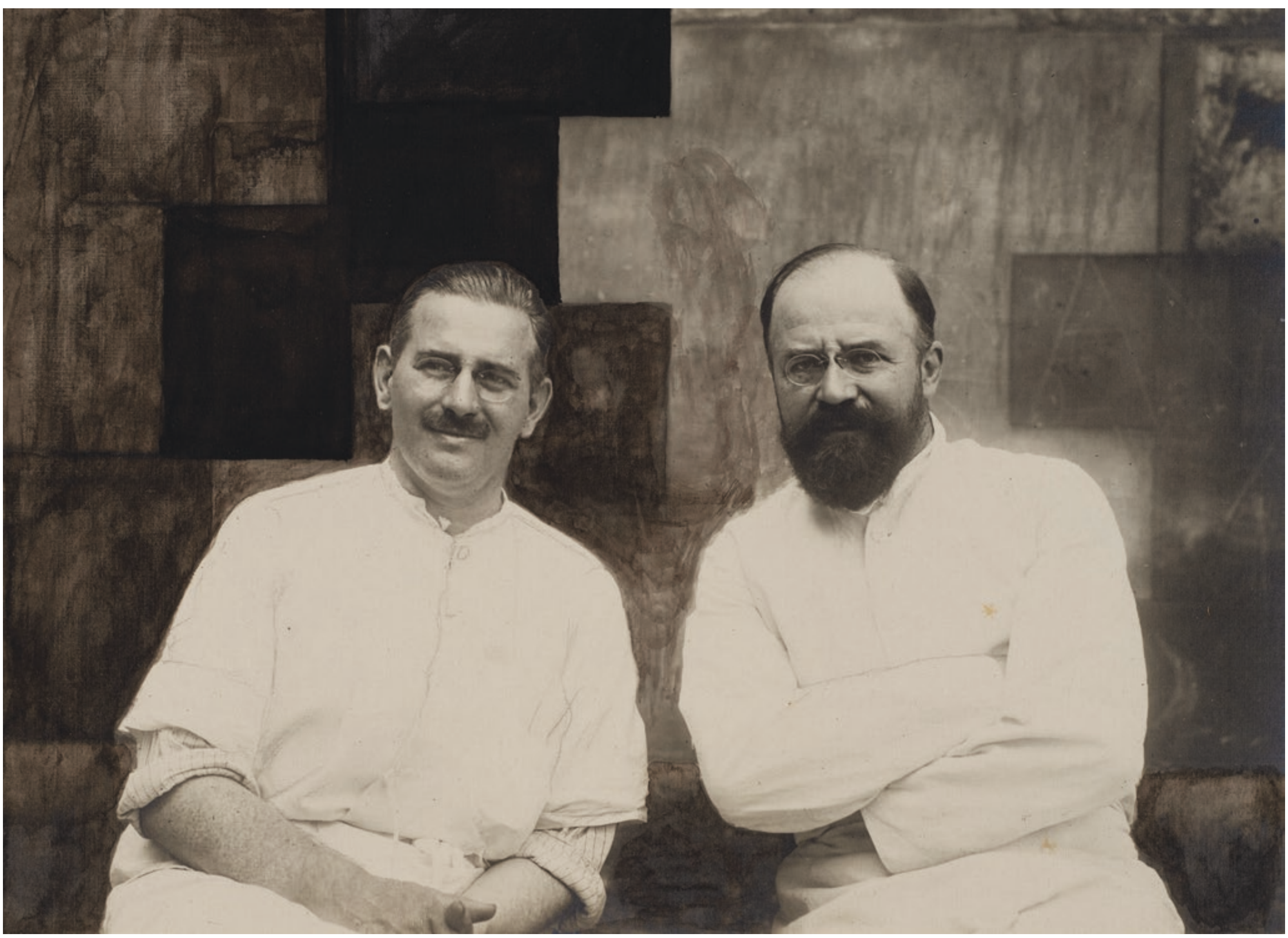


Fig. 6.30 Portrait of Eastman Sheehan (1885–1951) with Fernand Lemaitre (1880–1958)

6.2.11.4 Ferris Nicholas Smith

Ferris Nicholas Smith (1884–1957) was from Grand Rapids, Michigan. During WWI, he worked at Queen's Hospital, Sidcup, with Gillies and later in his home town at St. Mary's Hospital (Fig. 6.31). He was internationally known as a teacher and as a surgeon. He also lectured alongside Gillies and Sheehan at the training courses of facio-maxillary surgery, organized by **Fernand Lemaitre** (1880–1958) in Paris in 1923–1925. He was another of the founding members of the *American Board of Plastic Surgery*. In 1928, he published *Reconstructive Surgery of the Head and Neck* in which the most common step-by-step reconstructive and cosmetic procedures of the face were illustrated, including nasal reconstruction, cheiloplasty, blepharoplasty, face lifting, cosmetic upper eyelid skin excision, otoplasty, correction of crooked nose, and septal deviation [77]. In 1950, he issued *Plastic and Reconstructive Surgery. A Manual of Management*, a textbook that summarizes his 35 years of clinical experience in the field of plastic and reconstructive surgery, with numerous cases of facial burns and severe injuries, treated during the two world wars [78].

Fig. 6.31 Portrait of Ferris Smith (1884–1957)

6.2.11.5 Varaztad H. Kazanjian

The Armenian **Varaztad H. Kazanjian** (1879–1974) was born in Erzincan, Ottoman Empire (now Turkey), and attended a French Jesuit school in his home town. In 1895, to escape the massacres of Armenians occurring in Armenian Turkey, he moved to the USA, settled in Worcester, Massachusetts, and took a job in the local wire factory. Having obtained US citizenship in 1900, he decided on a career as a dentist. In 1902, he was accepted by the Harvard Dental School and qualified in 1905. He married and was successfully running his own dental practice when WWI exploded. He volunteered to join the Harvard Medical Corps, located in Camiers, northern France, where he served the British forces. For the next 22 months, he and his medical staff took care of over 60,000 wounded soldiers, about 3000 of them American. There he began to treat some of the horrific wounds suffered in the trenches: jaws, noses, cheeks, and skulls—devastating injuries caused by bullets and grenades. Working under basic conditions in temporary hospitals near the battlefields of France, Kazanjian exhibited humanitarian capabilities combined with innovative reconstructive surgical techniques. In June 1916, he was elevated to the rank of Major. When the war ended, he returned to Boston where he was appointed Professor of Clinical Oral Surgery at Harvard—a position he maintained from 1922 to 1941. In 1941, he became the first Professor of Plastic Surgery at Harvard Medical School. He served as President of the *American Association of Plastic Surgeons* and of the *American Society of Maxillofacial Surgeons*. He wrote more than 150 journal articles and in 1949, co-authored with **John M. Converse** (1909–1981) the classic, *The Surgical Treatment of Facial Injuries*, where his pioneering contributions to the treatment of soldiers wounded in WWI were scholarly illustrated [79, 80]. He changed the newly born discipline into an esteemed surgical specialty. He died in 1974, aged 95.

6.2.11.6 Jerome P. Webster

Jerome P. Webster (1888–1974) was born in Ashland, New Hampshire, the son of the Reverend Lorin Webster, headmaster of the Holderness School there. He graduated from Trinity College in 1910 and from Johns Hopkins Medical School in 1914, when he was appointed surgical intern and then Assistant Resident in Surgery.

After the USA entered the war, he joined the US Army Medical Corps as a First Lieutenant and served in France. In 1918, he received the French *Croix de Guerre* with star and with a citation for bravery. In World War II, a series of courses in plastic surgery were given under his direction, with the aid of seventy-five instructors, to Army medical and dental officers. At the request of the Army's Surgeon General, together with **Robert H. Ivy,** he inspected the nine plastic surgery centers in the Army's general hospitals in the USA.

Webster became Chief of Plastic Surgery at the Vanderbilt Clinic in New York and the first Director of Plastic Surgery of Columbia-Presbyterian Hospital's surgical service, as well as Professor of Clinical Surgery at the College of Physicians and Surgeons at Columbia University from 1928 until his death. He was recognized as a leader in his profession for over 30 years.

Among his awards were an honorary degree in medicine and surgery from the University of Bologna (Italy), the Columbia Libraries Award for distinguished service, the New York Academy of Medicine plaque, and in 1954, the William H. Welch Medal, received with Martha Teach Gnudi, his co-author of the textbook, *The Life and Times of Gaspare Tagliacozzi, Surgeon of Bologna, 1545–1599* [81]. Webster was also a historian and bibliophile. He assembled one of the most important rare book collections in plastic surgery, which he eventually donated to Columbia University. He died in 1974, aged 86 [82].

6.3 Official Recognition of Plastic Surgery

As we have seen, modern plastic surgery evolved in various European countries and in the USA from the experience of war. An incredible array of new reconstructive procedures was created to repair dramatic facial wounds. Transfer of skin flaps (tubed or pedicled) and use of grafts (skin, cartilage, bone, fat) became routine procedures. This demonstrated the social role of the discipline in an attempt to help soldiers return to their families and to re-enter society. Training programs were established to allow young Fellows to learn dedicated techniques. Scientific societies and journals were founded. In summary, the bases for the official recognition of the discipline as an independent specialty were established.

6.3.1 The Training Programs

With new units being created all over the world, the need for training programs, for young doctors to become familiar with reparative methods, grew desperate.

6.3.1.1 England

Queen's Hospital, Sidcup, headed by **Sir Harold Gillies**, was probably the most famous for the management of facial injuries. Anesthesia improved considerably thanks to **Ivan Magill** who developed nasal and endotracheal intubation. Other training programs in the UK were organized by **Sir Archibald McIndoe, Rainsford Mowlem,** and **Thomas Pomfret Kilner**, the famous big four, including Gillies [50].

6.3.1.2 France

In Paris, from 1923 onwards, the otorhinolaryngologist **Fernand Lemaître** (1880–1958), a disciple of **Pierre Sebileau**, established a residency at the International Clinic of Oto-Rhino-Laryngology and Facio-Maxillary Surgery. Initially, from 1923 to 1925, **Harold Gillies** and **Ferris Smith** were appointed as course directors (*see* Fig. 6.31). Later, from 1925 to 1927, **Eastman Sheehan**, Professor of Plastic Surgery at Columbia University, was the course director (*see* Fig. 6.30). The 2-year fellowship included an intense program of lectures and practical surgical demonstrations. Attendees from various parts of Europe and the USA were numerous. Among them was the Italian **Gustavo Sanvenero-Rosselli**, later appointed head of the Plastic Surgery Clinic, the Pavilion for Facial Cripples, in Milan (*see* Fig. 6.24 and 6.25).

6.3.1.3 The USA

In the USA, the first training programs were organized by **John Davis** at Johns Hopkins University School of Medicine and **Vilray Blair** at Washington University in St. Louis [72].

6.3.2 The Origin of the Scientific Societies

The aim of the scientific societies was to improve the scientific level of the specialty and to defend the public from charlatans. The first society was the *American Association of Oral and Plastic Surgeons*, established in 1921 by **Truman Brophy** (1848–1928), who strongly supported close cooperation between oral and plastic surgeons. Initially, membership required both MD and DDS degrees [82].

In Europe, the first society was the *Société Scientifique Française de Chirurgie Réparatrice Plastique et Esthétique* (SSFCRPE), established in 1930 by **Charles Claoué** (1897–1957) from Bordeaux and **Louis Dartigues** (1869–1940) from Paris. It only lasted 2 years.

In 1931, **Jacques Maliniak** (1889–1976) founded the *American Society of Plastic Surgeons* (ASPS). In 1934, Professor **Arturo Manna** (1886–1972) established the *Società Italiana di Chirurgia Riparatrice Plastica ed Estetica*, which later became *Società Italiana di Chirurgia Plastica Ricostruttiva ed Estetica* (SICPRE).

The first supranational society was the *Société Européenne de Chirurgie Structive*, created in 1936 by the Belgian **Maurice Coelst** (1894–1963) (*see* Fig. 6.16 and 6.21), with the aim of gathering annually all those international specialists interested in the new discipline. The term *structive* was coined by **Johannes Esser** as he considered it more appropriate than "plastic" to emphasize the repairing concept [52].

In 1941, **Vilray Blair** organized the *American Board of Plastic Surgery* (ABPS) to certify plastic surgeons who met specific educational, training and professional requirements [72].

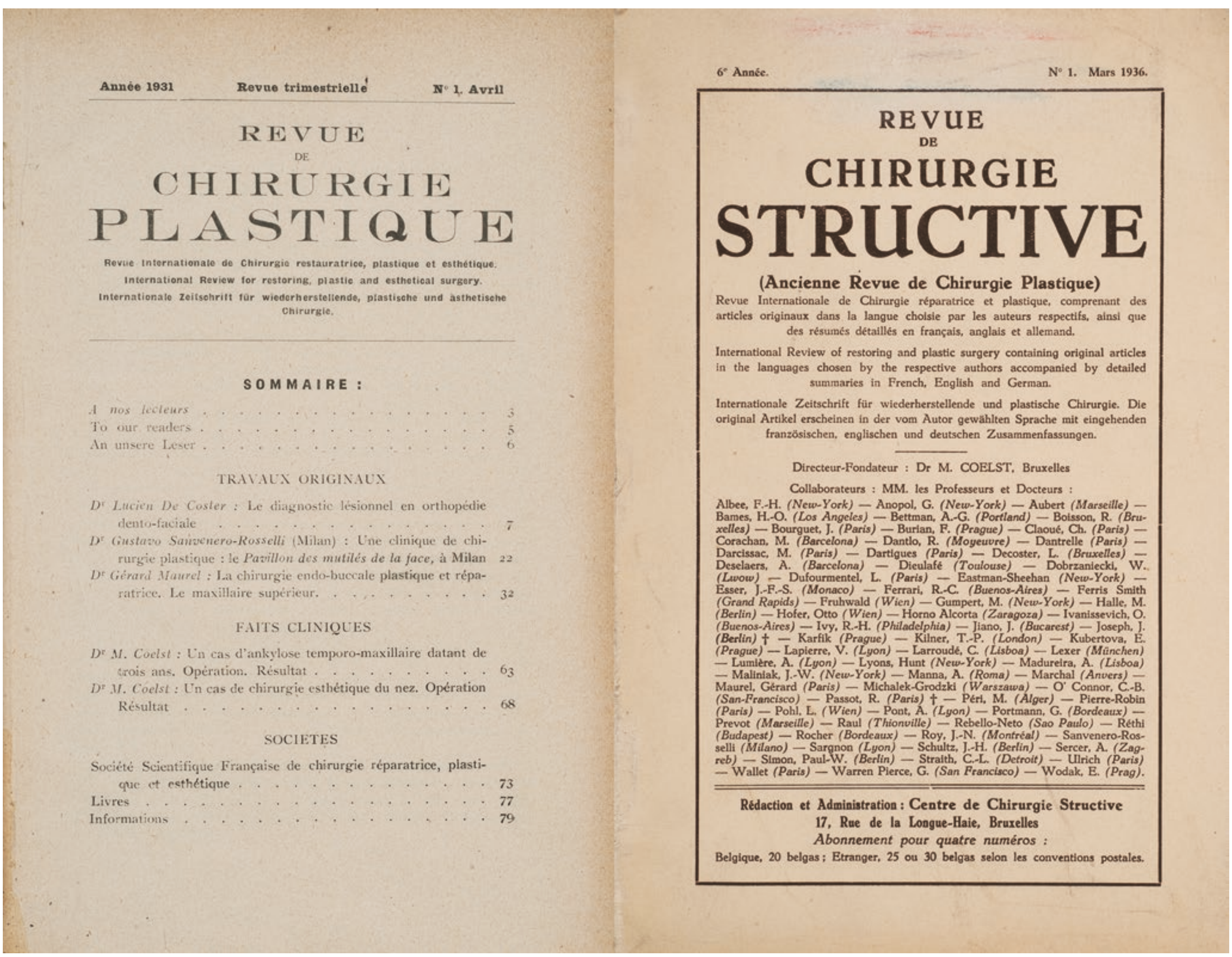
6.3.3 The Scientific Journals

At the time of the founding of the American Society (1931), the Belgian **Maurice Coelst** established and edited the *Revue de Chirurgie Plastique* (Fig. 6.32 *left*), the first international journal of plastic surgery ever published, which played an important role in the history of plastic surgery between the two wars. Thanks to an international editorial board that included the most prestigious plastic surgeons of that time, such as **Gustavo Sanvenero-Rosselli, Léon Dufourmentel, Joseph Eastman Sheehan, Ferris Smith, Erich Lexer**, and others, the journal published high-quality papers written by **Gillies, Maliniak, Esser,** and **Rethi** and the proceedings of the *American Society of Plastic Surgery* and those of the *Société Française de Chirurgie Réparatrice Plastique et Esthétique*. Papers appeared in the author's preferred language and were summarized in English, French, and German.

In 1935, at the request of **Johannes F. S. Esser**, the *Revue de Chirurgie Plastique* changed its name to *Revue de Chirurgie Structive* (Fig. 6.32 *right*), becoming the official journal of the *Société Européenne de Chirurgie Structive*. The *Revue* lasted until the end of 1938 (8 years), when it ceased publication, due to the advent of World War II.

In January of 1935, the first issue of *La Chirurgia Plastica*, the official Journal of the *Italian Society of Plastic Surgery*, a bi-monthly publication with an international editorial board appeared (Fig. 6.33). The journal was regularly issued for 7 years, until the end of 1941, when, due to WWII, it ceased its publication.

In 1946, the *American Society of Plastic Surgery* established *Plastic and Reconstructive Surgery*, and **Warren B. Davis** was appointed editor [82].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REVUE DE CHIRURGIE PLASTIQUE

Revue Internationale de Chirurgie restauratrice, plastique et esthétique.
International Review for restoring, plastic and esthetical surgery.
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Fig. 6.32 *Left:* issue No. 1 of *Revue de Chirurgie Plastique* (1931), the first international journal of plastic surgery ever published; *right*: from 1935 it changed its name becoming *Revue de Chirurgie Structive*

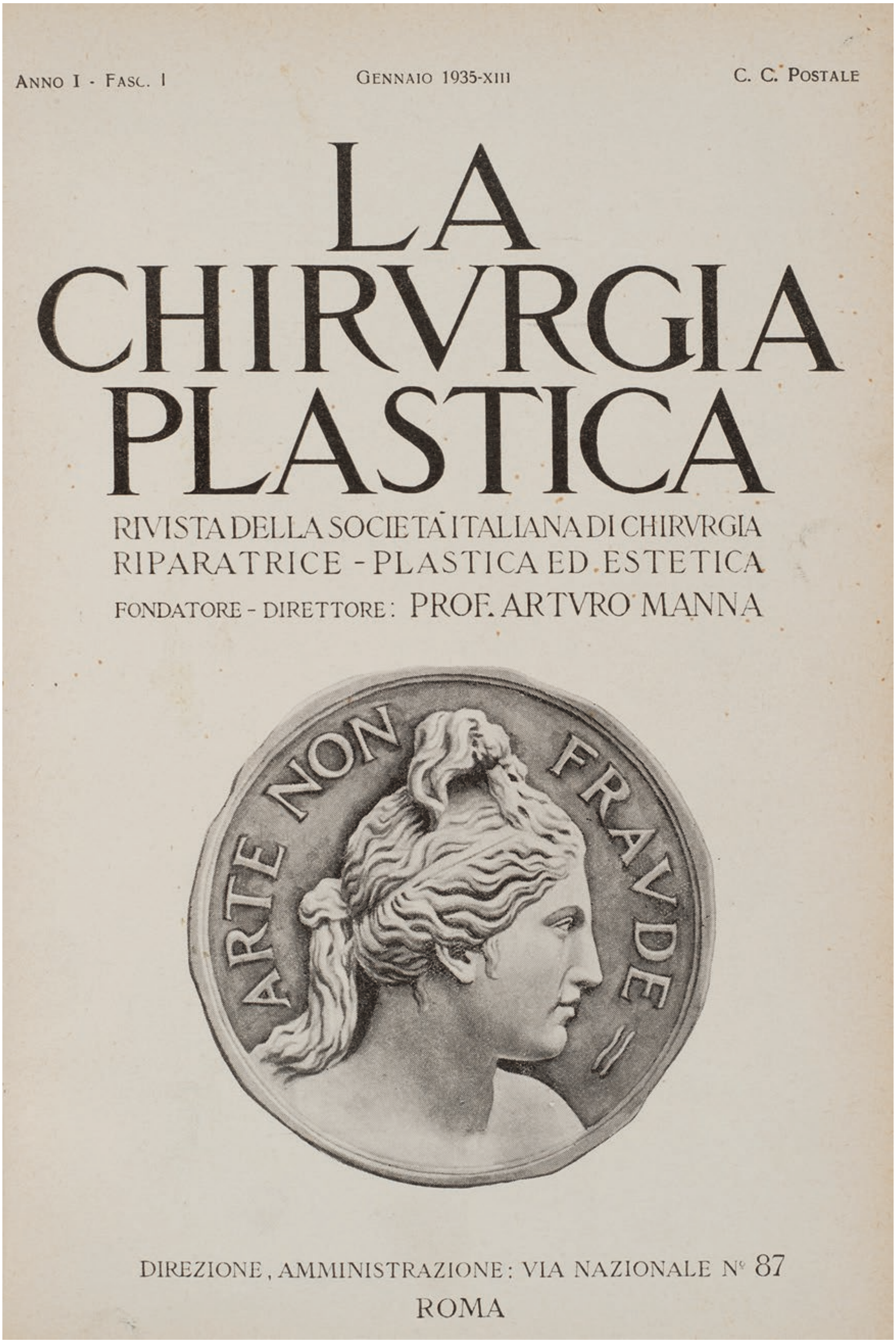

Fig. 6.33 Issue No. 1 of *La Chirurgia Plastica*, the official Journal of the Italian Society of Plastic Surgery (1935)

6.4 Conclusions

With the onset of World War II (WWII), our historical review on the origin and development of plastic surgery is nearing the end.

Initially, plastic surgery aimed to manage wounds, mainly caused by wars, and to reconstruct amputated noses.

We have traced the evolution of the surgeon's approach to the healing of wounds, one of the main concerns of man over the centuries.

Plastic surgery expanded its boundaries from mere nasal restoration to the reconstruction of missing parts or severe tissue loss. During WWI, management of the horrific facial wounds, sustained by soldiers and never before encountered by surgeons, necessitated the birth of a new, distinct specialty. It was the capacity, commitment, and ingenuity of surgeons coming from different backgrounds, education, and nationalities that brought together the techniques available at the time, such as flaps, graft of skin and other tissues, bone, cartilage, and fat, to correctly tackle these injuries. The final outcome was the possibility of reuniting patients with their families and society—a huge social role played by the discipline.

Recent history sees an incredible series of new reconstructive procedures, spanning from microvascular transfer of tissues, to new musculocutaneous or osteo-cutaneous composite flaps, craniofacial surgery, breast reconstruction, fat grafting, and face transplantation. At the same time, aesthetic surgery greatly developed in line with the continuous progress of our specialty.

We would like to conclude our review with text from **Gaspare Tagliacozzi's** (1545–1599) Book 1, Chapter 11 of *De Curtorum Chirurgia per insitionem* (On the Surgery of Injuries by Grafting): *Mutilated or missing parts confer so much shame and ugliness on the appearance that all the beauty and elegance of the face is lost. If these parts are restored the original grace and beauty of the face returns*. (…) *My procedure aims at restoring what Nature has given and chance has taken away*. (…) *The aim of the procedure is not to please the eye but rather to benefit the mind and soul.* (…) *The main purpose of this technique is not the restoration of the original beauty of the face, but rather the rehabilitation of the part in question* [83].

In other words, restoration of tissues after injuries is not only aesthetic, but also functional.

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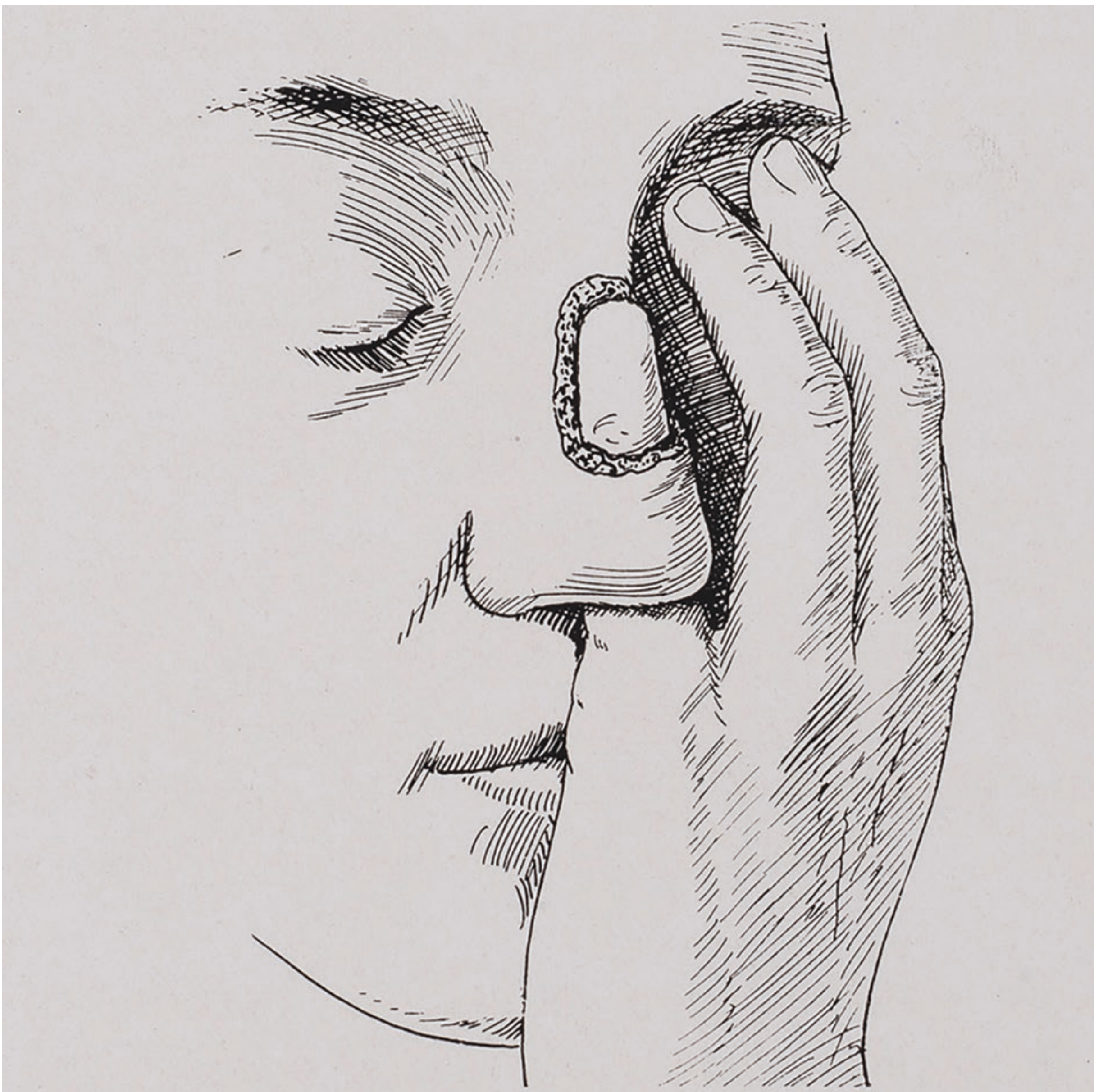
7 The Birth of Aesthetic Surgery



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Birth of Aesthetic Surgery: Salient Events in Aesthetic Surgery

- First report of an operation for correction of blepharochalasis is described by A. Cornelius Celsus (25 BC–AD 50) in Book 7, Chapter 7 of *De Medicina* (On Medicine), written in about AD 30.
- Paulus of Aegina (ca.AD 625–690) in his textbook *De Materia Medica* (On Medicine) describes the operations for correction of gynecomastia and cleft earlobes.
- In 1583, Georg Bartisch (1535–1607) publishes the first representation of blepharochalasis and its correction in the medical literature using a guillotine knife designed by Bartisch himself to excise upper eyelid skin excess.
- Johann Friedrich Dieffenbach (1794–1847) is credited with performing the first aesthetic/functional operation on the nose to improve a drooping tip by reducing a large nose using external incisions in 1845.
- First purely aesthetic procedure for the correction of prominent auricles is performed in 1881 by the US surgeon Edward Talbot Ely (1850–1885).
- John Orlando Roe (1848–1915), an otolaryngologist from Rochester, New York, publishes on the correction of a pug nose and on the excision of the hump in 1887 and 1891, respectively, performed under local anesthesia and intranasally and is rightly regarded as the originator of corrective aesthetic rhinoplasty.
- Robert Weir (1838–1927), a general surgeon from New York, describes the alar base excision for reducing the width of the nose in 1892, a technique still used.
- Jacques Joseph (1865–1934) establishes the fundamentals of rhinoplasty in 1912 and in 1931 and publishes *Nasenplastik*, a massive textbook, where the step-by-step procedures are described in detail and new dedicated instruments are shown, for which he is rightly acknowledged as the father of rhinoplasty.
- In 1934, the Hungarian otolaryngologist Aurél Rethi (1884–1976) publishes the transcolumellar incision, nowadays called open approach, to achieve better access to the dome and facilitating tip work and dorsal undermining.
- First report of an inframammary incision for the removal of a benign breast tumor by the US obstetrician and gynecologist Theodore G. Thomas (1831–1903) in 1882, an approach employed later by Guinard, Morestin, and others for aesthetic breast surgery, still used today.
- The French surgeon Michel Pousson describes the first procedure for correcting bilateral ptotic breasts in 1897.
- Eugene Holländer performs the first facelift in 1901 and the first fat injection to the breast in 1910.
- In 1921, Erich Lexer first transposes the nipple in a reduction mammoplasty, maintaining the galactophorous ducts.
- In 1930, the Austrian Emil Schwarzmann first recognizes the importance of maintaining the subdermal bridge around the areola through an accurate de-epithelialization of the cutaneous-glandular flap preserving venous return and reducing the risk of nipple necrosis.
- In 1900, the Austrian Robert Gersuny first advocates the use of paraffin in aesthetic surgery.
- In 1926, Lyons Hunt, probably the first surgeon in the USA to understand that not all faces age in the same way, describes the *forehead rhytidectomy* to correct frown lines, the *fronto-lateral rhytidectomy* to correct the tail of the eyebrow, the *frontal and naso-labial rhytidectomy* for the mid-lower part of the face and naso-labial folds, and the *cervico-rhytidectomy* for the neck.
- The first dermolipectomy dated 1890 is performed by Demars and Marx in France to excise an apron of fat and skin from the abdominal wall using a horizontal incision.
- F. Gaudet and H. Morestin are the first to preserve the umbilicus to obtain better aesthetic outcomes in abdominoplasty, and in 1905, they present a paper at the French Congress of Surgeons on horizontal upper abdominal lipectomy, combined with umbilical herniorrhaphy.
- In 1926, Suzanne Noël publishes *La Chirurgie Esthétique. Son rôle social*, one of the first textbooks on this topic and the first written by a woman.
- In 1925, the Frenchman Julien Bourguet first proposes the transconjunctival approach, instead of the traditional subciliary incision, to remove lower lid herniated fat.
- In 1910, William Henry Luckett observes that in prominent ear, the cause of protrusion is essentially the absence of antihelix folding and advocates the removal of a long ellipse of skin and cartilage from the whole length of the auricle, with the aim of correcting this unpleasant anomaly.

7.1 The Remote Origins of Aesthetic Surgery

Aesthetic surgery was not practiced until the second half of the nineteenth century. In a period when surgery was mainly functional and excisional, aesthetic procedures were not included in the surgeon's armamentarium, unless they had a functional feature. However, over the centuries a few examples were reported.

7.1.1 Eyelid Anomalies

7.1.1.1 Aulus Cornelius Celsus

Aulus Cornelius Celsus (25 BC–AD 50), the author of *De Medicina* (On Medicine) in eight volumes written about AD 30 [1] (*see* Sect. 1.7.1), describes the correction of entropion with the folding of the lid margin, sometimes complicated by eyelashes contacting the corneal surface, and the removal of excess upper eyelid skin, nowadays called blepharochalasis (Book 7, Chapter 7).

This is his description of the excision of excess of skin redundancy in the upper eyelid. On examining the text, it is astonishing to note how the technique described by Celsus almost 2000 years ago, closely resembles the method used today for the correction of blepharochalasis and how the author warns the reader about potential complications [2, 3].

> *The eye should be closed, and from the middle, either of the upper or the lower eyelid, a fold of skin between a finger and the thumb should be grabbed and raised. It is then evaluated the amount of skin to be removed so that the lid be in a natural position afterwards. There are two dangers: if too much skin has been excised, the eyeball cannot be covered; if too little, nothing has been improved, and the patient has been operated for nothing. Next, it should be established where the incision has to be made. A mark must be drawn by two lines of ink in such a way that between the eyelashes' margin and the adjacent line, there remains enough skin for a needle afterwards to suture. When everything is ready the scalpel is used. In the case of the upper lid, the incision closer to the eyelashes has to be made first.* (…) *Then the skin between the two incisions has to be excised. Next the edges of the wound are to be brought in contact by one stitch, and the eye is to be closed. If the eyelid descends too little the suture should be loosened, if too much, either the suture should be tightened, or an additional strip of skin may be excised from the margin. Where the eyelid has been cut, other sutures may be put in, but not more than three.* (…) *When there is but a slight drooping of the upper lid, this alone may suffice; the lower lid does not need the additional incision. When these things have been done, a sponge squeezed out of cold water is bandaged on. The next day an agglutinating plaster is applied; on the fourth day the sutures are removed, but in the course of the above treatment it sometimes happens that when too much skin has been excised, the eyeball is not covered.* (…) *The condition is named lagophthalmus by the Greeks. If too much of the eyelid is lost, no treatment can restore it. Just below the eyebrow the skin is to be incised in the figure of a crescent with the horns pointing downwards. The incision should reach the cartilage without injuring it; should the cartilage be incised, the eyelid will droop and cannot afterwards be raised.* (…) *Sometimes the lower lid is not raised enough, but hangs down and cannot reach the upper lid. And this happens sometimes from the defective treatment described above, sometimes from old age: the Greeks call it ectropion. If this is due to bad treatment, the same procedure as that indicated above is employed, but the horns of the incision are now to be directed towards the jaws, not towards the eyeball.*

7.1.1.2 Georg Bartisch

In 1583, **Georg Bartisch** (1535–1607) wrote *Ὀφθαλμοδουλεια (Ophthalmodouleia), das ist Augendienst* (Ophthalmodouleia, or eye-service) in the vernacular [4]. The book includes the first illustration of blepharochalasis and its correction in the medical literature using a guillotine knife designed by Bartisch to excise the upper eyelid skin excess (*see* Sect. 3.1.5.1) (*see* Fig. 3.41).

7.1.1.3 Lorenz Heister

The same guillotine knife with minimal modifications was used by **Lorenz Heister** (1683–1758) for the correction of blepharochalasis and illustrated in Chapter 46 of his *Chirurgie*, first published in 1718 [5] (*see* Sect. 4.2.2.3 "Lorenz Heister" in Chap. 4) (Fig. 7.1).

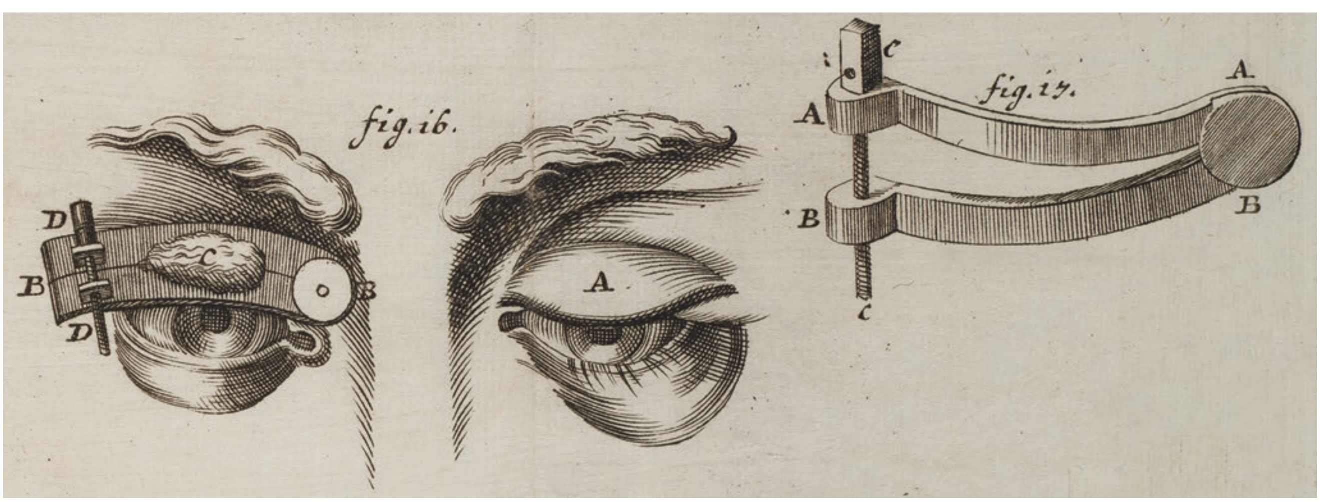


Fig. 7.1 Upper eyelid skin removal using a guillotine knife for the treatment of blepharochalasis, according to Lorenz Heister (1683–1758). (From: Heister L. *Chirurgie, in welcher alles was zur Wund-Artzney gehoeret* (…). Nürnberg, Heirs of Johann Hoffmann, 1724)

7.1.1.4 Pierre Dionis

In *Cours des Opérations de Chirurgie* (1707) (*see* Sect. 4.2.2.1 "Pierre Dionis" in Chap. 4), the Frenchman **Pierre Dionis** (1643–1718) showed how to prepare an operating table for eyelid surgery, with all the instruments necessary for that particular type of procedure, mainly correction of lagophthalmous and ectropion. There is no mention of blepharochalasis [6] (Fig. 7.2).

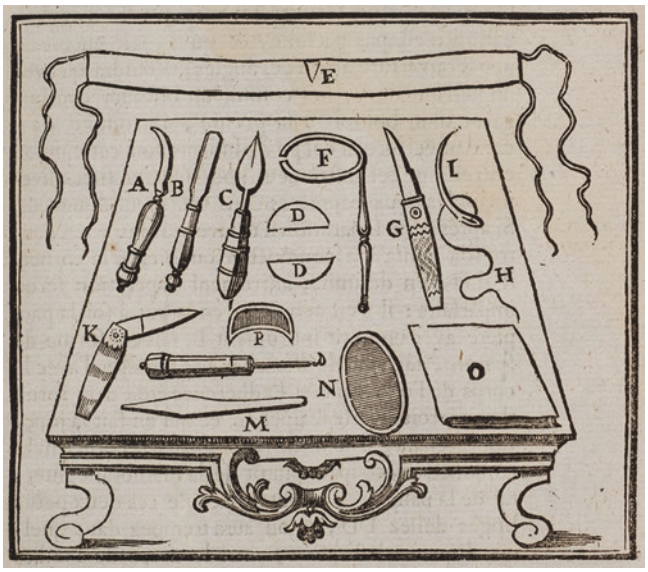


Fig. 7.2 The operating table with the surgical instruments necessary for eyelid surgery. (From: Dionis P. *Cours des Operations de Chirurgie, démontrées au Jardin Royal*. Paris, Laurent d'Houry, 1707)

7.1.1.5 George Joseph Beer

George Joseph Beer (1763–1821), in *Lehre von den Augenkrankheiten als Leitfaden zu seinen öffentlichen Vorlesungen entworfen* (Knowledge of Ophthalmic Diseases, as Guide for his public lectures project), described the condition of upper eyelid edema which often resulted in an acquired ptosis (nowadays termed blepharochalasis) and baggy lower eyelids, accompanied by the clinical image of the disease, the first representation in the medical literature (page 109 and Table 3, Fig. 1) [7] (Fig. 7.3).

Beer is considered the founder of the great ophthalmological school and clinic in Vienna. In 1812, he was appointed Chair of Ophthalmology at the University of Vienna. In 1813, he published the first volume of his major work *Lehre von den Augenkrankheiten* (…). He personally colored the figures of abnormal eye conditions to ensure their accuracy. The second volume was issued 4 years later in 1817. His influential textbook dictated the techniques of ophthalmological practice for several generations. He died in 1821, aged 58.

Fig. 7.3 First representation in the medical literature of an acquired eyelid ptosis (blepharochalasis) and baggy lower eyelids. (From: Beer GJ. *Lehre von den Augenkrankheiten* Wien, Camasina, 1817)

7.1.2 Breast Deformities

7.1.2.1 Paulus of Aegina

Paulus of Aegina (ca.AD 625–690), born on the island of Aegina (Greece), studied medicine and practiced in Alexandria about AD 640. He summarized the medical knowledge of his time in a seven-book encyclopedia entitled *Epitome*, or *De Materia Medica* (On Medicine) (see Sect. 1.8.3). In Book 6, devoted to surgery, Paulus describes numerous reconstructive and functional procedures. In Chapter 46, he illustrates the surgical treatment of gynecomastia.

> *The breast of the man is slightly swelling, as the female breast in the period of puberty. Usually, this enlargement diminishes later. Thus, if the man wants to get rid of the deformity, which gives a female aspect to the body, it is wise to operate it. An incision in the figure of a crescent in the lower pole of the breast should be carried out. Tissues are undermined and fat excised. Wound is closed by suture approximation. If by chance the breast remains pendulous, as in woman, due to its magnitude, we make in the upper pole two semilunar incisions, joining each other at their extremity, so that the larger comprehends the smaller. The skin between them is dissected away, fat removed and sutures are applied. If by mistake one has excised less than it is required, one may come back again, removing the excess* [8].

7.1.2.2 Abu-l-Qa-Sim (Albucasis)

The Arabian physician **Abu-l-Qa-sim** (**Albucasis**) (AD 936–1013) was born near Cordoba in southern Spain and practiced in Cordoba (see Sect. 2.1.1). He wrote *Al Tasrif* (On Surgery), which was translated into Latin by **Gerard of Cremona** and first published in 1500. The text, largely inspired by Paulus of Aegina, deals with fractures, dislocations, lithotomy, ophthalmology, gynecomastia, and dental surgery [8]. In Book 2, Chapter 47, Albucasis describes the surgical treatment of gynecomastia, using a technique very similar to that of Paulus, as reported above.

7.1.2.3 Giovanni Tommaso Minadoi

Giovanni Tommaso Minadoi (ca.1540–1615) was an Italian physician, born in Rovigo (northern Italy), who studied medicine at Padua University and practiced in Venice (see Sect. 4.1.2.5). He wrote *De Humani Corporis Turpitudinibus Conoscendis & Curandis* (On the Knowledge and Treatment of the Deformities of the Human Body), a treatise on hygiene, beauty, and well-being, published in 1600 [9]. Chapter 41 of Book 3 is devoted to the management of *Obesity and fatness*. On page129 verso, he advocated a possible reduction of breast hypertrophy and affirmed that: "Regarding the surgical treatment for reducing breasts' hypertrophy, one should perform a wide dissection with the iron and remove the fat." However, historians believe that he never practiced this type of surgery.

7.1.2.4 Giovanni Marinello

A few years earlier, in 1562, **Giovanni Marinello** (*fl.* sixteenth century), an Italian humanist, philosopher, and physician, published *Gli ornamenti delle Donne* (On Ladies Embellishments), the first practical textbook on hygiene, beauty, and well-being. In Book 4, he gives suggestions regarding how to reduce the volume of an hypertrophic breast with balms and ointments, without surgery [10].

7.1.2.5 Will Durston

In England, rumors arose regarding a possible breast operation, practiced in 1669 by a certain **Will Durston** (*fl.* seventeenth century), a physician in Plymouth, England. **G. Letterman** and **M. Schurter** in their accurate historical research [11] demonstrated those rumors to be inconsistent. According to them, Durston practiced neither mastectomy nor mammoplasty. He only incised a young girl's ulcerated gigantomastia and removed sixty-four pounds of weight from her left breast and forty from the right, prior to her death which occurred in 1669. He wrote three letters to the Right Honorable President of the *Royal Society of London* reporting the unusual case, and finally announced the death of the "bigg-breasted (*sic*) woman" after his excisional surgery.

7.1.3 Women in Medicine

7.1.3.1 Trotula

Trotula (or Trota) (*fl.* twelfth century) was a medical practitioner, a renowned midwife, and writer who taught at the medical school of Salerno (see Sect. 2.2.1). No independent biographical information exists beyond information that can be obtained from writings associated with her. That information allows us to place her sometime in the first half of the twelfth century. In the twelfth and thirteen centuries, her fame spread as far as France and England. To the mysterious Trotula was attributed *Summa qui dicitur Trotula*, the most influential compendium on women's medicine in Europe in the Middle Ages, resulting from three independent works. It was assembled later in the twelfth century, based upon a medieval text that was forgotten and rediscovered in the late twentieth century. Readers were unaware that this was the work of three different authors and it was thus misunderstood, as if Trotula was the author of the whole compendium.

According to historian **Monica H. Green** [12], the Summa included: *Liber de sinthomatibus mulierum* (Book on the Symptoms of Women), based on the *Tractatus de egritudinis mulierum* (Tract on the Diseases of Women) by Soranus of Ephesus, with details on gynecology and obstetrics. *De curis mulierum* (On Treatments for Women), on the diseases of women and cosmetics, and *De ornatu mulierum* (On women's cosmesis) on cosmetics.

In particular, *Liber de sinthomatibus mulierum* explains some complications related to delivery, as hemorrhage and recto-vaginal fistulae. Moreover, it includes medical advice to erase wrinkles, eliminate warts, remove capillaries, whiten teeth, and close clefts of the lips. For diminishing pain of the breast, reducing vaginal prolapse, and tightening the vagina so as to appear virgin, it was suggested to locally use a blend of white egg with warm herbs three times per day.

To the best of our knowledge, these are the only reports of aesthetic surgery performed in remote ages.

7.1.4 Opposition to Aesthetic Changes

We relate a curious and interesting work from the seventeenth century, *Anthropometamorphosis*, by the Englishman **John Bulwer** (ca.1606–1656), against the habits people use to modify their external appearance. The son of an apothecary, Bulwer was born in London and worked and lived there until his death. He was probably educated at Oxford and later in his life, between 1650 and 1653, he graduated in medicine at an unknown European university. He wrote five books, of which the final and most popular was *Anthropometamorphosis: Man Transform'd or, the Artificiall Changling*) [13]. First issued in 1650, and reprinted in 1653 in an enlarged and illustrated edition with numerous woodcuts, it describes how people attempt to modify their heads, faces, bodies, and clothes. *The beauty of the Universe consists in things so perfect and permanently regulated by Nature, that there is no need to change them*. The work, influenced by the philosopher **Francis Bacon** (1561–1626) of London, compares the habits of all the people of the world (Fig. 7.4), and represents an attack on the cosmetic modifications (*artificial changing*) performed by men and women. He was against all types of treatment, condemning *those who want to alter the natural features* (Figs. 7.5 and 7.6). The main body of the text consists of twenty-four sections, of which fifteen concern deformities or modifications to the head or face.

Fig. 7.4 Frontispiece of J. Bulwer work *Anthropometamorphosis.* In the center, the devil is figured as a God by all the creatures who want to change their image. (From: Bulwer J. *Anthropometamorphosis: Man Transform'd: or, the Artificiall Changling*. London, William Hunt, 1653)

Fig. 7.5 Earlobes modified. (From: Bulwer J. *Anthropometamorphosis: Man Transform'd: or, the Artificiall Changling*. London, William Hunt, 1653)

Fig. 7.6 *Left*: Pendulous breast raised by means of a waist; *right*: pendulous breast used to nurse the baby from behind. (From: Bulwer J. *Anthropometamorphosis: Man Transform'd: or, the Artificiall Changling*. London, William Hunt, 1653)

7.2 The Beginning of Modern Aesthetic Surgery

We have reported the remote origins of aesthetic surgery, but when was the first modern aesthetic procedure described? Very possibly in the middle of the nineteenth century and, according to **Blair Rogers** who published a detailed history of aesthetic surgery [14], the German **Johann Friedrich Dieffenbach** is considered the initiator.

7.2.1 Early Procedures

Johann Friedrich Dieffenbach (1794–1847), one of the greatest surgeons of the nineteenth century and a leading plastic surgeon working in Berlin at *La Charité Hospital* (see Sect. 5.2.1.2), published a two-volume textbook in 1845–1848, *Die operative Chirurgie* [15], which deals with almost every type of surgical operation known at that time. In the chapter related to rhinoplasty, besides the descriptions of the different flaps used to restore parts amputated or damaged by disease, he provided what is considered the first description of an aesthetic procedure, although with some functional implication in *Excision of an oblique piece of skin, from the dorsum of the nose* (Volume 1, pages 365-371). To improve a drooping tip and change the naso-labial angle, he excised two symmetrical triangular pieces of skin between the upper and lower lateral cartilage. The concurrent reduction of the large nose was achieved by removing a lozenge of skin using two lateral incisions and fracturing the nasal bones. No illustrations were supplied.

The scheme of the procedure, along with the final result, was provided by **Julius von Szymanowski** in his atlas issued in Kyiv in 1865 [16] (Fig. 7.7). In the chapter related to breast (Volume 2, pages 370-372), Dieffenbach described the reduction of the lower two-thirds of the breast and of a posterior segment for treatment of hypertrophy, leaving only a fine linear scar at the submammary fold.

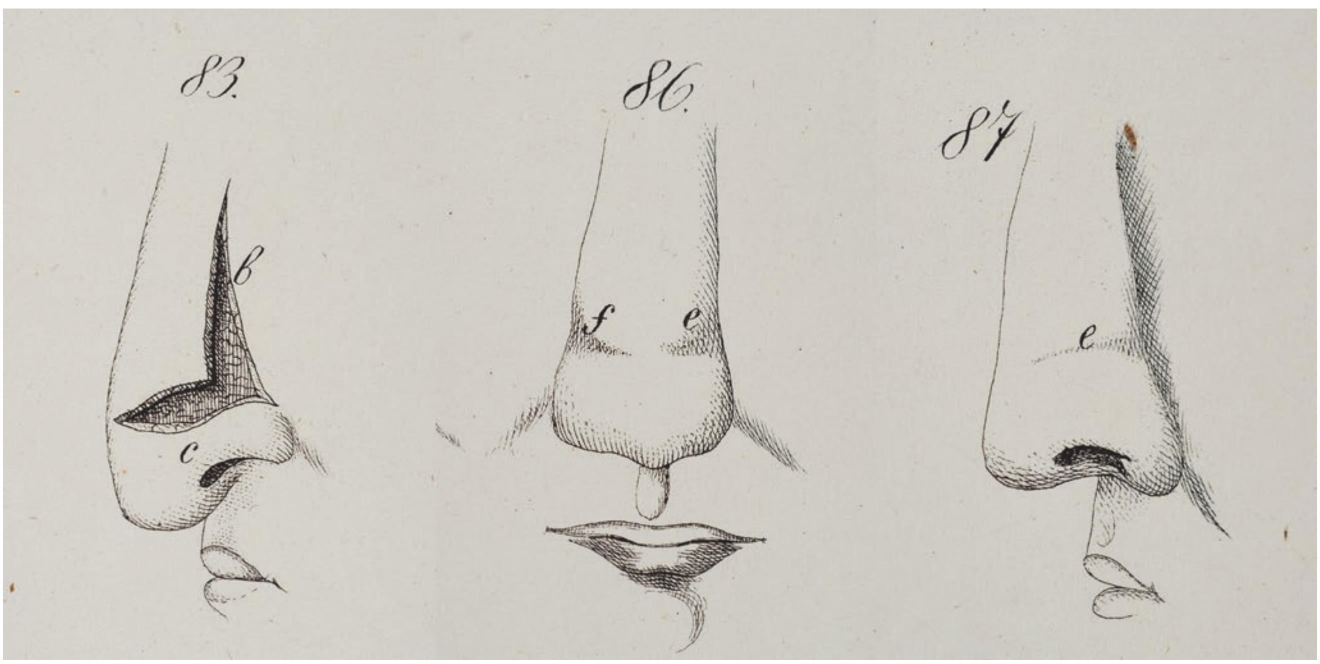


Fig. 7.7 Correction of a drooping tip by excision of two symmetrical triangles of skin, advocated by J.F. von Dieffenbach in 1845. First aesthetic procedure in the medical literature. *Left*: Drooping tip with excision of a lateral skin triangle – lateral view; *middle*: front view, with the bilateral triangular skin excision; *right*: final result with correction of the drooping tip. (From: Szymanowski J. *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865)

7.2.2 The First Purely Aesthetic Procedure: Correction of Prominent Ears

The first purely aesthetic procedure was the correction of prominent ears, performed in 1881 by **Edward Talbot Ely** (1850–1885), a surgeon in New York working at Manhattan Eye, Ear and Throat Hospital [17, 18]. Details about this intervention will be supplied later in this chapter in the section on otoplasty Sect. 7.8.4.

Initially, aesthetic operations were mainly concentrated on the face and neck, then on the breast, and finally, although to a smaller degree, on the abdomen, and arms (Table 7.1).

Table 7.1 The first generation of plastic/aesthetic surgeons and the countries where they practiced

Country	Name	Procedure	Notes
Germany	**Viktor Czerny** (1842–1916)	Fat grafting to the breast	First fat grafting to the breast, 1895
	Jacques Joseph (1865–1934)	Rhinoplasty, mammoplasty, facelifting, blepharoplasty	Chapter on rhinoplasty and otoplasty in an otolaryngological treatise, 1912 Comprehensive textbook on aesthetic rhinoplasty, 1931
	Erich Lexer (1867–1937)	Mammoplasty, facelifting	First free areola transplantation, 1912 First nipple transposition in breast reduction, 1921
	Eugene Holländer (1867–1932)	Facelifting, fat injection	First face lift, 1901 First fat injection, 1910
France	**Hippolyte Morestin** (1868–1919)	Mammoplasty, abdominoplasty	First umbilicus preservation in abdominoplasty, 1905
	Suzanne Noël (1878–1954)	Facelifting, brachioplasty	First textbook on aesthetic surgery by a woman, 1926
	Maurice Virenque (1888–1946)	Facelifting	Described a facelifting technique, recently rediscovered, 1927
	Raymond Passot (1886–1933)	Facelifting, mammoplasty	Published a textbook on aesthetic surgery, 1931
	Julien Bourguet (1876–1952)	Facelifting, blepharoplasty, rhinoplasty	First fat removal from lower eyelid with transconjuctival approach, 1925
	Louis Dartigues (1869–1940)	Mammoplasty	Founder of the Soc Franç Chir Plast Reconstr Esthét, 1930
	Charles Claoué (1897–1957)	Mammoplasty	Founder of the Soc Franç Chir Plast Reconstr Esthét, 1930
Italy	**Gustavo Sanvenero-Rosselli** (1897–1974)	Rhinoplasty	First textbook on rhinoplasty in Italy, 1931
Austria	**Robert Gersuny** (1844–1924)	Paraffin, otoplasty	Largely used paraffin, 1900
	Hermann Biesenberger (1885–1947)	Mammoplasty	Massive glandular resection, nipple transposition and skin remodelling in one stage, 1928
	Emil Schwarzmann (1885–1966)	Mammoplasty	First de-epithelialization of the cutaneous-glandular flap to preserve nipple vascularization, 1930
	Ernst Eitner (1867–1955)	Mammoplasty	First periareolar mammoplasty, 1931
Hungary	**Aurél Rethi** (1884–1976)	Rhinoplasty	First transcolumellar approach in rhinoplasty, 1934

Table 7.1 (continued)

Country	Name	Procedure	Notes
United States	**John O. Roe** (1848–1915)	Rhinoplasty	First aesthetic rhinoplasty, 1891
	Robert Weir (1838–1927)	Rhinoplasty	First alar base excision, 1892
	George Monks (1853–1933)	Rhinoplasty, otoplasty	Saddle nose correction with bone graft, 1898
	Edward Talbot Ely (1850–1885)	Otoplasty, prominent ears	Prominent ears. First pure aesthetic procedure in medical literature, 1881
	Charles C. Miller (1880–1950)	Facelifting, blepharoplasty, otoplasty	First textbook on aesthetic surgery, 1907 First fat injection in the USA, 1926
	Frederick strange Kolle (1871–1929)	Aesthetic surgery	Second textbook on aesthetic surgery, 1911
	Henry Schireson (1881–1949)	Facelifting	Published a well-received textbook on aesthetic surgery, 1938
	Joseph Eastman Sheehan (1885–1951)	Rhinoplasty	First textbook on rhinoplasty, 1925
	Adalbert G. Bettman (1883–1964)	Facelifting	First pre- and post-operative photographs of facelift patient in medical literature, 1919
	Lyons H. Hunt (1882–1954)	Facelifting, blepharoplasty, otoplasty	First perception that different types of facelifting should be devised, depending on the specific facial sector: Forehead, cheek, neck, 1926
	Jacques J. Maliniak (1889–1976)	Facelifting, mammoplasty	Founder of the American Soc of Plast. Surg (ASPS), 1931
	Howard A. Kelly (1858–1943)	Abdominoplasty	First removal of the lower abdomen redundancy of skin and fat with an incision just below the umbilicus, which was preserved, 1910
	Max Thorek (1880–1960)	Abdominoplasty, mammoplasty	Free areola transplantation, for gigantomasty, 1921
	Joseph Safian (1886–1983)	Rhinoplasty	Contributed to spread Joseph's rhinoplasty in the USA, 1935
	William H. Luckett (1872–1929)	Otoplasty	First described the absence of the antihelix fold in prominent ears and described its correction, 1910
Brazil	**Antonio Prudente** (1906–1965)	Otoplasty	Among the first to publish on the correction of prominent ears in Brazil, 1939
Argentina	**Ernesto Malbec** (1903–1991)	Otoplasty	Among the first to publish on the correction of prominent ears in Argentina, 1929

7.2.3 Rhinoplasty

Until the middle of the nineteenth century, nasal surgery was confined to the care of acute wounds and to the restoration of parts either mutilated or destroyed by disease. Aesthetic rhinoplasty for the modification of a deformed nose, typically hump removal for the reduction of a hypertrophic nose, was introduced soon afterwards. Initially, it was all in American hands, before moving to Europe. A particular aspect of nasal surgery was augmentation rhinoplasty to contrast the dramatic consequences of syphilis, largely disseminated at the end of the nineteenth century. To reduce the stigmata of syphilis, the most typical being saddle nose from cartilage resorption, numerous solutions have been proposed, as we shall see [19, 20].

7.2.3.1 The Beginning of Aesthetic Rhinoplasty: End of the Nineteenth Century. An American Story

John Orlando Roe

Following Dieffenbach's contribution, more than 40 years passed before the first aesthetic rhinoplasty *to improve the personal appearance of an individual* was reported by **John Orlando Roe** (1848–1915), an otolaryngologist from Rochester, New York, who graduated from Columbia University in 1871. In 1887, he presented a paper before the *New York Medical Society* on correction of five cases of bulbous or "pug nose" as he named it. Through intranasal incisions, he accessed the dorsum, dissecting the lining, lifting up the tip of the nose, and excising the bulk

[21]. In 1891, he presented another paper before the same society on the correction of a hump nose that he called "angular deformity." Under local, cocaine anesthesia and on an outpatient basis, he made an incision just in front of the nasal bones, between the upper and lower cartilage, as is often done today. He undermined the skin of the dorsum and excised the hump using a pair of angular scissors. A splint was applied to reposition the skin and to maintain gentle pressure, avoiding dead spaces. The final result was a perfectly straight, smooth profile [22]. He used to say: "In all surgical operations about the face, it is necessary to avoid mutilation of the skin so as to correct deformity. (…) In correction of all facial defects, the surgeon must be not only an artist, but also more or less a sculptor, with perception of symmetry as related to the different features."

The above two landmark papers demonstrated Roe as the originator of corrective aesthetic rhinoplasty.

Robert Weir

The following year, **Robert Weir** (1838–1927) published on rhinoplasty. Born in New York, Weir, at the completion of his medical studies, dedicated himself to surgery. He was appointed Professor of Surgery at the New York College of Physicians and Surgeons and elected President of the *Surgical Society*, the *Academy of Medicine* and the *American Surgical Association*. A great surgeon with numerous innovative ideas, he wrote on the treatment of the saddle nose deformity in 1892 [23]. In the same paper, besides this type of correction, Weir showed how to make a large nose smaller by two symmetrical full-thickness excisions of the alar base: "This was very readily accomplished by an incision along the curve made by the attachment of the nose to the cheek, and there slicing off a small beveled portion of the nose and re-uniting the divided edges by sutures. This was followed by no apparent cicatrix whatsoever." The alar base excision is now eponymously named the Weir operation. (Fig. 7.8).

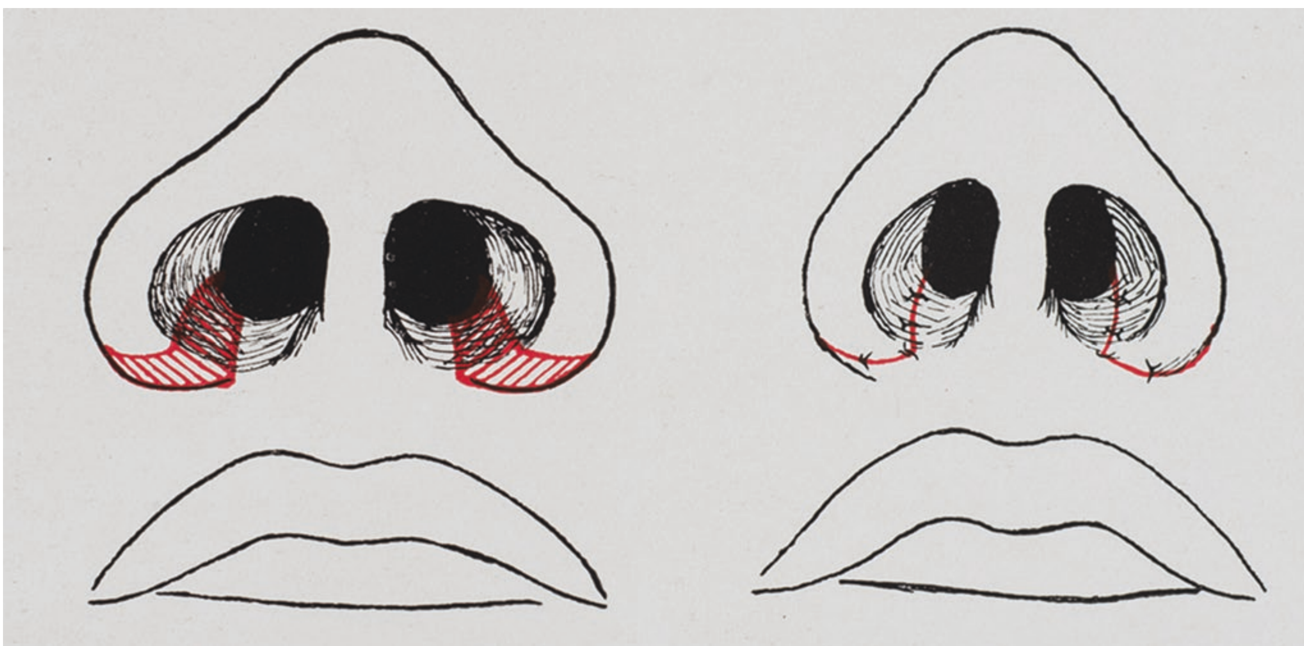


Fig. 7.8 Alar base excision to reduce the breadth of the nose. *Left*: before; *right:* after. (From: Weir RF. On restoring sunken noses without scarring the face. *New York Med J.* 1892; 56: 443–454)

George Monks

Following his graduation in medicine and his internship at Massachusetts General Hospital, **George Monks** (1853–1933) went to Europe to further improve his skills in medicine and surgery. In 1884, on his return to the USA, he opened an office in Boston, where he practiced medicine and surgery. In this period, he dedicated himself to nasal surgery. In 1898, he published a paper on the improvement of some lesions and deformities of the nose such as acne, bifid nose, and sequelae of traumas. He made a subcutaneous tunnel either to remove a bony hump, or to correct a saddle nose. In this latter case, he inserted bone graft or alloplastic material such as celluloid or a platinum plate [24]. A comprehensive biography of Monks was provided by **Robert M. Goldwyn** (see Sect. 5.2.8.7) [25].

7.2.3.2 Aesthetic Rhinoplasty Takes Shape: Jacques Joseph

In Europe, aesthetic rhinoplasty started in Berlin with **Jacques Joseph** (Fig. 7.9). He was born in Königsberg (Prussia) in 1865. At the completion of his medical studies, Joseph entered the Orthopaedic Clinic at *La Charité Hospital* in Berlin as an assistant. In 1896, he performed an operation for the correction of prominent ears, within the Orthopaedic Clinic, which was considered against the interest and image of the clinic. For this, he was immediately discharged. He continued his career in private practice, dedicating himself to developing his chief interests: improvement of auricle deformities and rhinoplasty. In 1898, he presented a paper before the *Berlin Medical Society* about operative reduction of the size of the nose, using a V-shaped midline external incision through the skin to directly expose bone, cartilage, and lining and removing the hump. He also excised a wedge of the caudal septum to make the nose shorter. To his great disappointment, he learned that in the USA a similar operation was carried out 7 and 6 years before, by Roe and Weir, respectively, but through an intranasal approach. This stimulated him to modify his technique, and in 1904 he published on dorsum lowering and concurrent narrowing of the sidewalls of the nose by sawing the frontal process of the maxilla, with intranasal approach. The osteotomy was carried out using a specially designed saw inserted in a tunnel made laterally to the pyriform aperture [26, 27] (Fig. 7.10).

In 1907, he described the management of a deviated nose [28]. About 1910, he established the fundamentals of aesthetic rhinoplasty, starting with the intranasal incision to approach the dorsum, continuing with dorsal undermining, hump removal using a saw (Fig. 7.11), trimming of the lower lateral cartilage, excising the caudal portion of the septum to favor the rotation of the nasal pyramid in a cranial direction and to shorten the nasal pyramid (Fig. 7.12), and finally performing the lateral osteotomy for narrowing the nose (Fig. 7.10). In 1912, he contributed a 50-page chapter on nose and ear deformities to the four-volume treatise on otolaryngology by Katz, Preysing, and Blumefeld [29]. The chapter has particular value in the history of aesthetic rhinoplasty, and it should be regarded as the first systematic overview on the subject. Joseph described the step-by-step procedure in detail, getting outstanding results from almost every operation he undertook, always providing superb pre-and post-operative photographs of patients (Fig. 7.13).

Joseph also took care of the Unit for Facial Plastic Surgery at *La Charité Hospital* in Berlin, where major post-war facial injuries were treated, as we have seen in Sect. 6.2.3.2. For this social involvement, he was granted the title of Professor by the Ministry of Science, Art and Culture.

Joseph soon became a leader in aesthetic nasal surgery. He had a brilliant, innovative mind. He not only categorized the different steps of the technique in a teutonic manner, but also developed the whole field of rhinoplastic surgery, and invented all the instruments necessary for the procedure. He recorded every single case regarding the nose, from simple defects to congenital anomalies, to sequelae of injuries, to aesthetic deformities. He documented each case with pre- and post-operative photographs, front and profile, at the same distance using the same lighting and background (Fig. 7.13). He carefully studied the relationships between the nose and face using a special device to measure the facial angles (Fig. 7.14), and evaluated the positive psychological impact the operation had on patients' social relationships (Fig. 7.15).

Joseph dominated the rhinoplasty scene in Europe in the interwar period, operating on the most distinguished patients from Germany and from abroad, charging elevated fees. He became extremely rich and built a beautiful villa in the prestigious Berlin-Wilmersdorf.

He had a very difficult character. His clinic in Berlin was regularly visited by surgeons coming from all over the world. He gave expensive courses on rhinoplasty to foreigners, mainly Americans, interested in learning directly from him (Fig. 7.16). Legends existed regarding Joseph's peculiar behavior toward the attendees. Essentially, teaching included 4 weeks of observing his operations, but without any opportunity to raise questions. He never talked or commented during operations and avoided meeting students and physicians at the completion of the procedure. Tuition was cheaper if access to the OR was not included. Practically, attendees only became familiar with his surgical instruments. Special fees were granted to physicians coming from eastern Europe. Among his numerous students, mention should be made of the Hungarian **Gustave Aufricht** (see 6.2.4). After studying with Esser, Aufricht visited Joseph to further improve his nasal surgery skills and remained with him from May 1922 to October 1923 before moving to the USA where he started his practice in New York.

A prolific writer, Joseph published an epoch-marking textbook *Nasenplastik und sonstige Gestichstplastik* (Rhinoplasty and Other Facial Plastic) with more than 1700 illustrations [30], and divided into three parts. Parts 1 and 2, issued in 1928 and 1929, dealt exclusively with the reconstructive and aesthetic aspects of the nose. Part 3 appeared in 1931 and included different types of facial repair, such as blepharoplasty, facelifting, cheiloplasty, and otoplasty, along with a section on breast reduction. With the publication of the final section, all three parts were grouped in a single volume, issued in 1931, which became not only the standard text, but also one of the most influential in the field of modern plastic surgery (Fig. 7.17).

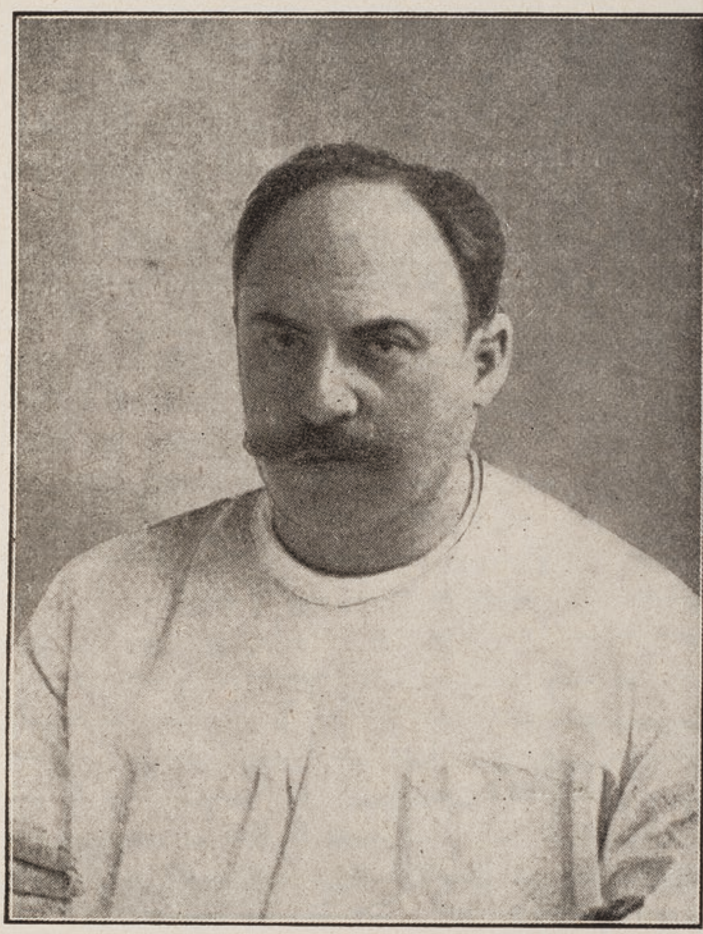
Although Joseph was not the first surgeon to perform aesthetic rhinoplasty, being preceded by Roe and Weir, and this was extremely difficult if not impossible for him to admit, he pioneered and established the fundamentals of the technique. For this, he should be acknowledged as the father of rhinoplasty.

The dramatic restrictions imposed on doctors by the Nazis in 1933 greatly upset Jacques Joseph. On February 1934, he passed away in his office under unknown circumstances: heart attack or suicide. Impossible to know. He was buried at Weissensee Jewish cemetery in Berlin.

A comprehensive biography was written in 1982 by **Paul Natvig** [31].

NÉCROLOGIE

Le professeur Jacques JOSEPH



Nous avons appris avec douleur la mort de notre collaborateur le Prof. Jacques Joseph de Berlin. Sa mort date de février dernier et est survenue dans la clinique universellement connue du maître, là où nous l'avons nous-même rencontré, alors qu'il déployait son activité inlassable. On peut dire qu'il a été le chef de la rhinoplastie moderne et que chacun de ceux qui s'occupent sérieusement de la question lui ont fait au moins visite. Nombreux sont ceux, et nous en sommes, qui ont passé chez lui plusieurs semaines ou plusieurs mois pour observer de près sa science biologique et son adresse chirurgicale.

Fig. 7.9 Portrait of Jacques Joseph (1865–1934)

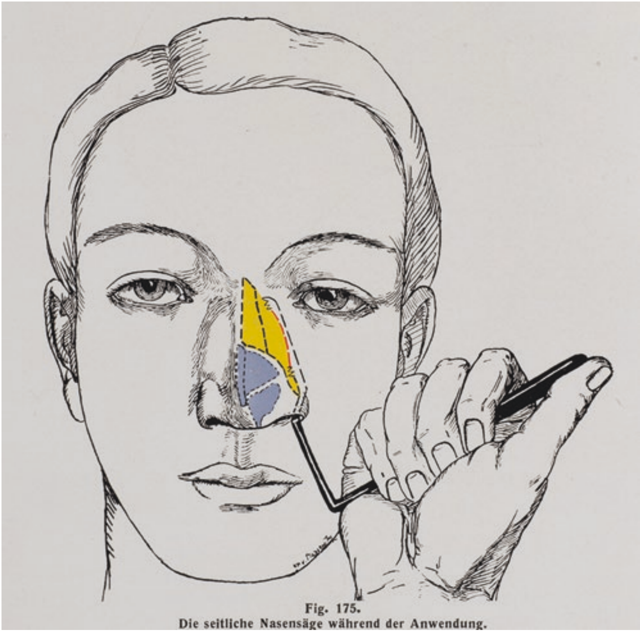


Fig. 7.10 The saw designed by Joseph for performing a lateral osteotomy. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931)

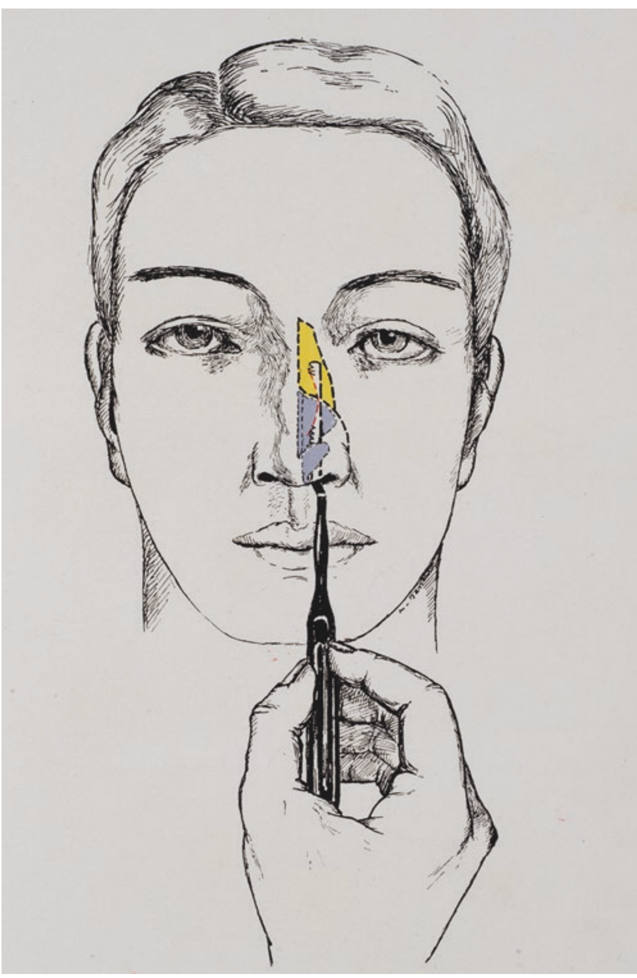


Fig. 7.11 The saw designed by Joseph for performing a dorsal osteotomy. From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931

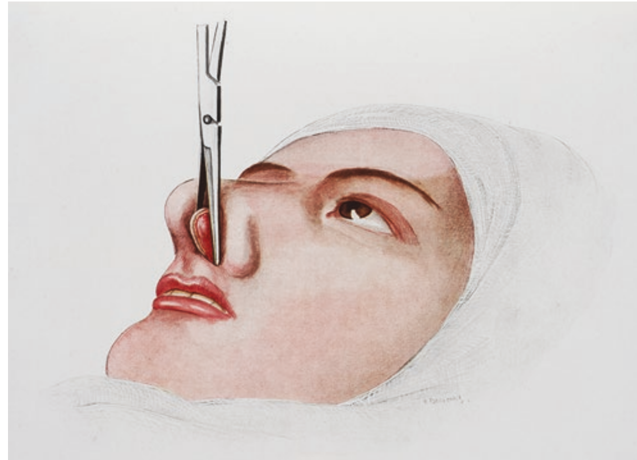


Fig. 7.12 Excision of the caudal portion of the septum to favor the rotation of the nasal pyramid in a cranial direction. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931)

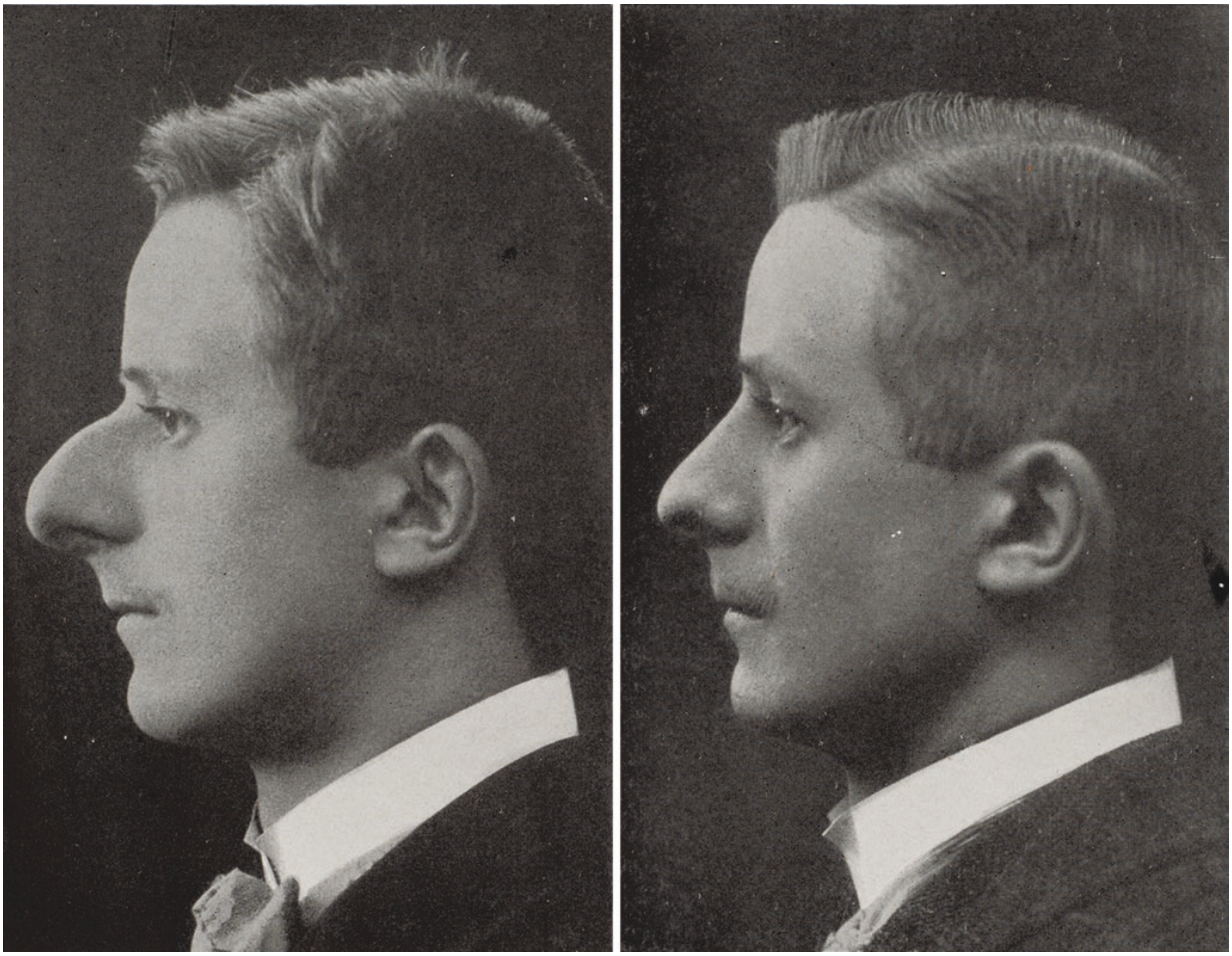
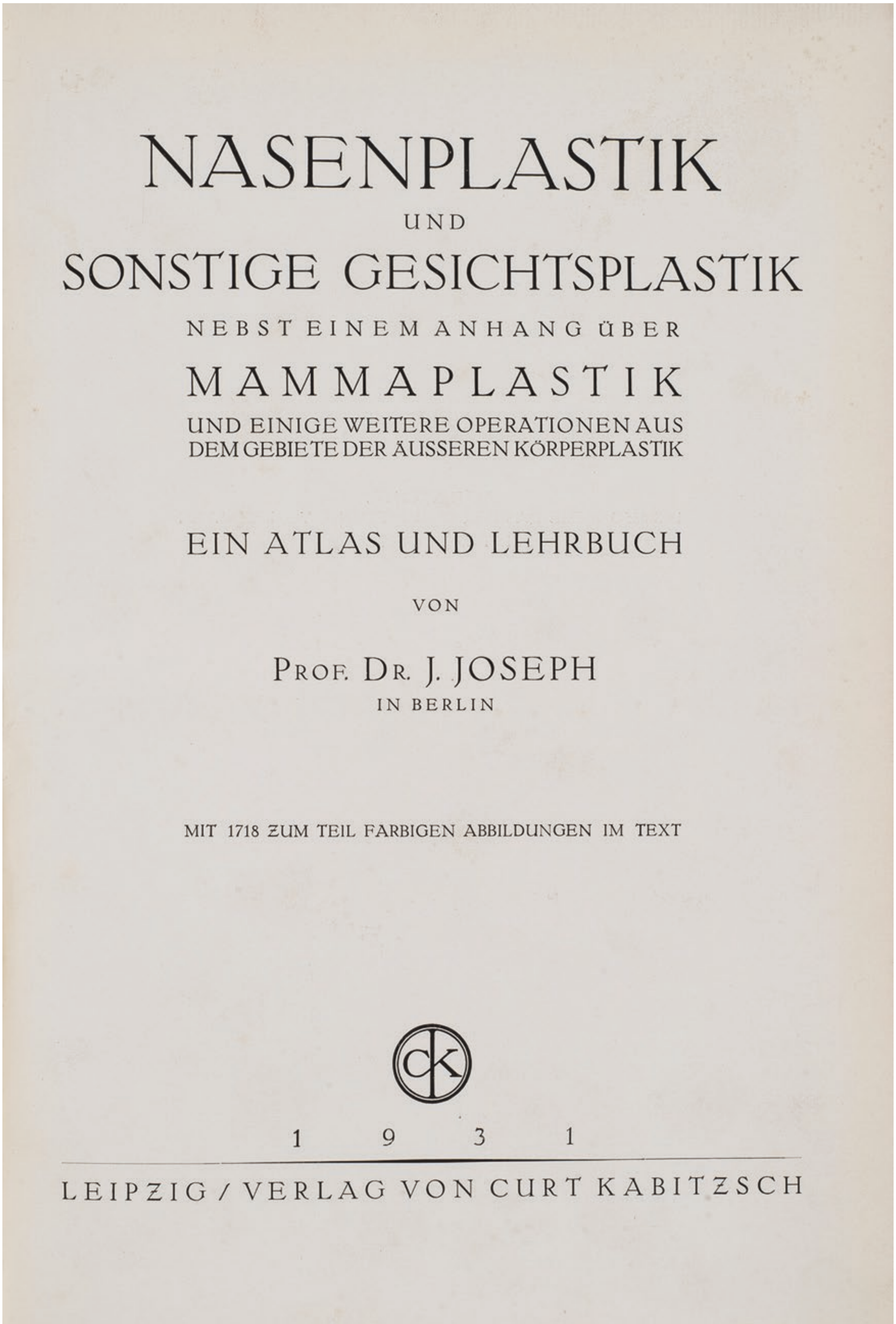


Fig. 7.13 *Left*: Pre- and *right:* post-operative profile views of a patient operated on by Joseph in 1912. (From: Katz L, Preysing H, Blumefeld F (eds.) *Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege*. Würzburg, Kabitsch, 1912)

Fig. 7.14 Device invented by Joseph to measure the naso-frontal and naso-facial angle. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931)

Fig. 7.15 Two happy patients dancing at completion of their rhinoplasty operation. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931)

Fig. 7.16 Joseph in the OR performing a rhinoplasty. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931)



NASENPLASTIK

UND

SONSTIGE GESICHTSPLASTIK

NEBST EINEM ANHANG ÜBER

MAMMAPLASTIK

UND EINIGE WEITERE OPERATIONEN AUS
DEM GEBIETE DER ÄUSSEREN KÖRPERPLASTIK

EIN ATLAS UND LEHRBUCH

VON

PROF. DR. J. JOSEPH
IN BERLIN

MIT 1718 ZUM TEIL FARBIGEN ABBILDUNGEN IM TEXT

1 9 3 1

LEIPZIG / VERLAG VON CURT KABITZSCH

Fig. 7.17 Title page of *Nasenplastik* by Jacques Joseph (1865–1934), a monumental textbook on Rhinoplasty, with 1718 illustrations in the text, published in 1931

7.2.3.3 Textbooks on Aesthetic Rhinoplasty in the Interwar Period

Joseph Eastman Sheehan

The first textbook specifically devoted to rhinoplasty was probably by **Joseph Eastman Sheehan** (1885–1951) who published it in 1925 [32]. He used a columellar-splitting incision to approach the dorsum, and chisels instead of saws for osteotomy. In the second edition, issued in 1936, he switched to an intranasal approach. Board certified in otolaryngology, he became interested in plastic surgery after a period spent at Sidcup with Gillies. He was Professor of Plastic Surgery at New York Polyclinic Hospital and Clinical Professor of Surgery at Columbia University (see Sect. 6.2.11.3).

Sebileau and Dufourmentel

In Europe, one of the first textbooks on rhinoplasty was written by **Pierre Sebileau** (1860–1953) and **Léon Dufourmentel** (1884–1957), *Correction chirurgicale des difformités congénitales et acquises de la pyramide nasale* (Surgical Correction of Congenital and Acquired Deformities of the Nasal Pyramid) [33], in which emphasis was on correction of breathing problems associated with aesthetic improvement of the nose.

Julien Bourguet

The following year, in 1927, **Julien Bourguet** (1876–1952) published *La Correction Esthétique des diverses Déformations Nasales* (The Aesthetic Correction of the Different Nasal Deformities) [34]. Born in Albi (southern France) in 1876, Bourguet studied medicine in Toulouse and graduated in 1905. A student of the renowned anatomist **Adrien Charpy** (1848–1911), Bourguet initially became prosector and in 1912 Associate Professor of Anatomy. In the meantime, he was an assistant in the Ophthalmologic Clinic of Toulouse, and later an ENT and head and neck surgeon. In 1914, he visited Jacques Joseph in Berlin to improve his rhinoplasty knowledge. At the end of WWI, he moved to Paris, working at the Rothschild Foundation and in a private clinic. A member of the *Société Française de Chirurgie Plastique et Esthétique*, established in 1930, and of otorhinolaryngology and ophthalmology societies, he contributed to the first scientific journal of plastic surgery, the *Revue de Chirurgie Plastique*. Anatomist, otolaryngologist, and ophthalmologist, he provided innovative techniques for the progress of all that is related to facial surgery, mainly reconstructive and aesthetic. He died in 1952, aged 76—a true pioneer in aesthetic facial surgery [35].

Julien Bourguet was already publishing on rhinoplasty in 1909, and later in 1913 in *Toulouse Médical*. In *La Correction Esthétique des diverses Déformations Nasales*, Julien Bourguet included an overview of the anatomy before explaining his treatment modality. He described how to remove a hump, with dorsal undermining and endonasal approach, the medialization of the nasal pyramid in case of septal deviation, and alar base excision for excessive nostril width. He showed the use of L-shaped grafts for tip support; the trimming of the lower lateral cartilage for reducing an overprojected nose; the correction of wide dome using an interdomal suture; and increasing tip projection by conchal cartilage graft. He provided numerous post-operative photographs of patients. His essay is one of the first published on rhinoplasty.

Gustavo Sanvenero-Rosselli

In 1931, the same year of Joseph's monumental *Nasenplastik und sonstige Gestichstplastik* (Rhinoplasty and Other Facial Plastic), **Gustavo Sanvenero-Rosselli** (1897–1974) issued *Chirurgia Plastica del Naso* (Plastic Surgery of the Nose), the first monograph on rhinoplasty, written in Italian, in which, besides the numerous cases of nasal reconstruction, derived from the treatment of post-war facial injuries, he illustrated aesthetic modifications of the nasal pyramid, basically following Joseph's technique [36].

Joseph Safian

Joseph Safian (1886–1983) is credited with bringing the attention of the English-speaking world to the rhinoplasty achievements of Jacques Joseph, and also for a number of personal modifications. His *Corrective Rhinoplastic Surgery* issued in 1935 [37] is an example of scholarly written text and systematic description of the rhinoplasty procedure. Thanks to Safian, Joseph's technique was popularized in the USA. In 1940, **James Barrett Brown** (1899–1971) contributed a chapter to *Nelson Loose-Leaf System Surgery* entitled *Reconstructive Surgery of the Nose* [38] in which he described the methods for reconstructive surgery after trauma or cancer, treatment of fractures, sequelae of cleft lip, cartilage grafts, and aesthetic rhinoplasty. For dressings, he used malleable aluminum nasal splints.

7.2.3.4 The Open Approach

Following the publication of Joseph's book, the number of individual papers on rhinoplasty increased substantially, with many variations, suggestions, and improvements. It is almost impossible to record all of them and to establish a priority for each.

One of the drawbacks of Joseph's technique was the lack of attention given to the tip. Patients complained that the tip was often broad and round with lack of definition. In 1934, the Hungarian otolaryngologist **Aurél Rethi** (1884–1976) pioneered the transcolumellar incision, nowadays called open approach, to achieve better access to the dome and facilitating tip work and dorsal undermining [39]. Regrettably, Rethi's method was incorrect. He proposed the open approach to make a long nose short, excising about 3–5 mm of columella, at the end of his tip work, before suturing the columella (Fig. 7.18). The final result was a drooping tip, without any projection. Due to the poor long-term results, the technique fell from favor and was abandoned. It took almost 40 years before the open approach was rediscovered and popularized by the Canadian, **Wilfred S. Goodman** in 1973 [40].

Fig. 7.18 The transcolumellar incision to facilitate access to the tip. *Left*: the incision; *center*: the dissection of the skin from the dome; *right*: excision of 3–5 mm of columella to make a long nose short. (From: Rethi A. *Raccourcissement du nez trop long*. *Rév Chir Plast*. 1934; 4: 85–106)

7.2.3.5 Augmentation Rhinoplasty

At the end of the nineteenth century, syphilis was largely disseminated around the world with all its dramatic consequences—the most typical being the saddle nose, or sunken profile, as a result of complete resorption of septal cartilage. To reduce the stigmata of syphilis, numerous solutions were proposed [19, 20, 41]. However, treatment was extremely complex, particularly in severe cases, when the entire septum was missing and the inner nose showed a unique cavity. Endless discussions arose between proponents of autologous tissue versus supporters of implants. Harvesting autologous material, such as bone or costal cartilage, was a major, painful operation. Moreover, transplantation was complicated, with a high risk of failure.

James Hardie

In 1875, the British surgeon **James Hardie** inserted a denuded fifth finger of the patient into the dorsum and, once the bone to bone contact was firmly established, severed it [42] (Fig. 7.19).

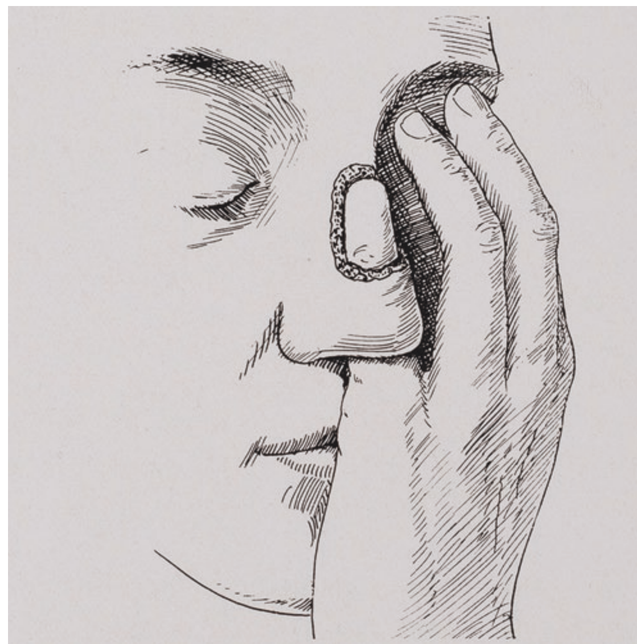


Fig. 7.19 Hardie finger method for correction of saddle nose. The denuded fifth finger is inserted into the dorsum and severed at metacarpophalangeal joint, when bone to bone contact is established. (From: Loeb HW. *Operative Surgery of the Nose, Throat and Ear*. St. Louis, C.V. Mosby Co., 1914. p. 331)

James Israel

James Israel (1848–1926), a general surgeon from Berlin, the teacher of **Eugene Holländer**, first reported the use of bone graft to the nose in 1895. He harvested a piece of bone from the tibia and placed it into a saddle, syphilitic nose. In another case, he used a flap of skin and bone from the ulna and transferred it to the nose, with a technique similar to that of Tagliacozzi [43].

Friedrich von Mangoldt

In 1899, **Friedrich von Mangoldt** (1859–1909) from Dresden described the first successful costal cartilage graft to the nose with the same indication of saddle, syphilitic nose correction [44] (see Sect. 6.1.3.2).

Surgeons were prone to using implants or paraffin injections. The operation, both easy and not painful, was usually performed under local anesthesia and on an outpatient basis. The immediate results were amazing. Long term, extrusion was the most common complication.

Robert Weir

Robert Weir, in the abovementioned paper on the treatment of sunken noses, proposed a metal prosthesis in the form of a tripod, resting on the frontal and maxillary bone, and introduced in the unique nasal cavity through the columella, divided at its base at the level of the upper lip junction [23]. The prosthesis was made following a model designed by the Parisian stomatologist **Claude Martin** (1843–1910) and published in 1889 [45] (Fig. 7.20). As an alternative, Weir suggested the use of the tripod-shaped sternum of a duck, harvested from a fowl brought to and killed directly in the OR, to obtain fresh bone. Apparently, the immediate result was very satisfactory, he affirmed, but at the end of 8 weeks, signs of rejection were noticed and removal of the heterograft was necessary [23].

Curiously, over the years, every possible material has been introduced in the nose. The ingenuity of surgeons managing saddle nose was unlimited. Ivory was the primary choice for Joseph [30], for others celluloid [23], platinum plate [23], rubber [46], gutta-percha [46] (Fig. 7.21), marble [47], and cork [48].

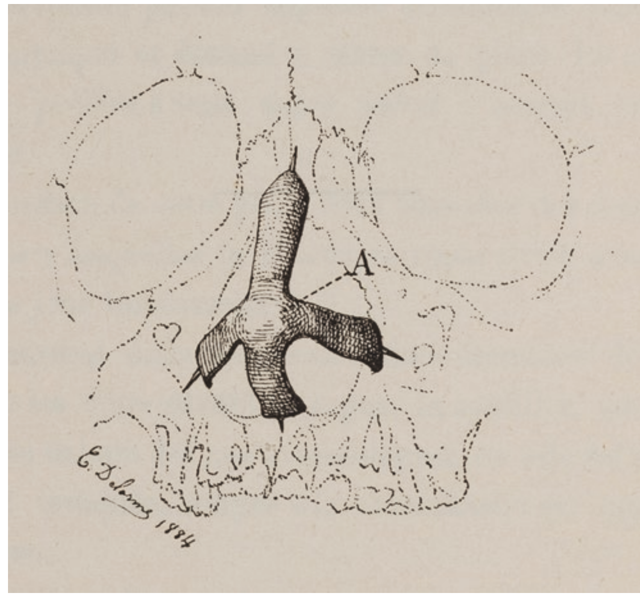


Fig. 7.20 Metal prosthesis designed in the form of a tripod for saddle nose correction. (From: Martin C. *De la prothèse immediate appliquée à la resection des maxillaires. Rhinoplastie sur appareil prothétique permanent. Restauration de la Face*. Paris, G. Masson, 1889)

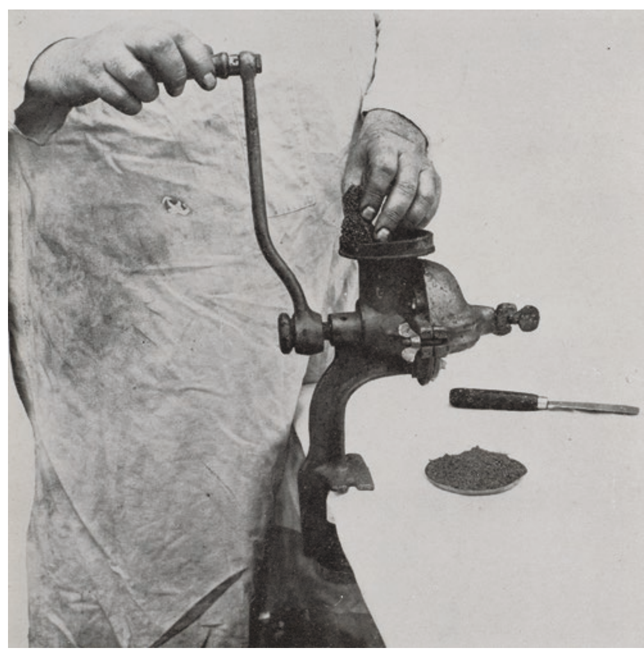


Fig. 7.21 The Miller's mill used to ground crude rubber and gutta-percha directly in the OR for injecting subcutaneously in the saddle nose. (From: Miller CC. *Cannula implants and review of implantation technics in esthetic surgery*. Chicago, Oak, 1926)

7.2.3.6 Paraffin Implants

Finally, the "miracle" arrived! At the end of the nineteenth century and in the first decade of the twentieth century, paraffin, discovered in 1830 by **Baron Karl von Reichenbach** (1788–1869), was widely used to correct depressions, featural imperfections, saddle noses, and wrinkles. Paraffin was simple to inject alone, with petroleum jelly (Vaseline), or with Vaseline and olive oil, and seemed the panacea for solving numerous aesthetic deformities, avoiding the need for surgery [49, 50] (Fig. 7.22). Its use spread rapidly. Soon quacks and charlatans enthusiastically recognized paraffin's potential. They advertised and gave public demonstrations in beauty salons and drugstores. A true "miracle" was available (Fig. 7.23). Regrettably, complications soon appeared. Granulomas resulting from foreign body reaction, specifically named "paraffinomas," due to wax, oil, and vaseline penetrated within the tissues, were the most common, unfavorable outcome, almost impossible to solve. But also, migration of the implant, extrusion, infection, and last but not least pulmonary embolism were reported—something similar to what occurred later with liquid silicone. Thus, the paraffin "miracle" began to fade. According to Robert Goldwyn: "What may seem a medical miracle, may prove to be a therapeutic folly" [51].

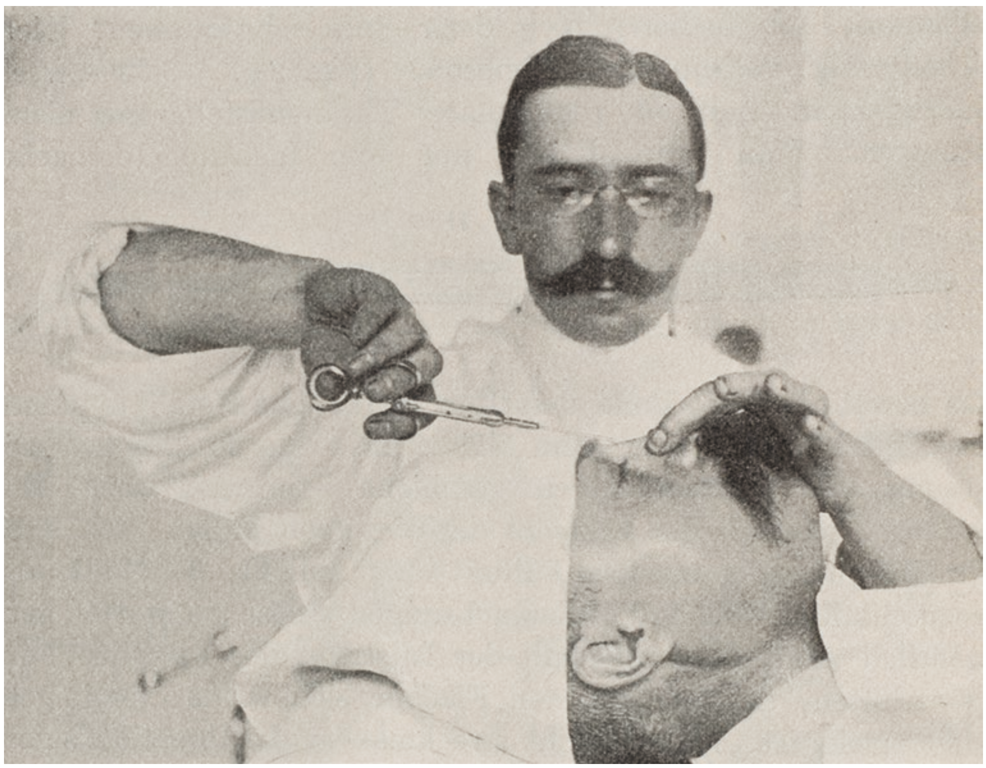


Fig. 7.22 Paraffin injection into the dorsum of the nose. (From: Stein A. *Paraffin-Injektionen. Theorie und Praxis*. Stuttgart, Enke, 1904)

Fig. 7.23 A British advertisement about the miracles of paraffin injection for saddle nose

7.3 Breast Surgery

Chronologically, the third aesthetic operation in medical history, after rhinoplasty and correction of prominent auricles, was management of breast hypertrophy and ptosis. The techniques developed over the years in the interwar period were numerous. Our aim is to offer the reader an evolution of ideas regarding plastic surgery operations for correction of breast hypertrophy and ptosis, from the end of the nineteenth century until the onset of WWII, with the understanding that the great development in this field occurred in the post WWII period.

7.3.1 Reduction Mammoplasty

7.3.1.1 Michel Pousson

The first attempt to correct a bilateral ptotic breast, nowadays called reduction mammoplasty, is usually ascribed to the French surgeon, **Michel Pousson**, from Bordeaux in 1897 [52] who excised a large segment of skin, fat, and mammary gland, with a semilunar incision in the upper pole, that extended from the axilla to the sternum, exposing the fascia of the pectoralis major. He closed the defect with subcuticular suture, without transposition of the areola, after fixing the residual gland to the denuded pectoralis fascia. In this way, the breast was reduced and elevated, but, according to the author, the result was moderately satisfactory from an aesthetic point of view, due to the obvious scar. However, patient complaints of either ptosis or pain pre-operatively were relieved by surgery (Fig. 7.24).

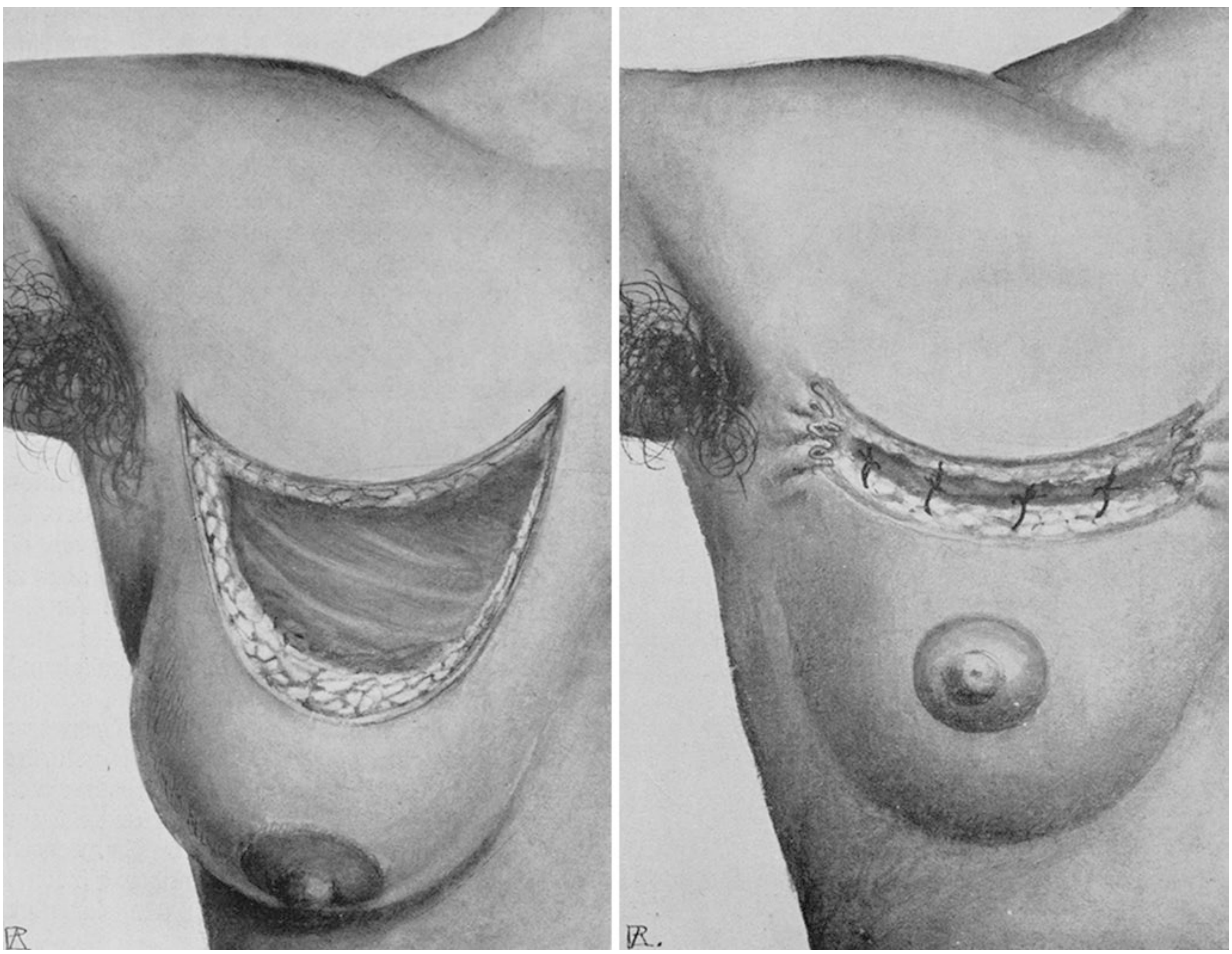


Fig. 7.24 First attempt to reduce breast hypertrophy and correct mastoptosis in the literature by Michel Pousson with *Left*: a semilunar incision in the upper pole; *right:* final result. (From: Biesenberger H. *Deformitäten und kosmetische Operationen der weiblichen Brust*. Wien, W. Maudrich, 1931)

7.3.1.2 F. Verchère

The following year, **F. Verchère** made a triangular excision in the upper pole and sutured the margins together, in a Y-shape, achieving breast reduction and elevation, without transposition of the areola. The problem of the visible scar in the upper quadrant remained [53] (Fig. 7.25).

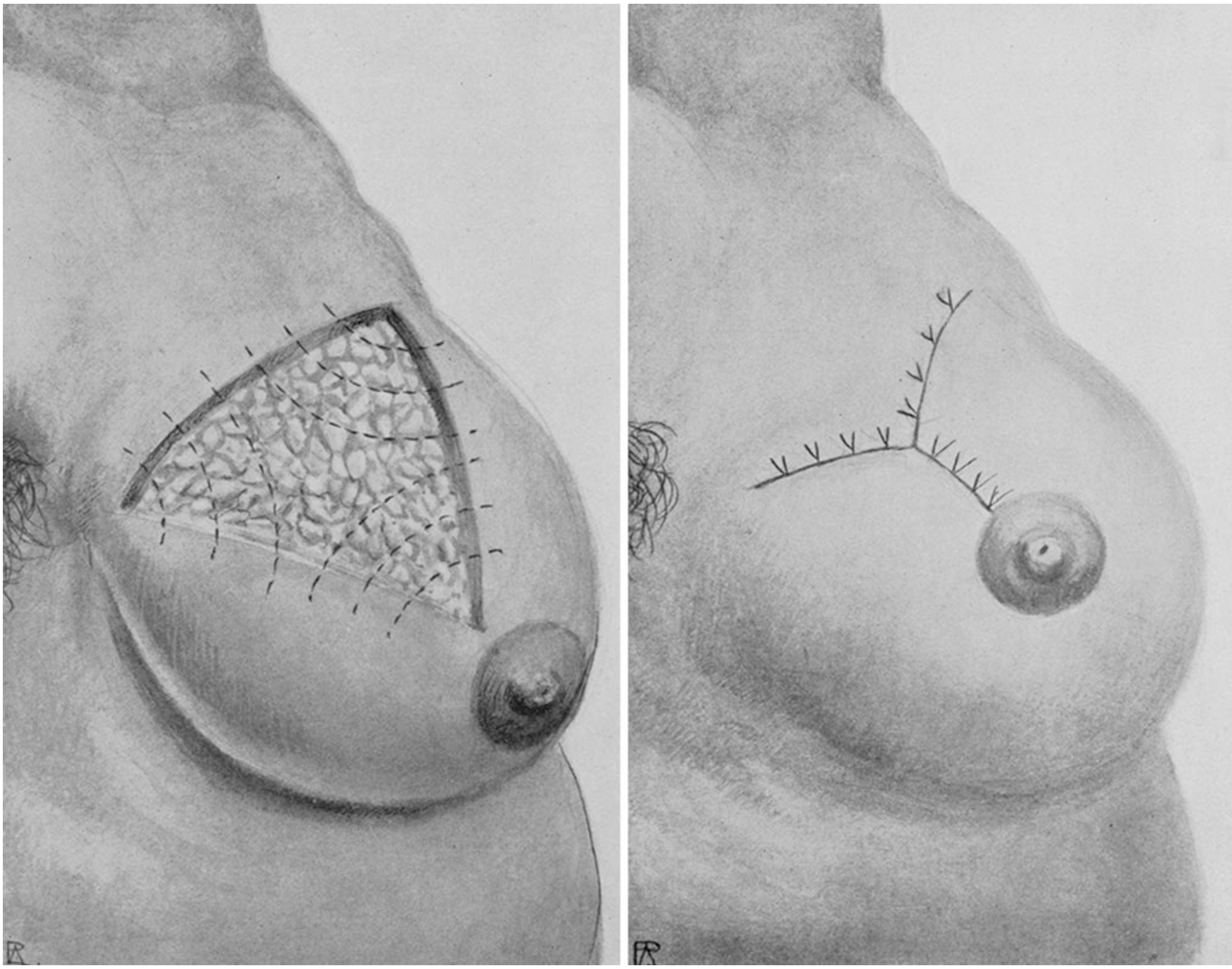


Fig. 7.25 *Left*: excision of a triangular segment of skin, fat, and mammary gland from the upper pole to reduce breast hypertrophy; *right:* final result, according to F. Verchère. (From: Biesenberger H. *Deformitäten und kosmetische Operationen der weiblichen Brust.* Wien, W. Maudrich, 1931)

7.3.2 Suspension of the Gland

Surgeons noticed a sagging tendency to recur after surgery. To contrast this unpleasant side effect, different suspension mechanisms were employed.

7.3.2.1 J. Dehner

In 1908, **J**. **Dehner** described a procedure which consisted of removing a large semilunar segment of skin from the upper quadrant, dividing the pectoralis major and minor muscles, and anchoring the breast tissue to the periosteum of the third rib using catgut sutures with the idea that the sagging tendency would be prevented. Regrettably, the ensuing visible scar and the relapse of ptosis created a poor result [54] (Fig. 7.26). Nevertheless, Dehner's technique should be acknowledged, as it represents the first example of a breast suspension operation.

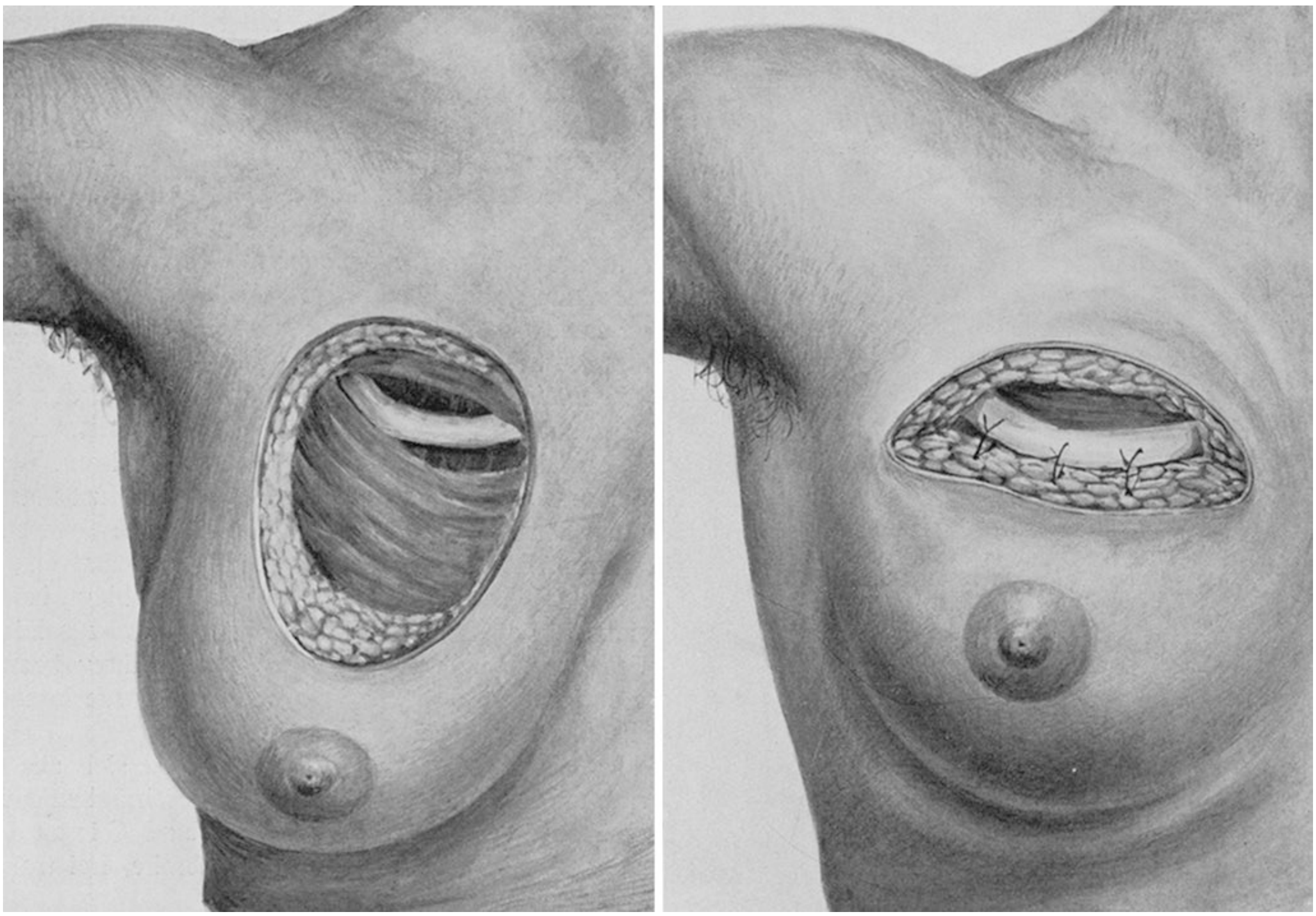


Fig. 7.26 Dehner's method for mastopexy. *Left*: excision of a semilunar segment of skin, fat, and mammary gland from the upper pole; *right:* fixation of the breast tissue to the exposed third rib with three catgut sutures. (From: Biesenberger H. *Deformitäten und kosmetische Operationen der weiblichen Brust.* Wien, W. Maudrich, 1931)

7.3.2.2 C. Girard

Two years later, the technique was improved by **C. Girard**, from Geneva, who employed the inframammary incision, a less visible approach, described by **Theodore Gaillard Thomas** in 1882 (see Sect. 7.3.2.6). Besides the suspension of the breast to the second costal cartilage with large sling loops of catgut, he stabilized the posterior surface of the gland to the pectoralis fascia with numerous interrupted catgut sutures [55].

7.3.2.3 R. Göbell

Instead of catgut sutures, **R. Göbell** preferred strips of autologous fascia lata, fixed to the third costal cartilage, to achieve the same goal [56].

7.3.2.4 Aimé Guinard

In the evolution of ideas regarding aesthetic breast surgery, **Aimé Guinard** (1856–1911) plays an important role, contributing to the history of correction of breast hypertrophy with an original technique. Guinard was a disciple of Verneuil and Tillaux, an *Interne des Hôpitaux* of Paris in 1892, working in different Parisian hospitals. His main interests were breast and abdominal surgery.

To reduce breast volume, he excised 1200 grams of breast tissue from the right side and 1400 grams from the left side in the form of a truncated cone (French: *en tronc de cône*), through an inframammary incision. In a period when the management of gigantomastia was by breast amputation [57], he successfully presented his innovative method before the members of the *Surgical Society of Paris* on May 27, 1903. Regrettably, he didn't publish the technique.

7.3.2.5 Hippolyte Morestin

However, the description of Guinard's operation was issued by **Hippolyte Morestin** (1868–1919) in 1907 [58]. Morestin developed an operation very similar to Guinard's method, describing the same concealed approach to the breast, with a curvilinear incision in the inframammary fold and exposing the lower and posterior surface of the breast after careful undermining. The difference between Guinard's and Morestin's techniques related to volume reduction: progressive and discoid-shaped by Morestin; in the form of truncated cone by Guinard. At the completion of the excision, Morestin reconstructed the breast with deep catgut sutures and fixed it to the pectoral fascia. The skin incision was closed by interrupted sutures. For details regarding Morestin's life and contributions, see Sect. 6.2.1.1.

7.3.2.6 Theodore Gaillard Thomas

A great breakthrough in breast surgery was the type of curvilinear incision carried out in the inframammary sulcus in both of the abovementioned cases. Priority for the aesthetically innovative approach should be given to the US obstetrician and gynecologist **Theodore Gaillard Thomas** (1831–1903) who used the inframammary incision for the removal of a benign breast tumor, thus avoiding an unpleasant, noticeable scar in the middle of the breast. He read his paper before the members of the *New York Obstetrical Society* on February 21, 1882, and published it in the official journal of the society [59].

7.3.3 Nipple Management: Free Grafting Vs. Transposition

Lalardrie and **Jouglard** considered the transposition of the nipple with concurrent volume reduction a capital moment in the history of breast surgery [60]. The methods devised were numerous, always aiming at achieving better aesthetic results, acceptable scars, safety, and reliability in avoiding nipple and skin necrosis, and in maintaining the lactation function.

7.3.3.1 Free Nipple Grafting

Erich Lexer

In 1912, **Erich Lexer** (1867–1937) presented a free nipple grafting for managing severe gigantomastia before the *German Medical Society* in Jena [61] This is his description: "I operated on a young girl with great hypertrophy of her breasts to the extreme that the inferior border of both breasts went almost down to the umbilicus and each of them had the size of the head of a man. Naturally, in this case it was possible to achieve a reduction of the outstanding volume of the breasts by means of a large excision of the glandular tissues. The excision was made following the same procedure that I will explain later on, with the difference that no attention was given to the galactophorous ducts, which were sectioned and separated from the nipple and areola when their transplantation was made. The aesthetic result was good."

Max Thorek

Indeed, this was a preceding step to **Max Thorek's** (1880–1960) breast amputation with free nipple-areola complex (NAC) transplantation, still the treatment of choice for gigantomasty, described 9 years later, in 1921, and presented before the *Chicago Medical Society* [62]. Despite Thorex's insistence regarding the priority of the procedure, which clearly belongs to Lexer, Thorek is credited for having popularized the method, which is now named after him.

Max Thorek was a relevant figure in the first half of the twentieth century in US surgery. Born in Hungary in 1880, Thorek did his undergraduate studies in Budapest. When the family migrated to Chicago, he began his medical studies in Chicago from where he graduated in 1904. Initially, he practiced as a physician and later as a surgeon. He founded the American Hospital in Chicago, serving as chief surgeon until his death in 1960. He dedicated himself to breast and abdominal surgery and published innovative techniques.

7.3.3.2 Nipple Transposition

Erich Lexer

According to **Ulrich Hinderer** [63], **Erich Lexer** (1867–1937) was the first to perform breast reduction with an "open" NAC transposition, preserving not only the continuity of the skin to the remaining gland, but also the galactophorous ducts. The operation was carried out on an 18-year-old girl in the following way: "The skin and the subcutaneous cellular tissue were removed, respecting the nipple and areola" (Fig. 7.27 left). "The extremes of the lateral incisions ended at the inferior fold of the breast and the ends were joined at this level by a curved incision" (Fig. 7.27 center). "Then the whole breast was isolated from the pectoral aponeurosis, and the nipple, displaced upward could reach the superior arch of the wound. Once the breast was in this position the inferior third of the gland was removed, respecting the galactophorous ducts from both sides. The areola was attached with interrupted sutures to the central superior arch of the skin incision, the two lateral halves of the breast wound were also approximated together so that it was not necessary to suture the breast to the aponeurosis in the inferior part. The redundant skin was removed. To finish, it was only necessary to unite the skin borders" [64] (Fig. 7.27 right).

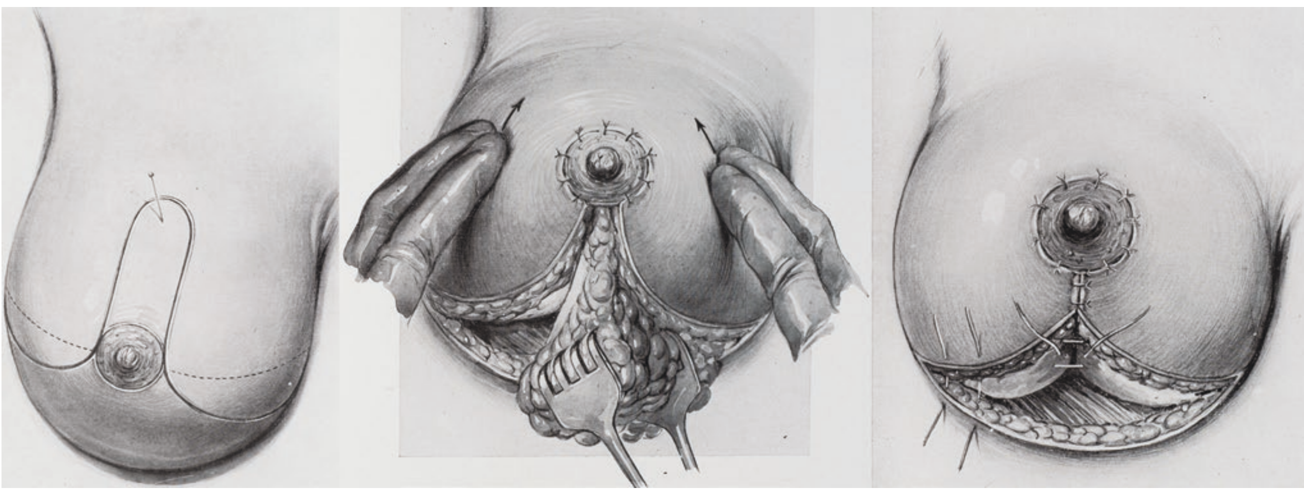


Fig. 7.27 Correction of breast hypertrophy with nipple areola complex (NAC) transposition performed by E. Lexer (1867–1937) in 1921. First open NAC transposition in the medical literature. *Left*: skin incision; *center*: NAC transposition and concurrent breast tissue excision; *right*: final breast reconstruction by approximation of the margins of the resected gland. (From: Lexer E. *Die gesamte Wiederherstellungschirurgie*. Vol. 2. Leipzig, A. Barth, 1931)

V. Aubert

It is generally assumed that the first reduction mammoplasty with nipple transposition was performed by **V. Aubert** from Marseille who, in 1923, presented his *buttonhole technique* at the *Surgical Society of Marseille*. It consisted of making a circular incision around the nipple and transferring it upward into an opening on the upper pole of the newly reconstructed breast at a pre-defined location, and fixing it to the surrounding tissues with interrupted sutures. Cuneiform resection of glandular tissue to the desired amount followed [65]. Despite Aubert claiming priority for the nipple transposition procedure, Lexer preceded Aubert by 2 years, describing his above-reported method in 1921.

Following Lexer's and Aubert's publications, a series of papers appeared, reporting different techniques, modifications, and refinements for breast reduction with nipple transposition, accurately summarized by **Irène Bernard** in her thesis on breast surgery [66].

H. Kraske

In 1923, **H. Kraske**, one of Lexer's co-workers, published the same operation devised by his chief in a more visible journal [67]. The Lexer-Kraske procedure of uniting the breast with interrupted catgut sutures below the upward displaced nipple gave a very satisfying form to the reconstructed breast. Before suturing the skin, the gland was firmly fixed to the pectoralis fascia, to avoid its downward sagging. The final result was an inverted T scar, which extended from the areola to the inframammary fold (Fig. 7.27). The method became very popular and could be considered a forerunner of the most important mammoplasty techniques of the modern period, such as **Penn** [68], **Arie** [69], **Strombeck** [70], **Pitanguy** [71], and others. It was resurrected by **J. A. Tamerin** in 1963 [72].

Raymond Passot

Raymond Passot (1886–1933) from Paris, a co-worker of **Hippolyte Morestin**, and *Interne des Hopitaux*, one of the best known Parisian aesthetic surgeons, added innovative techniques for breast ptosis, abdomen, and facial rejuvenation. In contrast to reparative surgery, he introduced the term *Chirurgie esthétique pure* (Pure Aesthetic Surgery), and published a well-illustrated textbook entirely devoted to this topic, with numerous drawings and pre- and post-operative views of patients [73] (see Fig. 7.50). His technique for correction of breast hypertrophy and ptosis, published in 1925, started with a circular incision made around the nipple and another, curved, horizontally placed, to meet the submammary fold at completion of the breast modeling (Fig. 7.28 *left*). The skin between the horizontal incision and the submammary fold was resected. The new areola position was established in sitting position. Following extensive undermining, the areola was grasped, with appropriate forceps, elevated, transposed in the new site, and sutured. The excess breast tissue was removed from the lower pole (Fig. 7.28 *center*). The submammary fold incision was finally sutured [74] (Fig. 7.28 *right*).

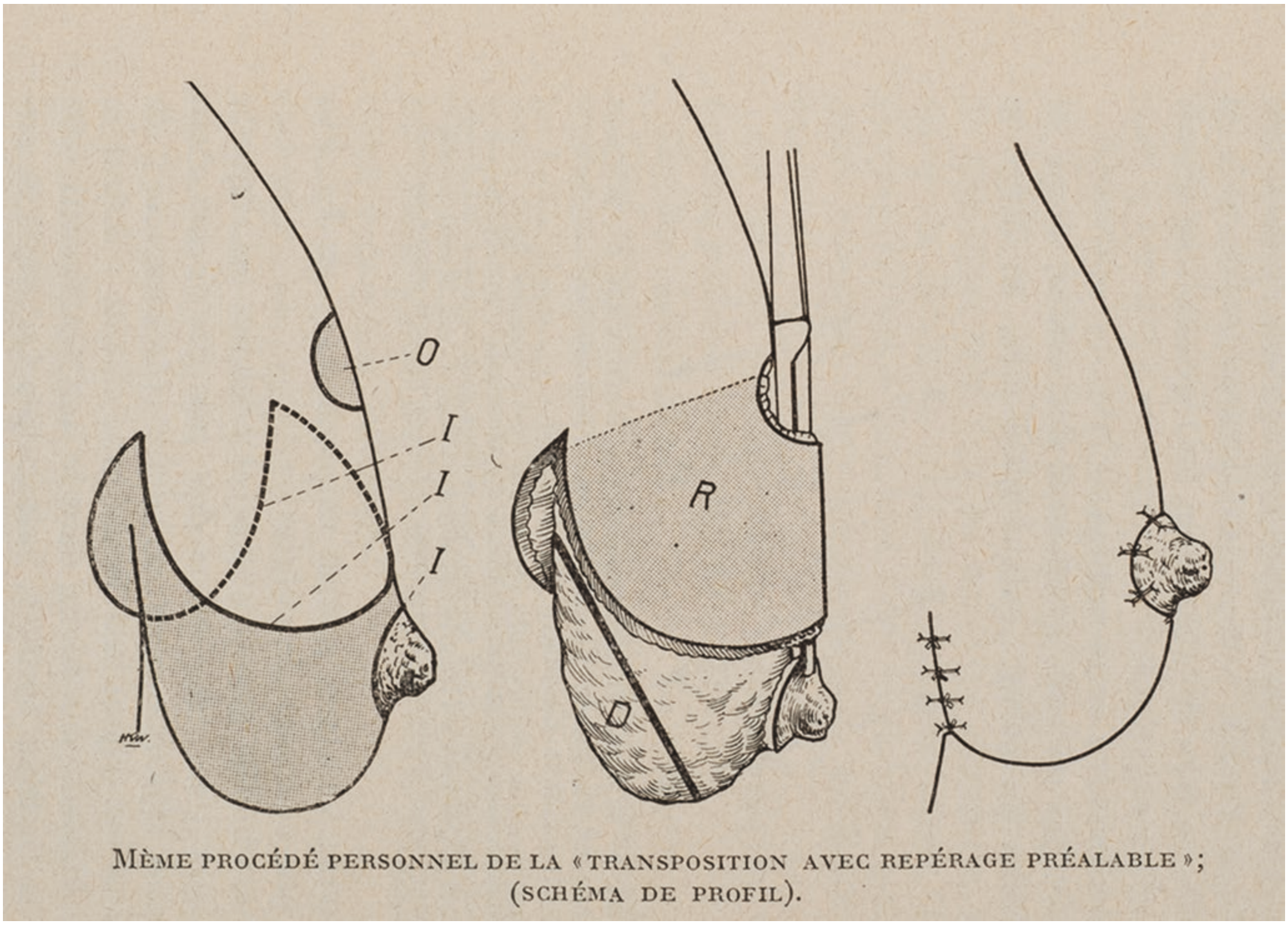


Fig. 7.28 Operation for correction of breast hypertrophy and ptosis with nipple transposition according to Raymond Passot (1886–1933). *Left*: skin incision; *center*: NAC transposition and concurrent lower pole breast tissue excision; *right*: final breast suture. (From: Passot R. *Chirurgie esthétique pure. Technique et Résultats*. Paris, G. Doin, 1931)

Louis Dartigues

In 1925, **Louis Dartigues** (1869–1940), one of the founders of the *Société Scientifique Française de Chirurgie Réparatrice, Plastique et Esthétique* (SSFCRPE), the first European plastic surgery society, established in 1930 (see Sect. 6.3.2), described a lunate skin incision in the lower quadrant, excising fat and glandular tissue from below the nipple to reduce volume. He transposed the areola subcutaneously in an upward position using a method similar to that of Passot [75] (Fig. 7.29).

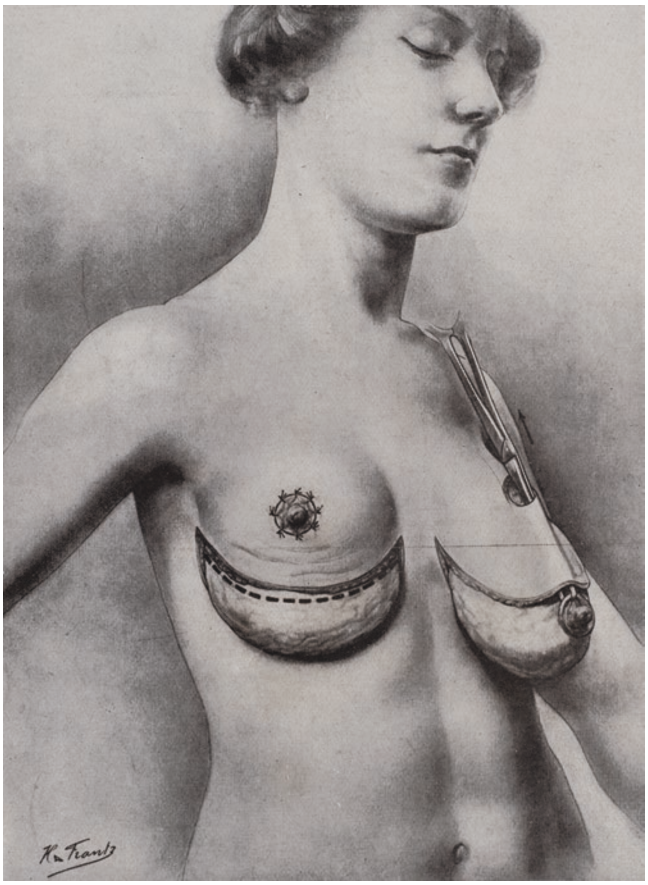


Fig. 7.29 Operation for correction of moderate breast hypertrophy and ptosis with nipple transposition according to Louis Dartigues (1869–1940). (From: Dartigues L. *Chirurgie Réparatrice, plastique et esthétique de la Poitrine, et de l'Abdomen*. Paris, R. Lépine, 1936)

F. Lötsch

A method very similar to the one by Lexer-Kraske was reported by **F. Lötsch** in 1928 [76]. Lötsch affirmed that his procedure was conceived independently from Lexer.

Surgeons were often confronted with one of the most unpleasant complications after correction of breast hypertrophy with nipple transposition, that is, total or partial nipple necrosis apparently without solution.

Jacques Joseph

To reduce the risk of NAC necrosis, **Jacques Joseph** (1865–1934) proposed a two-stage method for mammoplasty in 1925, with an inferiorly based cutaneous-glandular flap bearing the areola [77].

Hermann Biesenberger

In an attempt to avoid necrosis of the nipple and areola and to obtain a satisfying result, particularly in cases of severe breast hypertrophy, **Hermann Biesenberger** (1885–1947) from Vienna, published his own method in 1928. The technique he proposed was very courageous for the period: massive glandular resection, nipple transposition, and skin remodeling in one stage. The gland, undermined from the skin covering, was resected in the external half of the breast through an S-shaped incision (Fig. 7.30 *left*). The reconstruction of the mammary cone was by torsion of the remaining breast parenchyma and its suture with catgut to the gland itself (Fig. 7.30 *center*). To avoid downward displacement, the gland was secured to the pectoralis fascia. Removal of the redundant skin was achieved with a vertical and horizontal incision. Finally, the areola was sutured in the desired position [78] (Fig. 7.30 *right*). Variously improved over the years, the technique became one of the most popular for breast hypertrophy correction and was published in Biesenberger's classic textbook *Deformitäten und kosmetische Operationen der weiblichen Brust* (Deformities and Cosmetic Operations of the Female Breast), issued in 1931 [79].

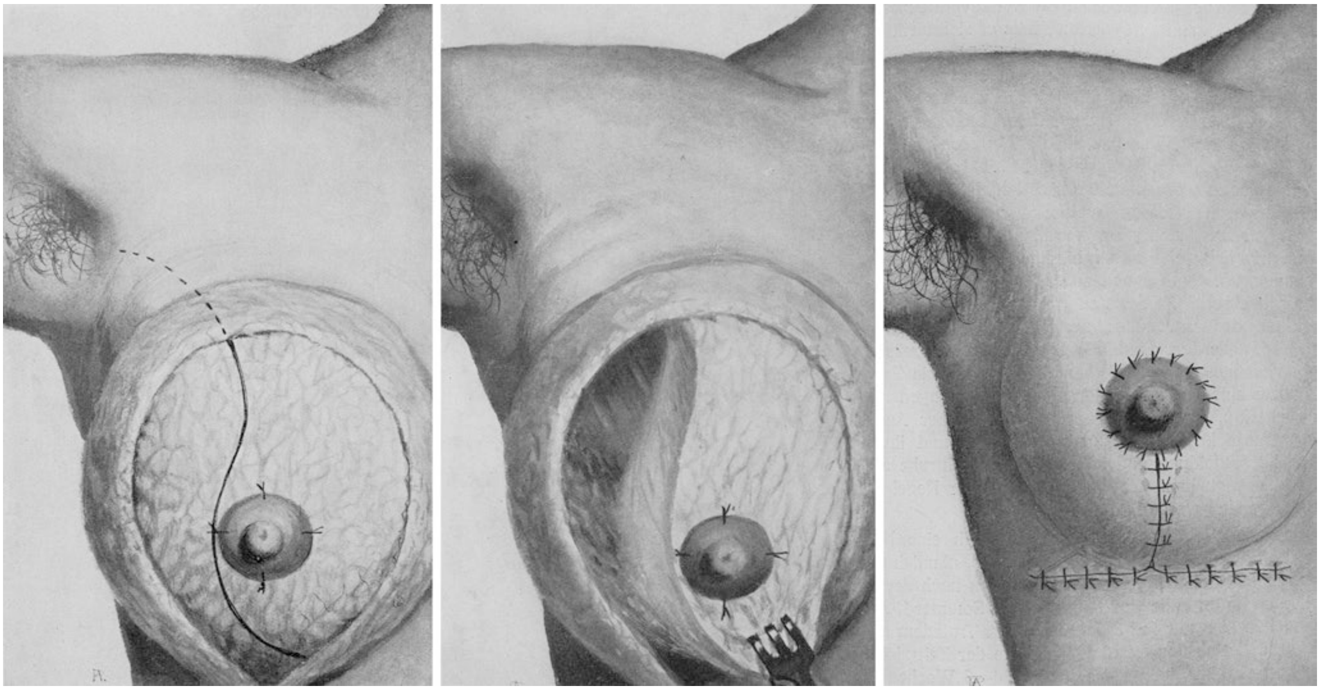


Fig. 7.30 Operation for correction of breast hypertrophy and ptosis with nipple transposition according to Hermann Biesenberger (1886–1933). *Left*: resection of the external half of the breast; *center*: reconstruction of the mammary cone by torsion of the breast parenchyma; *right*: final inverted T suture. (From: Biesenberger H. *Deformitäten und kosmetische Operationen der weiblichen Brust*. Wien, W. Maudrich, 1931)

Emil Schwarzmann

However, the method proposed by Biesenberger did not solve the problem of potential areola necrosis. The solution came from the anatomical studies of **Emil Schwarzmann** (1885–1966) who demonstrated that the areola has cutaneous vascularization and to avoid the risk of necrosis, a large area of dermis should be maintained around it. The technique is named as periareolar de-epithelialization. Schwarzmann first recognized the importance of the subdermal bridge around the areola and its role in preserving venous return. For this, he performed a very fine supero-medial superficial de-epithelialization of the cutaneous-glandular flap, thus increasing the vascularization to the NAC. With this artifice published in 1930, the risk of NAC necrosis, not an uncommon complication in mammoplasty, diminished dramatically. "A curved incision is made along the inframammary fold down to the fascia and over the pigmented zone of the areola. Another incision is made upward in a convex arch, without forming an angle. The cutis should not be transected. Although, as Lötsch demonstrated, there should be no doubt about the blood supply of the areola from the gland, I find it mandatory as a safeguard to preserve a medial pedicled bridge of cutis to avoid necrosis of the areola" (Fig. 7.31). "The medial cutaneous bridge is de-epithelialized, but all the superficial veins should remain intact and unsevered. Small bleeding veins need not be ligated: they are clamped by the assistant. After that, the gland to be resected is detached from the pectoralis fascia, laterally and caudally, but it remains still connected to the breast. After hemostasis here and at the axillary zone, the upper skin flap is prepared with about ½ cm of subcutaneous fat. (…) Before making the incisions for the new areola, one can draw the skin over the resected gland, to be sure that the previous markings are in the correct position. (…) With a previously marked oval excision of a patch of skin, we make a hole into which the areole is to be sutured. The opening should be smaller than the diameter of the areola, so as not to stretch it into the opening" [80].

Born in Turkey, **Schwarzmann** attended medical school in Vienna, from where he graduated in 1910. After WWI, from 1922 to 1938, he occupied different positions in Vienna, the most important being head surgeon at Mariahilfer Hospital. In 1938, he emigrated to the US where he practiced surgery in the outpatient department of Mount Sinai Hospital in New York. He died in 1966, aged 81.

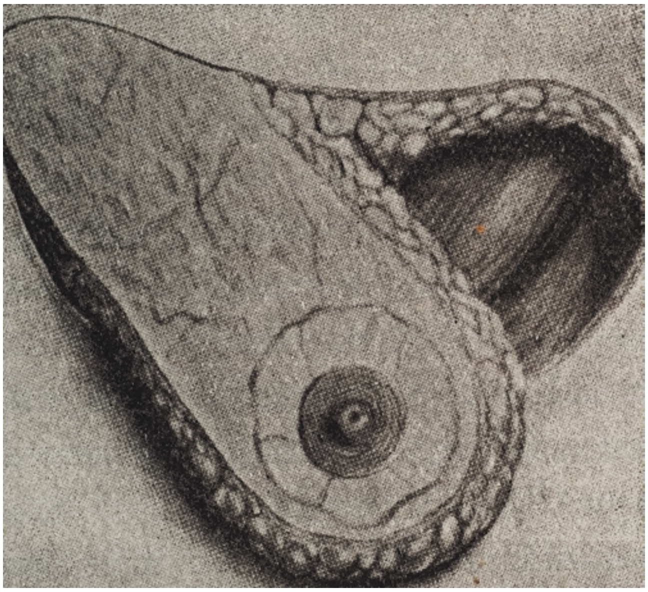


Fig. 7.31 The de-epithelialized supero-medial cutaneous-glandular flap bearing the areola, as described by E. Schwarzmann (1885–1966) in 1930. First example of de-epidermization of the skin around the NAC to avoid areolar necrosis. (From: Schwarzmann E. *Beitrag zur Vermeidung von Mammillen-Nekrose bei einzeitiger Mammaplastik*. *Rev Chir Structive*. 1937; 7: 206–209)

Ernst Eitner

For moderate breast hypertrophy and ptosis, the Austrian surgeon **Ernst Eitner** (1867–1955) advocated a circular incision around the areola (periareolar mammoplasty), followed by undermining of the gland, wedge resection of the upper pole, and reconstruction of the mammary cone, so as to allow elevation of the NAC (Fig. 7.32). This technique has several advantages. It avoids torsion and does not jeopardize the vascularization to the nipple. Only one scar around the areola is created [81]. Almost 60 years after Eitner, in 1990, the French surgeon **Louis Benelli** described a similar operation. To avoid its enlargement, he suggested a continuous cerclage of the areola using a non-resorbable suture, passed as a purse string in the dermis. He named this method the "round-block" [82].

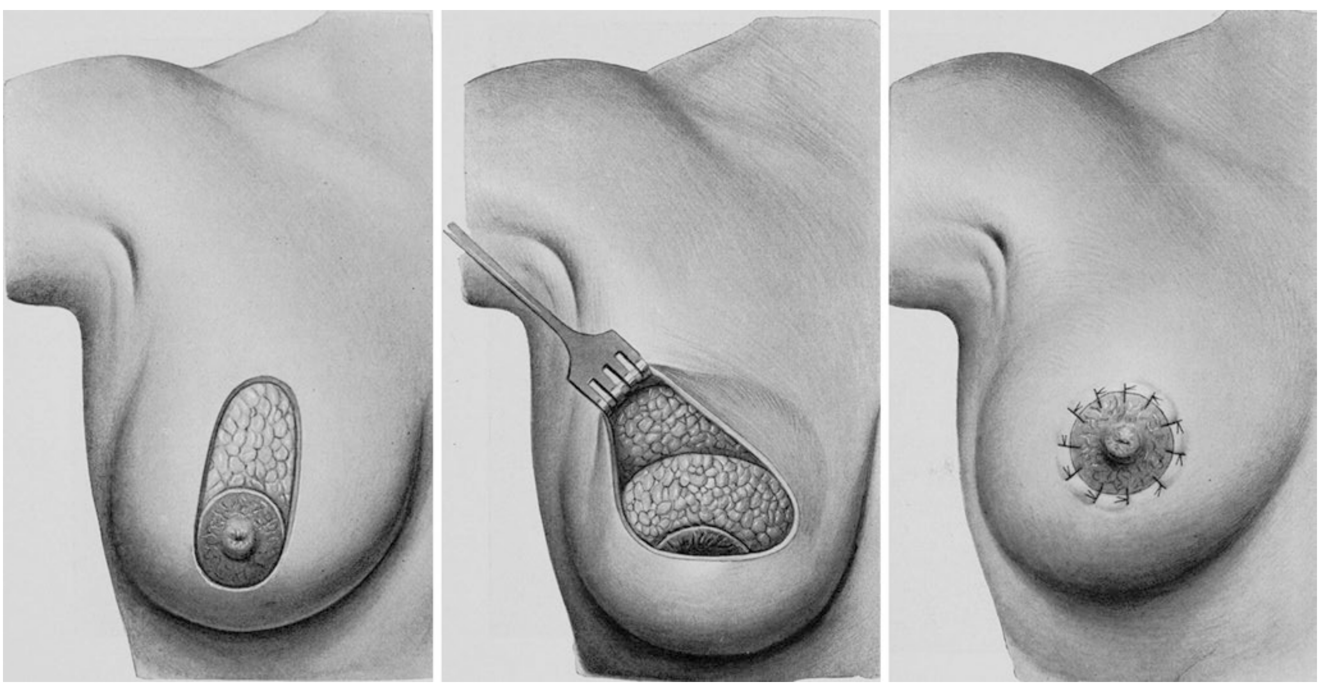


Fig. 7.32 Periareolar mammoplasty according to E. Eitner (1867–1955) *Left*: circular incision around the areola and NAC elevation; *center*: wedge excision of the gland in the upper pole; *right*: final result. First example of mammoplasty with a single scar around the areola. (From: Eitner E. *Kosmetische Operationen*. Wien, J. Springer, 1932)

7.3.4 Augmentation Mammoplasty

In introducing the chapter on the surgical correction of breast atrophy in his successful textbook *Chirurgie esthétique pure* (Pure Aesthetic Surgery), **Raymond Passot** affirmed that: "It is rare to correct breast atrophy; without any doubt, this plastic insufficiency corresponds to the tendency of the majority of modern women to request augmentation mammoplasties" [73]. Until the advent of silicone prostheses in the 1960s, the available procedures for breast augmentation were limited. Fat was considered the ideal tissue for volume replacement, but results were often poor [83].

7.3.4.1 Fat Grafting

Viktor Czerny

In 1895, to re-establish breast symmetry following unilateral partial mastectomy for fibrocystic mastitis, **Viktor Czerny** (1842–1916) had the brilliant idea of transferring a lipoma harvested from the patient's buttocks [84].

Erich Lexer

Erich Lexer (1867–1937) was the first to use and recommend free fat grafts taken from the abdomen or lateral thigh for various volume replacements. In 1919–1924, he published a two-volume textbook, *Die freien Transplantationen* (Free Transplantations), in which besides the different types of free grafts available at that time, he showed the correction of breast asymmetry with adipose tissue. He emphasized that fat transplants heal well, but must be handled with great care and never transferred into infected areas to avoid failures. However, resorption was the major problem related to fat grafting [85].

L. Wrede

L. Wrede reported a case of excision of a large fibroadenoma from the left breast and replacement of the ensuing defect with an adipose flap outlined from the subcutaneous fat layer of the abdominal wall. He presented the operation before the *Society of Natural Sciences* in Jena, Germany on December 9, 1915 [86].

Raymond Passot

Raymond Passot suggested the use of numerous parcels of adipose tissue to fill in either the hypoplastic breast or the depressions, as it was less prone to resorption or necrosis with respect to the transfer of large amounts of fat [73].

7.3.4.2 Fat Injection

Eugene Holländer

To contrast the dramatic complications related to paraffin injections, the German surgeon **Eugene Holländer** (1867–1932) injected fat that he considered a more natural filler [87] (see Sect. 6.1.3.4). The resorption rate, the main drawback of the procedure, was reduced by mixing adipose tissue with a harder type of fat harvested from a ram. The blend of human and ram fat was moderately heated to become fluid, and injected with a syringe into the desired place to improve asymmetries, deformities, or to manage post-mastectomy scars. This fat injection technique to the breast was published in 1912 [87] (*see* Fig. 6.9).

7.3.4.3 Omentum Grafting

Raymond Passot

In thin patients, when adipose tissue was not available, **Raymond Passot** harvested a free graft of omentum, surrounded by fat, and transferred it to the breast. He felt that the results were favorable, despite a slight resorption tendency long term [88].

7.3.4.4 Implants

Emil Schwarzmann

In selected cases, **Emil Schwarzmann** proposed the introduction of glass balls into the breast, as psychological relief [89]. However, for correction of breast atrophy, the easiest solution was to employ paraffin implants.

Robert Gersuny

Advocated by the Austrian **Robert Gersuny** [90], use of paraffin mixed with olive oil was extensively used at the beginning of the twentieth century for the pleasing immediate aesthetic outcomes [49] (see Sect. 7.2.3.6). As a result of the dramatic general and local long-term consequences following paraffin injections, giving rise to blindness from central retinal artery occlusion, pulmonary embolism, cerebral embolism, paraffinomas, and breast deformities, the procedure of mammary augmentation with paraffin was almost completely abandoned in the western world [51]. **F. Koch** reported the dramatic case of a patient who had undergone paraffin injections for breast hypoplasia [91]. She soon developed high fever and severe discoloration of both breasts which became extremely painful to the touch. After a year, a fistula occurred through which paraffin was discharged. At 3 years, the patient complained of pain and swelling in the hands and in the metacarpo-phalangeal joints. Gradually most of the joints of her body became similarly affected. She couldn't open her mouth because of the involvement of the temporo-mandibular joint. The patient was no longer able to work and drifted into a state of psychological deterioration. After 6 years of suffering, both of her breasts were excised and wounds closed by flap transposition.

7.3.4.5 Surgical Treatment

Erna Gläsmer

Erna Gläsmer of Heidelberg, Germany, proposed an original technique based on moving the cutaneous mammary envelope toward the midline with a horseshoe incision, thus transforming a flat breast into a conically shaped form without adding foreign body material. Gläsmer reported that the plication of the cutaneous structures gave a pleasing, satisfactory result [92].

7.3.5 The Beginning of Breast Reconstruction

7.3.5.1 Viktor Czerny

We have learned (Sect. 7.3.4.1) how **Viktor Czerny** (1842–1916) transferred a lipoma harvested from the patient's buttocks for filling the empty space resulting from unilateral partial breast tissue excision for fibrocystic mastitis [84]. This operation, performed in 1895, can be considered the first attempt of a breast reconstruction with the aim of re-establishing breast symmetry [93].

7.3.5.2 L. Wrede

A similar operation was described by the German surgeon, **L. Wrede**, who, on the contrary, transposed an adipose flap from the abdomen to close the cavity resulting from fibroadenoma removal [86] (Sect. 7.3.4.3).

7.3.5.3 Eugene Holländer

Instead of transferring parcels of fat *en bloc* or using flaps of adipose tissue, **Eugene Holländer** (1867–1932) advocated injection of fat with a syringe into the breast to manage post-mastectomy scars and to create a certain bulging after total mastectomy. This is the first report of fat grafting into the breast in the medical literature. Holländer published this technique in 1912 [87] (see sections 6.1.3.4 "Eugene Holländer" in Chap. 6 and 7.3.4.2) (*see* Fig. 6.9).

7.3.5.4 Sir Harold D. Gillies

Probably, the first real breast reconstruction in history, although not after cancer, was performed by **Sir Harold D. Gillies** (1882–1960) in 1943 on a young woman whose pectoral area was completely "burned by X-rays" due to previous treatment of a naevus, affecting the mammary gland, the skin, and subcutaneous tissues. This is Gillies' description: "It was decided to take the circumumbilical skin on an oblique abdominal tube pedicle to replace the excision, the inverted umbilicus to be everted as a nipple (…). One month after this, the lesion was excised and the flap attached to the pectoral area. Three months later the pedicle was divided from the abdomen and used to support the lateral aspect of the breast. Transferred to the breast, after three months, the skin was modeled, and an ox cartilage ring and strut were later inserted to give the nipple projection" [94] (Fig. 7.33).

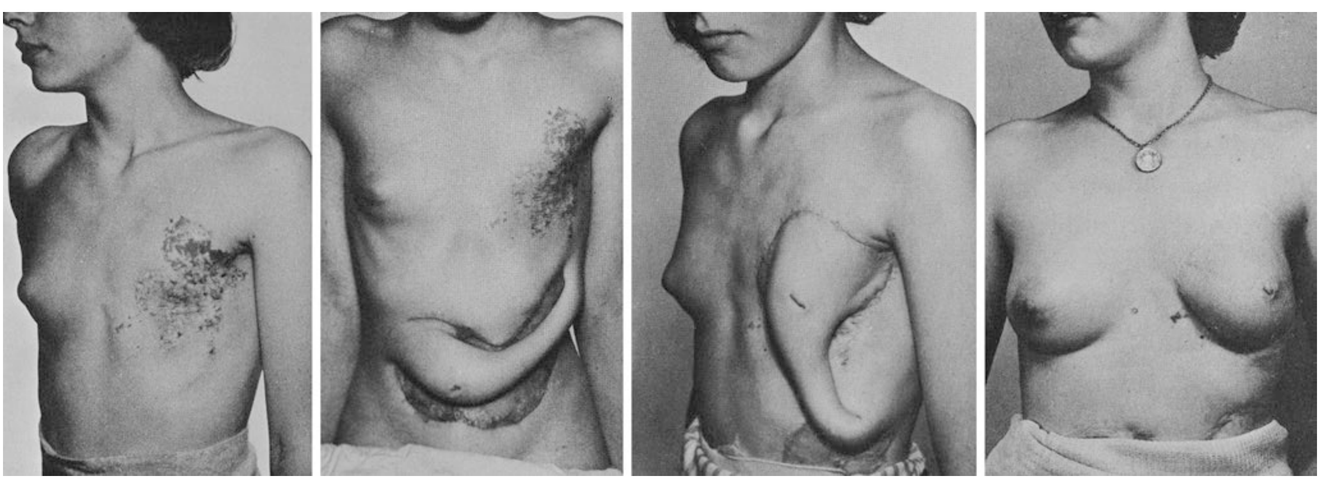


Fig. 7.33 Breast reconstruction with a tubed flap performed by Sir H.D. Gillies (1882–1960) in 1943. Probably the first breast reconstruction in medical literature. *Left*: pre-operative situation; *center left*: the abdominal tube flap where the umbilicus everted acts as a nipple; *center right*: the flap is transferred to the pectoral area; *right*: final result. (From: Gillies HD, Millard RD. *The Principles and Art of Plastic Surgery*. Boston, Toronto, Little Brown and Co., 1957)

7.3.5.5 William Stewart Halsted

Why did breast reconstruction following mastectomy develop so late? The potential explanation was that treatment of breast cancer was dominated by the charismatic figure of **William Stewart Halsted** (1852–1922). He had proposed the *en bloc* resection of skin, areola, mammary gland, pectoralis major and minor, and axillary lymph nodes since 1882 [95]. The ensuing chest wall defect was dramatic. Without the breast, with the loss of the anterior axillary pillar, with a long important often hypertrophic scar on the thorax, and the swelling of the ipsilateral arm, women, suffered devastating psychological trauma. Initially, the thoracic wound was left open for healing by secondary intention. Then Halsted accepted the idea of using thin skin grafts to cover the raw area, principally to reduce some of the most common complications of radical mastectomy: infections, scar contractures, and reduced arm mobility.

With the aim of covering the large thoracic defects resulting from the excision of the breast affected by carcinoma, numerous thoracic-abdominal flaps have been published over the years.

7.3.5.6 Iginio Tansini

We have mentioned the latissimus dorsi flap, a safe, viable solution for repairing the raw area of the thorax, and at the same time the first musculo-cutaneous flap in the literature, described in 1906 by **Iginio Tansini** (1855–1943). Considered too invasive, Tansini's flap fell from favor. It was rediscovered in the 1970s and largely employed for breast reconstruction when this operation was popularized (see Sect. 6.1.1.4) [96] (Fig. 6.5).

7.3.5.7 Louis Ombrédanne

Louis Ombrédanne (1871–1956) dissected the pectoralis minor which was folded on itself to create a certain bulkiness. He then covered the thoracic defect with a long superiorly based cutaneous flap adjacent to the raw area. The final result was apparently pleasing. Interestingly, the reconstruction was done for the first time immediately after a radical mastectomy (Fig. 7.34). Ombrédanne claimed that he successfully operated on two cases and emphasized the importance of breast reconstruction from a psychological point of view [97, 98].

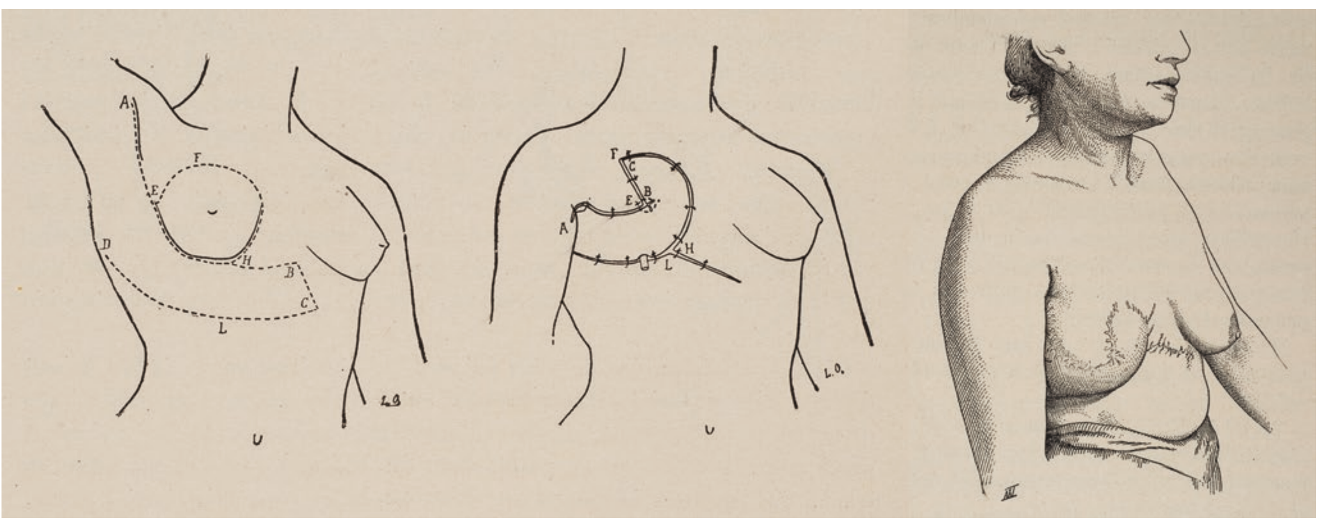


Fig. 7.34 The superiorly based cutaneous flap adjacent to the cover raw area following breast excision for cancer devised by Louis Ombrédanne (1871–1956). *Left*: flap design; *center*: the flap folded into position; *right*: final result. From: Nélaton C, Ombrédanne L. *Les Autoplasties*. Paris, G. Steinheil, 1907. p. 146–147

7.3.5.8 Ernst Ferdinand Sauerbruch

The well-known German surgeon, **Ernst Ferdinand Sauerbruch** (1875–1951), was among the first to cover the raw thoracic area, resulting from mammary excision, using the contralateral breast, a procedure highly condemned nowadays for the risk of spreading the tumor to the opposite breast [99].

7.3.5.9 David Patey

Against Halsted's aggressive treatment, in 1948, **David Patey** introduced the modified radical mastectomy by maintaining the pectoralis major [100]. The ensuing result was more acceptable having a shorter scar on the thorax, and with the preservation of the anterior axillary pillar.

For oncologic reasons Halsted was strongly against any type of reconstruction, convinced, as he was, that scar tissue represented a barrier against the local spread of cancer. Halsted's statements prevented general surgeons from proposing breast reconstruction to patients. This dogma lasted for almost a century. Finally, in the 1980s detailed studies demonstrated that the recurrence rate and prognosis was not affected by reconstructive surgery. This opened a new era for reconstructive surgery.

The multiple operations often needed have been an important drawback until the end of the 1970s when John Bostwick and colleagues finally proved the feasibility of one-stage reconstructions on large series using musculocutaneous flaps (see Sect. 6.1.1.4).

7.4 Abdominoplasty

Abdominal adiposity is often accompanied by umbilical hernia to a greater or lesser extent. Thus, the first dermolipectomies started about the turn of the twentieth century with the dual aim of repairing massive umbilical hernias and concurrent removal of the pendulous abdomen.

The first dermolipectomy to excise an apron of fat and skin from the abdominal wall using a horizontal incision dates from 1890 and was performed in France by **Demars** and **Marx** [101].

In the last hundred years, abdominoplasty has evolved considerably and changed continuously as new techniques have developed. We shall briefly mention the evolution of thoughts until WWII, being aware that the most significant progress in this field came in the 1960s [102, 103].

A number of incisions have been described for this operation over the years, the most common being the horizontal, above, or below the umbilicus, followed by the vertical and mixed incision, the last type being a combination of the horizontal and vertical. However, numerous variations have been reported.

7.4.1 Howard A. Kelly

In 1899, **Howard A. Kelly** (1858–1943) [104], a gynecologist from the Johns Hopkins Hospital in Baltimore, carried out a transverse, elliptical incision, extending across both flanks, incorporating the umbilicus and resecting the abdominal fat and skin, and simultaneously performing a herniorraphy. The defect was closed without undermining, but without umbilical preservation (Fig. 7.35 *left*). Later, in 1910, during abdominal operations, he improved his technique using a more aesthetic procedure. He first recognized the importance of removing the redundancy of skin and fat localized in the lower abdomen, just below the umbilicus, which was preserved [105]. He reported the most satisfactory physical and psychological advantages and claimed priority for this technique.

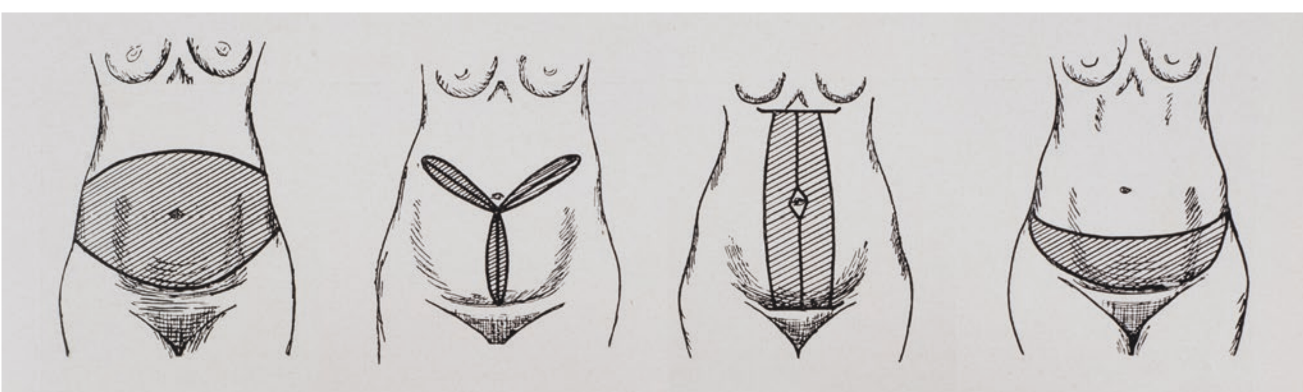


Fig. 7.35 Evolution of the abdominoplasty's incisions over the years. *Left*: horizontal, by H.A. Kelly in 1899, with umbilicus excision; *center left*: cloverleaf, by S. Weinhold in 1909. The umbilicus remains untouched; *center right*: vertical, by H. Küster in 1926. The umbilicus is preserved and relocated along the midline scar; *right*: horizontal, below the umbilicus, by M. Thorek in 1930, with umbilicus preservation. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931. p. 819)

7.4.2 F. Gaudet and H. Morestin

F. Gaudet and **H. Morestin** [106] were the first to preserve the umbilicus to obtain better aesthetic outcomes. They presented a paper to the French Congress of Surgeons in 1905 on horizontal upper abdominal lipectomy combined with umbilical herniorraphy.

7.4.3 S. Weinhold

To improve the contour of the abdominal wall, the German **S. Weinhold** [107] suggested the cloverleaf incision in 1909, a combination vertical and oblique approach. The umbilicus remained untouched in its location (Fig. 7.35 *center left*).

7.4.4 Amédée Morestin

In 1911, **Amédée Morestin**, the younger brother of Hippolyte, reported five cases of abdominal lipectomy through a transverse elliptic approach in his thesis [108].

Babcock, **Schepelmann**, and **Küster** were proponents of the vertical incision.

7.4.5 W. Babcock

In 1916, **W. Babcock** was the first to report the vertical, elliptical resection of the abdominal wall with wide undermining. He also dealt with abdominal wall laxity with a buried silver chain [109].

7.4.6 E. Schepelmann

Two years later, in 1918, the German **E. Schepelmann** modified Babcock's design into an elliptical incision extending from the xiphoid cartilage to the symphysis pubis for the treatment of so-called globular abdomen [110]. This allowed dissection and exposure of anterior sheaths of recti abdominal muscles. The strips of fascia of the recti muscles were united with interrupted catgut sutures and the right anterior sheath of the rectus abdominis muscle displaced to the left side and sutured into position. The subcutaneous fat was approximated with interrupted catgut sutures, and skin closed with silk. To preserve the umbilicus, Schepelmann made a transverse incision around it and pulled the umbilicus through this opening. At the completion of the procedure, before approximation of the skin flaps, the umbilicus finds its location along the midline scar and is sutured to the wound's margins. To avoid potential reopening, he stressed that flaps should never be sutured under tension.

7.4.7 H. Küster

In 1926, the German gynecologist **H. Küster** used an approach similar to Schepelmann's, insisting on the importance of umbilicus isolation, preservation, and its maintenance along the midline. He would say that "an abdomen without a navel is comparable to a face without a nose and that the umbilicus is the resting place of the eye" [111] (Fig. 7.35 *center right*).

7.4.8 Max Thorek

Max Thorek (1880–1960) contributed greatly to the development of the abdominoplasty technique. Initially, he described removal of the umbilicus, if required, within the crescent excision, and its transplantation to its new place at the end of the operation as a composite graft, with great success. He advocated that a good abdominal support garment should be worn by the patient for about 3 months after surgery [62]. Later, in 1930, he proposed a crescentic incision below the umbilicus in a transverse fashion, removing the lower abdominal panniculus, the excess skin and fat down to the fascia layer in a wedge-shaped form, to avoid dead space. He called the technique plastic adipectomy or lipectomy (Fig. 7.35 *right*). In his text *Plastic Surgery of the Breast and Abdominal Wall* [112], issued in 1942, one of the most outstanding contributions to plastic and reconstructive body contour surgery, he strongly advocated the importance of umbilicus preservation for achieving a good aesthetic result.

7.4.9 Ernst Eitner

The Austrian **Ernst Eitner** (1867–1955) proposed a reverse mid-abdominal W-incision with maintenance of the umbilicus [81].

7.5 Brachioplasty

Brachioplasty refers to a procedure which aims at correcting the skin laxity of the arm. The loosening connections between the superficial fascia of the arm and of the axilla are considered responsible for the relaxation. Brachioplasty is usually part of the body contouring treatment program and often associated with abdominoplasty.

7.5.1 Suzanne Noël

Suzanne Noël was one of the first aesthetic surgeons to perform dermolipectomy of the arm. She removed a long ellipse of skin and underlying fat for the correction of flabby tissues of aging or obese women, ensuring that the scar remained hidden in the inner aspect of the arm. In her book, published in 1926, she presented pre- and post-operative photographs of brachioplasty, probably the first in the medical literature, with fine results [113] (Fig. 7.36).

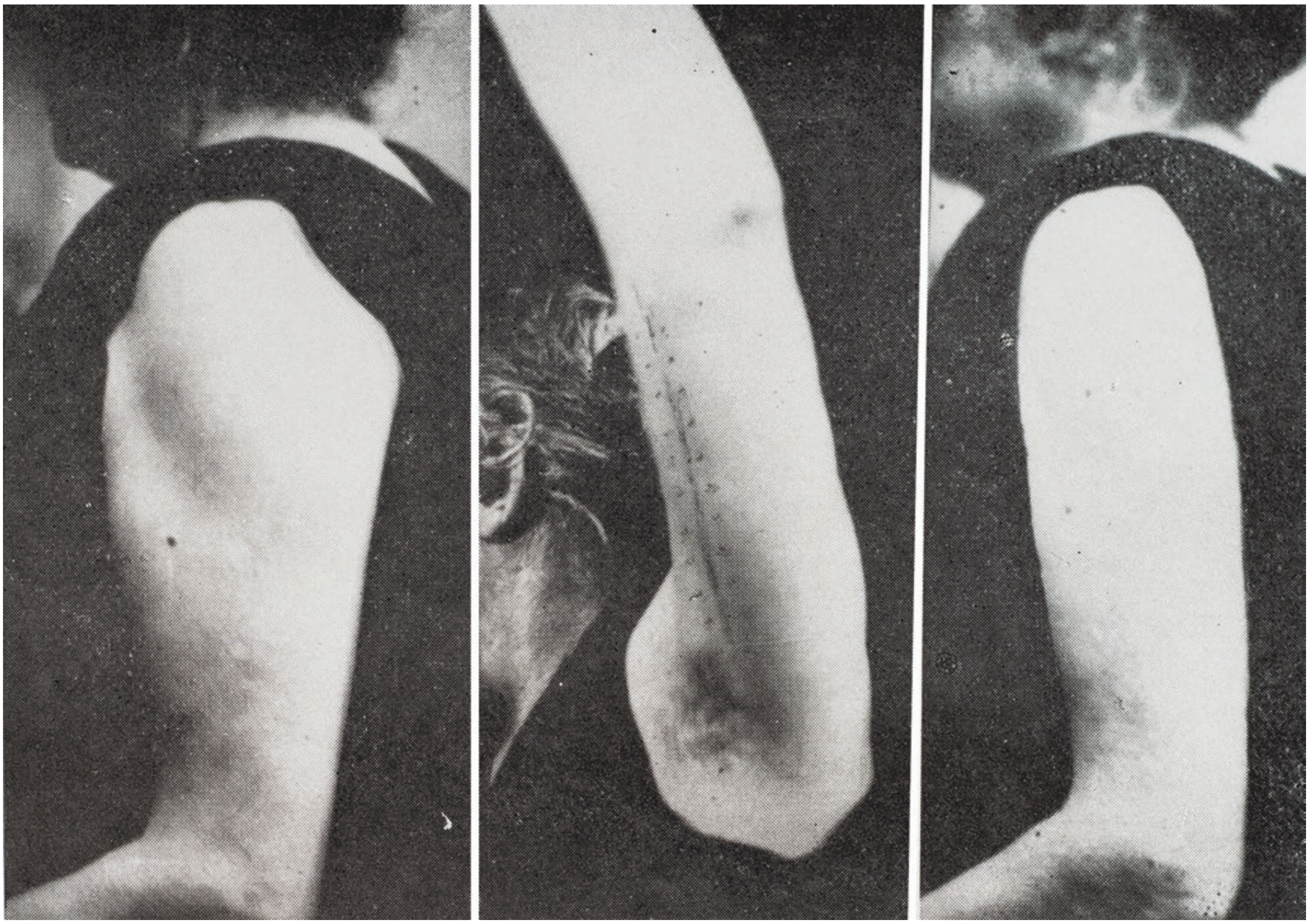


Fig. 7.36 Brachioplasty according to Suzanne Nöel. *Left*: preoperative situation; *center*: the scar hidden in the inner aspect of the arm after removal of an ellipse of skin and underlying fat; *right:* post-operative result. Probably the first photographs of brachioplasty in medical literature. (From: Noël S. *La Chirurgie Esthétique. Son Rôle Sociale.* Paris, Masson, 1926)

Fig. 7.37 Brachioplasty according to Jacques Joseph. *Left*: preoperative situation; *right:* post-operative result from the left side, before the right side procedure. (From: Joseph J. *Nasenplastik*. Leipzig, Curt Kabitzsch, 1931. p. 821)

7.5.2 Max Thorek

In 1930, **Max Thorek** showed a case of brachioplasty in an obese patient simultaneously operated for abdominoplasty [112, 114].

7.5.3 Jacques Joseph

A case of brachioplasty was also published by **Jacques Joseph** in his book *Nasenplastik* [30] (Fig. 7.37).

7.5.4 Raymond Passot

Raymond Passot [73] warns the reader about closure of the ensuing defect under tension, which may cause impairment of venous circulation, a potentially severe complication of the procedure.

7.6 Facial Rejuvenation

Humankind has always been concerned with old age and death, something unavoidable in life. As we get older, we lose our vitality, mental capacity, and beauty. It is no wonder that people seek to invent solutions to prevent or contain aging stigmata.

Does the Fountain of Youth, the mythical source that potentially increases longevity and maintains beauty, really exist somewhere? Regrettably, the Fountain of Youth does not exist, but since time immemorial numerous solutions have been available to help human beings maintain or even improve facial features, the so-called anti-aging techniques that result in facial rejuvenation.

Basically, facial rejuvenation can be obtained with non-invasive, minimally invasive, or invasive procedures. The first group includes cosmetic/medical treatments such as creams and ointments. The second group involves chemical peeling, dermabrasion, and fillers. The third group requires surgery. Technology-dependent options such as radiofrequency and laser, introduced in a relatively recent period, are excluded from the present historical review.

7.6.1 Non-invasive Procedures

7.6.1.1 Use of Cosmetics: A Historical Overview

Cosmetics are as old as vanity itself. Throughout the centuries, much has been written about the use of cosmetic remedies alone or in combination, beginning in ancient Egypt, where facial wrinkles, a consequence of excessive exposure to the sun and not just old age, were managed by applying a wax-based blend containing gum of frankincense, moringa oil, ground Cyprus grass, and fermented plant juice. A youthful look was maintained by honey, red natron, and salt mixed together and rubbed on the face and limbs [115].

During the Renaissance, the Italian physician and humanist **Giovanni Marinello** (*fl.* sixteenth century) published *Gli ornamenti delle Donne, tratti dalle Scritture di una Reina greca* (On Ladies' Embellishments, Drawn from the Writings of a Greek Queen) in 1562 [10, 116]. It was the first textbook in the medical literature entirely devoted to the beauty of women and how to preserve it with creams, ointments, and other remedies. Proposed recipes were a blend of magic and scientific knowledge. He suggested how to take care of the brow, eyebrows, eyelashes, eyelids, nose, ears, and lips and how to improve their beauty. For facial wrinkles, for example, he advocated the use of powder of deer horn mixed with broad beans.

A few years later, in 1585, **Girolamo Mercuriale** (1530–1606), Professor of Practical Medicine at Padua University, wrote *De Decoratione*, an account of cosmetics in which he demonstrated how it was possible to improve the appearance and beauty of the body and to treat different imperfections such as spots, cutaneous horns, and scars [117]. As we have seen (see Sect. 7.1.4), the English physician **John Bulwer** (ca.1606–1656), offered completely the opposite advice. While appreciating the perfection of the woman's face, he was strongly against any sort of cosmetic remedy and modification of the body, unless provided by nature. What he called *the artificial changeling* had to be condemned. His book *Anthropometamorphosis*…, published in 1653, replete with numerous illustrations, was a demonstration of the foolishness of the human mind when it came to the excesses of vanity [13].

7.6.2 Minimally Invasive Procedures

7.6.2.1 Chemical Peeling and Dermabrasion

Resurfacing and restoring skin with chemical peeling was introduced in the second half of the nineteenth century by the Austrian dermatologist **Ferdinand Ritter von Hebra** (1816–1880), founder of the Vienna School of Dermatology. He used exfoliative agents like phenol, croton oil, and nitric acid, in various cautious combinations, to treat freckles and skin irregularities. In 1882, the German dermatologist **Paul Gerson Unna** (1850–1929) reported the advantages of salicylic acid, resorcinol, phenol, and trichloroacetic acid (TCA) [118]. Since then, chemical peeling of the skin surface has been largely employed, obtaining constant results, mainly for sun damaged skin, alone or concurrent with surgery.

Dermabrasion represents another option for skin resurfacing. In 1905, the German dermatologist **Ernst Kromayer** (1862–1933) invented an electrically powered instrument that rotates a burr capable of abrading the superficial skin layers at various depths [119]. Nowadays, with the advent of laser resurfacing, interest for dermabrasion has been partially eclipsed.

7.6.2.2 Fillers

The history of injectables, often disseminated with disastrous and sometimes tragic results, is very instructive.

Paraffin

In 1830, **Baron Carl von Reichenbach** (1788–1869), a notable German chemist and a member of the prestigious Prussian Academy of Sciences, discovered paraffin wax, the first injectable material ever used in modern times (see Sect. 7.2.3.6).

J. Leonard Corning (1855–1923), a New York City neurologist, the pioneer of spinal anesthesia, and the Viennese physician **Robert Gersuny** (1844–1924), began to experiment with paraffin in the late nineteenth century apparently simultaneously and independently [49]. Leonard Corning used paraffin to prevent the reunion of nerves after subcutaneous neurotomy and to enhance the antalgic effect of cocaine on some sensory nerves, whereas Gersuny used it to solve featural imperfections, urinary incontinence, velopharyngeal incompetence, and Romberg disease.

One of the most common indications was correction of saddle nose deformity due to cartilage resorption, a very frequent problem caused by the diffusion of syphilis (see Sect. 7.2.3.5) but also deep nasolabial folds, frown lines, neck wrinkles, and breast augmentation. With a melting point between 46 and 68 °C (115 and 154 °F), and an easily obtainable armamentarium, paraffin could be injected, without incisions, using a syringe either alone or in combination with Vaseline, or Vaseline with olive oil (*see* Fig. 7.22). Apparently the material that resulted was inert [50].

With the popularity of the procedure and the immediate, favorable results obtained, an order of charlatans climbed on to the paraffin success story. Paraffin represented the panacea for a variety of cosmetic and functional applications without the need of a surgical knife. News of this apparently prodigious material began to spread through the medical community. The demand for removing the typical characteristic of saddle nose deformity was great and the immediate outcome extremely favorable [120] (*see* Fig. 7.23).

Complications soon appeared. The new miracle began to fade. Formation of granulomas by foreign body reaction, specifically named “paraffinomas,” due to wax, oil, and Vaseline penetrated within the tissues, was the most common event and was almost impossible to remove (Fig. 7.38). **Frederick S. Kolle** in his book on cosmetic surgery, published in 1911 [121], reported a series of side effects ranging from inflammatory reactions to tissue necrosis, infection, and embolism. Despite these adverse reactions, paraffin continued to be injected mainly into the nose, face, and breast until the 1960s. **Robert Goldwyn**, in his paper on the paraffin story [51], reported the drama of one of the most beautiful women on the planet, a victim of paraffin, the Duchess of Marlborough. In 1935, she had paraffin introduced into her face and forehead, causing an incredible number of bumps and swellings. Completely disfigured, she became a recluse for the rest of her life, seeing only close friends. She died in 1977 completely forgotten.

Fig. 7.38 Dramatic complication following paraffin injection. Diffuse facial granulomas (paraffinomas) with an attempted removal. (From: Loeb HW. *Operative Surgery of the Nose, Throat and Ear*. St. Louis, Mosby, 1914. p. 350)

Other Fillers: Gutta-Percha and Celluloid

Charles C. Miller (1880–1950) of Chicago, one of the first cosmetic surgeons, published *Cannula implants* in 1926, a textbook on fillers to modify featural imperfections [46]. He proposed the use of gutta-percha, celluloid, or rubber sponges, ground in a mill (*see* Fig. 7.21) and heated before injecting them into the recipient site, to correct depressions, crow's feet, naso-labial grooves, and saddle noses. He asserted that these materials were inert, well tolerated, and particularly effective. He used a special syringe with a barrel to introduce them subcutaneously.

Liquid Silicone

James Franklin Hyde (1903–1999), an American chemist, is credited with the creation of the silicone industry in the 1930s. For this he was called the "Father of Silicone." In 1943, he established the Dow Corning Corporation to pioneer the development of silicone products, also for medical use. Pure silicone presented a small risk of adverse reactions, due to low toxicity, and gained widespread recognition and popularity in medical circles.

This new "miraculous" filler was capable of turning old faces into young by erasing wrinkles, improving lips and nasolabial folds, and changing hypoplastic breasts into a C cup without any problem. Use of liquid silicone injections curiously resembles the paraffin affair [120]. Despite the fact that liquid silicone appeared on the market in the 1960s, thus beyond the scope of our book, we consider it an instructive event in the history of aesthetics.

After an initial honeymoon period, dramatic complications such as discoloration, infections, migration, granuloma formation, the so-called "siliconomas" (the equivalent of "paraffinomas"), and hardening of tissues were soon being documented. Eventually, after almost 30 years of disasters, injection of liquid silicone for cosmetic purposes was banned in January 1992 in the USA.

The lesson drawn from the paraffin and silicone stories is that physicians must always be very cautious about complications and side effects before injecting products into the human body.

Fat

To contrast paraffin complications, in 1910 the German surgeon **Eugene Holländer** (1867–1932) [122] and later in 1926, **Charles C. Miller** from Chicago [46] both proposed injection of fat, a more natural filler, according to them. In particular, Holländer injected fat into the face to minimize the consequences of facial atrophy and into the breast to improve post-mastectomy scars (*see* Figs. 6.8 and 6.9). In the beginning, surgeons enthusiastically favored the technique of fat grafting. However, by the 1930s, with growing experience, clinicians realized that the very encouraging early results worsened over the long term due to an unpredictable resorption rate and a tendency to form cysts and for tissue to become fibrotic. This is the reason why use of fat transplantation, particularly for the face, was considered questionable and fell from favor. In the early 1980s, with the advent of liposuction, independently developed by **Yves Gérard Illouz** (1929–2015) and **Pierre Fournier**, fat grafting was rediscovered, and in the 1990s, **Sydney Coleman** systematized the technique which now ranks among the most popular procedures and is regarded as one of great clinical value [123].

7.6.3 Invasive Procedures

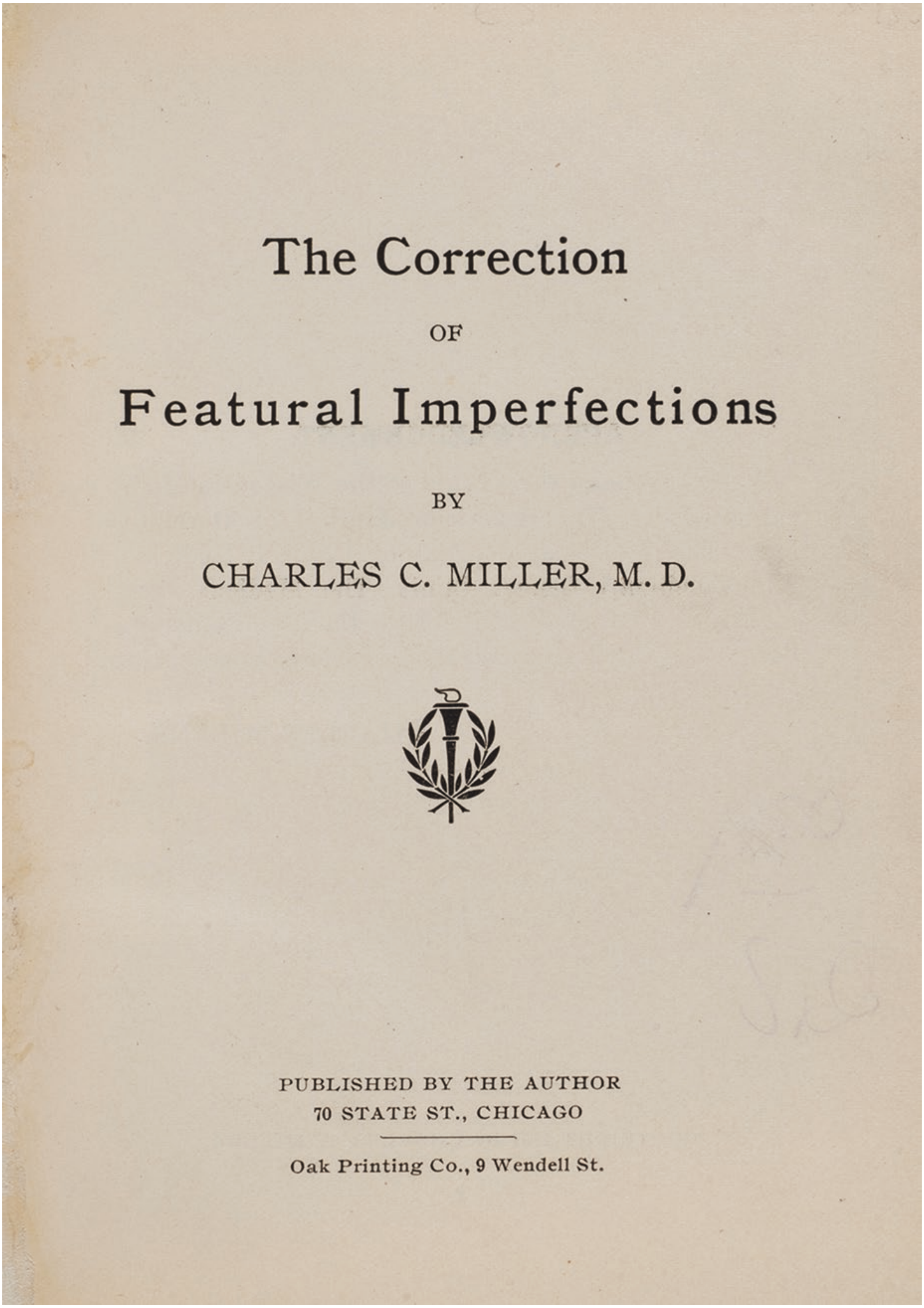
7.6.3.1 Facelifting

Eugene Holländer

Eugene Holländer, a disciple of the famous surgeon **James Israel** (1848–1926) from Berlin, is credited with being the first to report on facelifting. "Victim myself of the art of feminine persuasion, a few years ago, I performed the excision of a piece of skin along the hairline and the natural folds of the aging wrinkles and I rejuvenated the drooping cheek for the satisfaction of the beholder" [122]. In a later publication, he stated that this occurred in 1901 and that the patient was a Polish aristocrat. Before that, the operation was completely unknown. Thus, the date of 1901 should be regarded as the beginning of the facelifting procedure.

Charles C. Miller

In 1907, **Charles C. Miller**, considered the "father of modern cosmetic surgery" by some and "an unabashed quack" by others [120], published *Cosmetic Surgery. The Correction of Featural Imperfections*, the first textbook on aesthetic surgery ever issued (Fig. 7.39), dealing with different procedures for improving aesthetics. No mention of operations for facial rejuvenation was made, apart from the correction of double chin [124]. In the expanded edition, issued 17 years later [125], Miller dedicated an entire chapter to facelifting operations, to improve the forehead, temple, and cheek, with segmental cutaneous excision (Figs. 7.40 and 7.41) illustrated with numerous drawings, many of them totally unrealistic. No pre- and post-operative photos of patients were supplied.



The Correction

OF

Featural Imperfections

BY

CHARLES C. MILLER, M. D.

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Fig. 7.39 Title page of *Cosmetic Surgery. The correction of featural Imperfections* by Charles C. Miller (1880–1950) in 1907, the first textbook on aesthetic surgery ever published

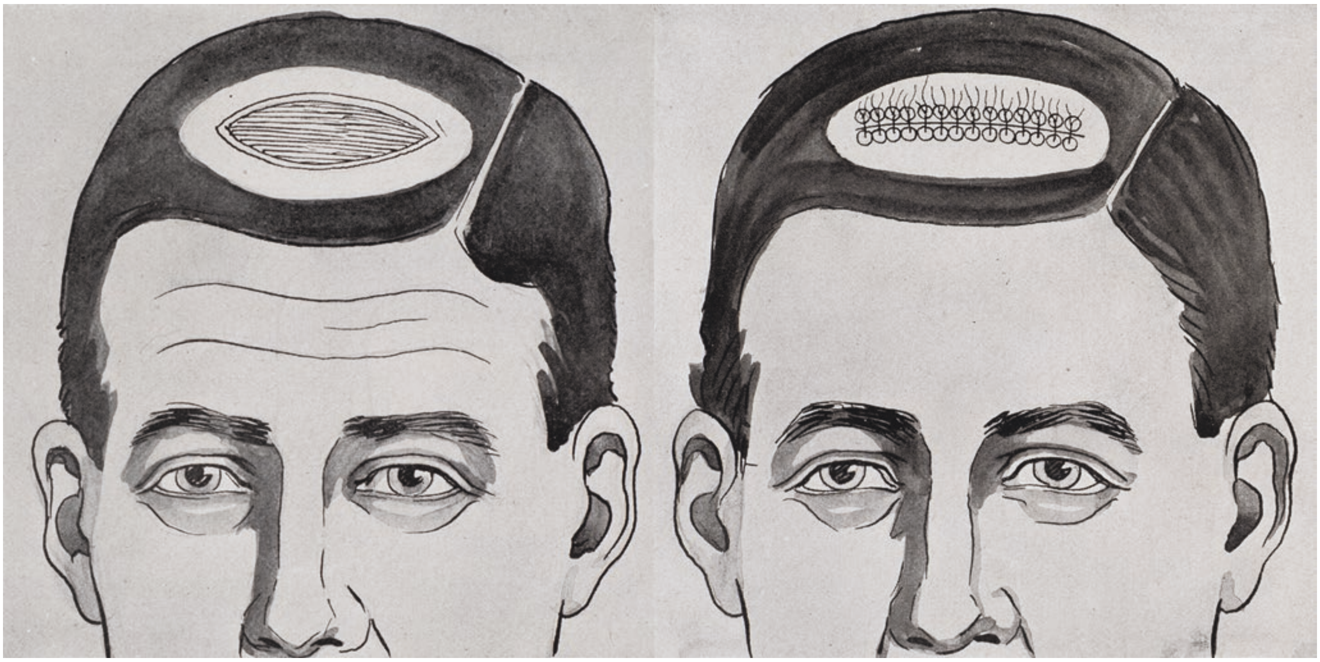


Fig. 7.40 Correction of frown lines with segmental skin excision above the hairline according to C.C. Miller. *Left*: pre-operative situation; *right*: post-operative result. (From: Miller CC. *Cosmetic Surgery. The correction of featural Imperfections*. 2nd ed. Philadelphia**,** FA Davis, 1924)

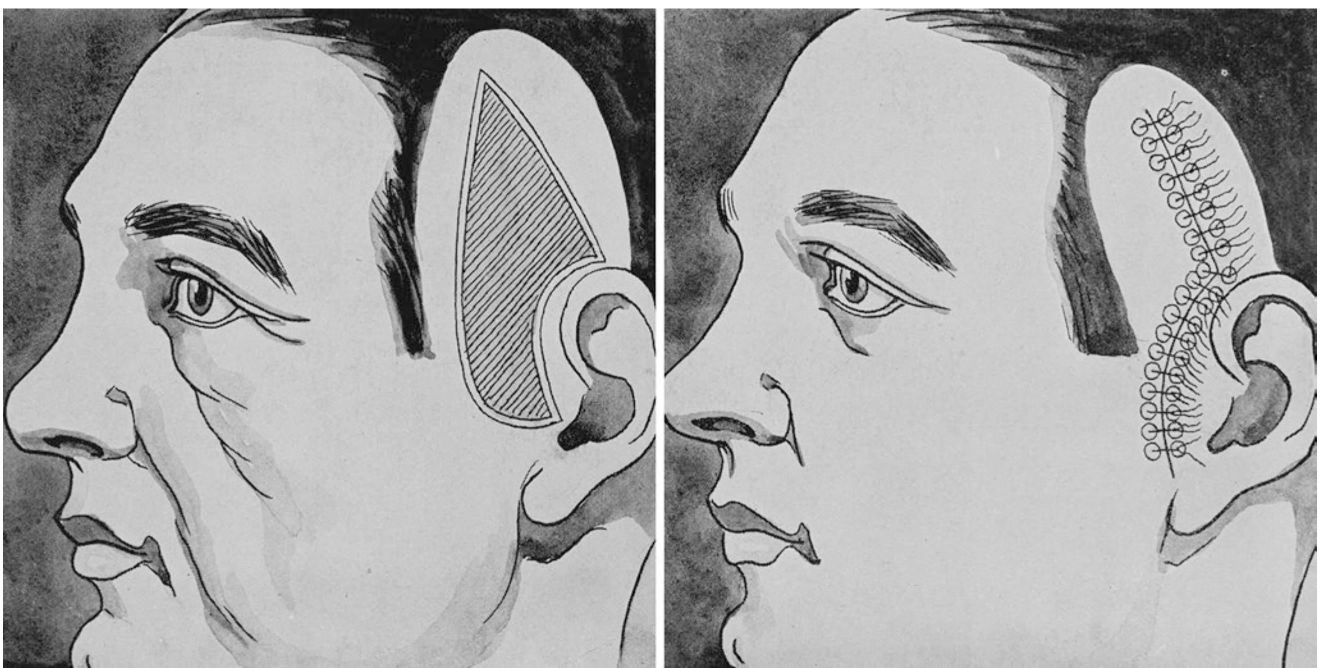


Fig. 7.41 Correction of the facial sagging with an incision in the temporal region, behind the hairline and continuing in front of the auricle, according to C.C. Miller. *Left*: pre-operative situation; *right*: post-operative result. (From: Miller CC. *Cosmetic Surgery. The correction of featural Imperfections*. 2nd ed. Philadelphia**,** FA Davis, 1924)

Frederick S. Kolle

Interestingly, **Frederick S. Kolle** (1872–1929), a German born American, practicing in New York, in his texbook *Plastic and Cosmetic Surgery*, issued in 1911, the second book on aesthetic surgery in terms of priority, does not mention any operation for facial rejuvenation [121].

7.6.3.2 Facial Rejuvenation in the Interwar Period

The interwar period was an exciting moment in which to live, after the dramatic years of WWI. The Great War was now just a memory. The world seemed to face a better period, and started to enjoy peace and quiet [120, 126]. In this favorable environment, cosmetic surgery developed rapidly. Fully trained by the *gueules cassées*, the dramatic and complicated postwar facial reconstructions, surgeons now enthusiastically took on operations of the well, or in other terms, aesthetic procedures.

7.6.4 Development of Facial Rejuvenation Techniques in the USA

In the USA, **Adalbert G. Bettman** (1883–1964), **Lyons H. Hunt** (1882–1954), **J. Howard Crum** (1888–1975), **Henry J. Schireson** (1881–1949), **Maxwell Maltz** (1899–1975), **J. Eastman Sheehan** (1885–1951), and **Jacques W. Maliniak** (1889–1976) represented the full range of practicing plastic surgeons with a particular inclination for facial rejuvenation [120]. All of them played salient roles in shaping the professional and public image of the specialty. A comprehensive review of the development of facial rejuvenation surgery in the USA was issued by **Blair Rogers** in 1976 [14].

7.6.4.1 Adalbert G. Bettman

Adalbert G. Bettman from Portland, Oregon, was an innovative supporter of aesthetic surgery. In 1919, at the annual meeting of the Alumni Association of the University of Oregon's Medical School in Portland, he presented to the attendees the pre- and post-operative photographs of a facelift, probably the first in the medical literature. The following year he published them in a scientific journal where he showed the extensive facelifting incision, very similar to what is done today, starting in the temporal region, continuing in front of the auricle and behind the ear. However, undermining and skin excision were limited [127]. Despite this, Blair Rogers considered Bettman the "father" of the total facelift operation [14].

7.6.4.2 Lyons H. Hunt

Lyons H. Hunt was born in London and trained under Gillies. He migrated to the USA and established himself in New York where he had a successful private practice. He became a Consultant Plastic Surgeon at Lexington Hospital, Professor of Surgery at Fordman University School of Medicine, and was the co-founder of the International College of Surgeons. After 1926, Hunt devoted himself chiefly to treating male impotence by the transplantation of ram and sheep testicles. He died in 1954. Hunt is best remembered for his *Plastic Surgery of the Head, Face and Neck*, published in 1926, accurately written and illustrated, with a wide range of subjects covered, including an important section on cosmetic surgery for facial rejuvenation [128]. Hunt was probably the first surgeon in the USA to understand that not all faces age in the same way, nor do they require the same procedure to restore a youthful appearance. He described the *forehead rhytidectomy* for correction of frown lines, using an incision behind the hairline, extending from one temporal region to the other, nowadays called coronal (Fig. 7.42 *left*). He proposed the *fronto-lateral rhytidectomy* for correction of the tail of the eyebrow and of the vertical lines between brows (Fig. 7.42 *right*). He suggested the *frontal and naso-labial rhytidectomy*, with oblique and vertical vector for the mid- and lower part of the face and naso-labial folds (Fig. 7.43 *left*), whereas for the redundant skin at the angle of the mandible, he removed a large ellipse in the temporal region, making a horizontal incision above the auricle to avoid the displacement of the sideburn (Fig. 7.43 *right*). Finally, for correction of redundant skin in the neck, he advocated the *cervico-rhytidectomy*, with an incision not dissimilar from today's standard procedure for the gobbler neck (Fig. 7.44 *left*). Pre- and post-operative photographs were supplied (Fig. 7.44 *center and right*).

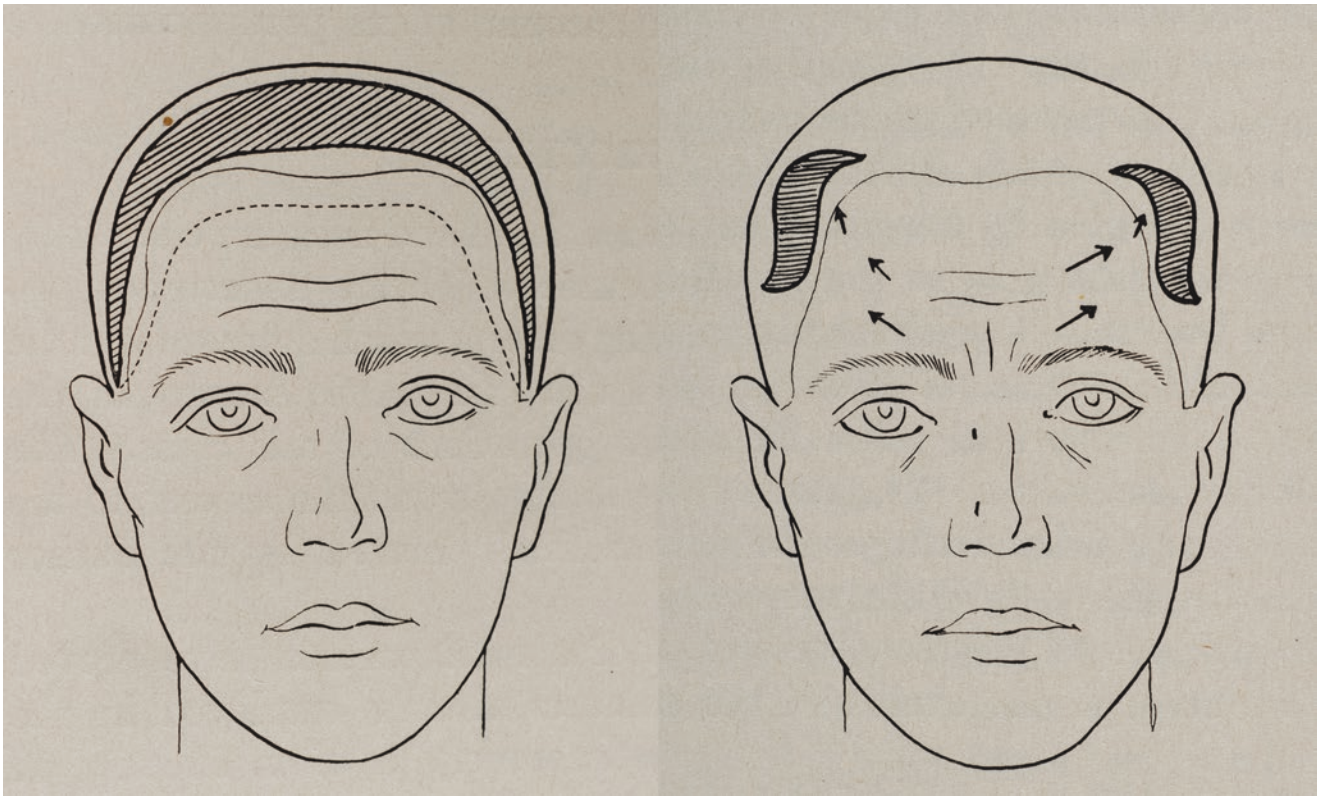


Fig. 7.42 Lyons H. Hunt (1882–1954) management of facial rejuvenation. *Left*: *forehead rhytidectomy* for correction of frown lines, using an incision, behind the hairline, extending from one temporal region to the other; *right*: *fronto-lateral rhytidectomy* for correction of the tail of the eyebrow and of the vertical lines between brows. (From: Hunt HL. *Plastic Surgery of the Head, Face and Neck*. Philadelphia, Lea & Febiger, 1926, p. 163–165)

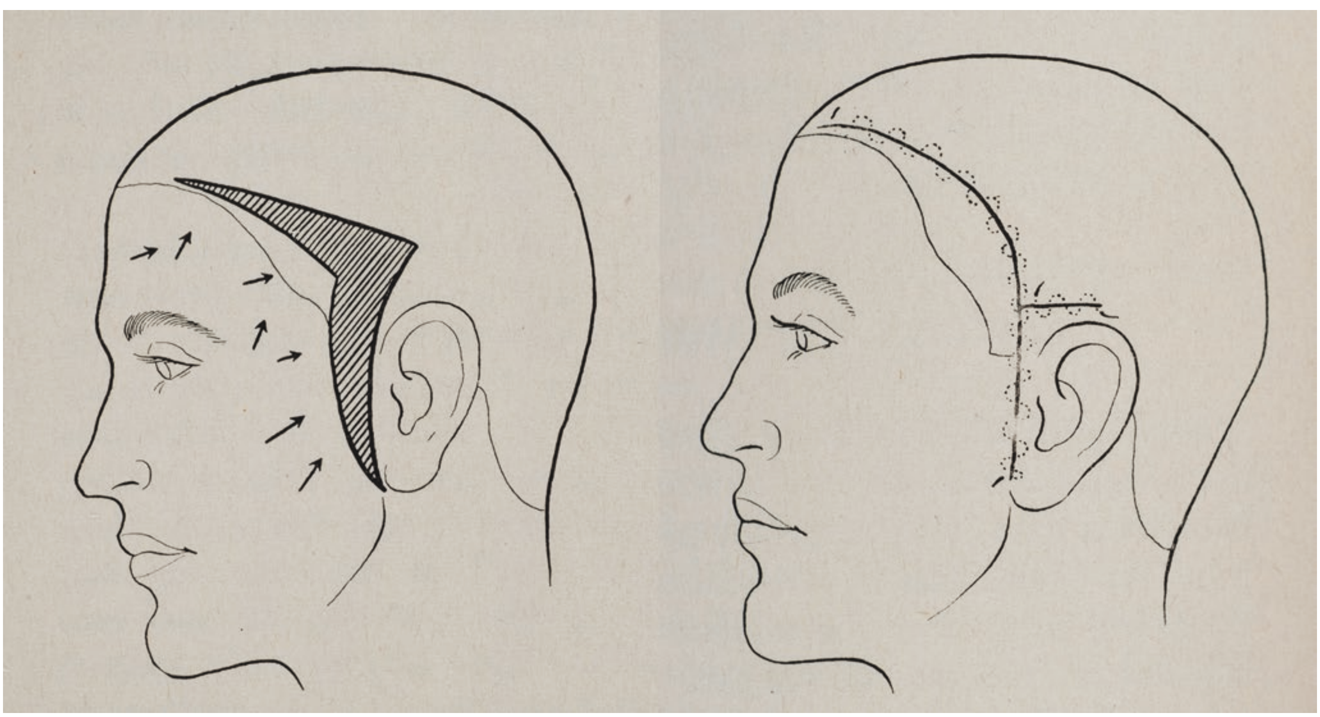


Fig. 7.43 Lyons H. Hunt – management of facial rejuvenation. *Left*: *frontal and naso-labial rhytidectomy*, with oblique and vertical vector, for the treatment of the mid- to lower part of the face and naso-labial folds; *right*: treatment of redundant skin at the angle of the mandible. Note the horizontal incision above the auricle to avoid displacement of the sideburn. (From: Hunt HL. *Plastic Surgery of the Head, Face and Neck*. Philadelphia, Lea & Febiger, 1926, p. 264–265)

Fig. 7.44 Lyons H. Hunt – management of neck lift. *Left*: *cervico-rhytidectomy*, with an incision not dissimilar from the today's standard procedure for the treatment of "gobbler neck"; *center and right*: pre- and post-operative photographs of correction of redundant skin of the neck. (From: Hunt HL. *Plastic Surgery of the Head, Face and Neck*. Philadelphia, Lea & Febiger, 1926, p. 369–371)

7.6.4.3 J. Howard Crum

On a completely different wavelength, **J. Howard Crum's** *The Making of a Beautiful Face; or, Face Lifting Unveiled*, was a very commercial textbook, one of the first of this genre [129]. No technical description of any surgical procedure was supplied, apart from saying that it lasted between 40 and 60 min. No pre- and post-operative photos were shown. Crum defined facelifting as the *most effective facial operation whereby loose, flabby skin is made to disappear from the face and neck as if by magic*. He performed the first facelift on record in the grand ballroom of the Pennsylvania Hotel in New York in 1931, in front of more than 600 women, during which a pianist accompanied him with appropriate popular tunes; flashbulbs popped and men and women fainted [120]. He practiced in New York from 1928 until his death.

7.6.4.4 Henry J. Schireson

Henry J. Schireson, from Chicago, had a moment of fame for having successfully "lifted" the face of an English actress famous for her title as well as for her professional achievements. He then promised to correct the bow legs of a showgirl through an operation in 1927. Regrettably, something went wrong and both legs were amputated above the knee. Schireson's license was revoked. Despite this, he continued to operate, visit patients, and advertise in beauty magazines. In 1938, he published *As Others See You. The Story of Plastic Surgery*, a book which was well received and positively reviewed by the press [130]. In 1944, *Time Magazine* dubbed him the king of quacks [120]. A few years later he issued a well-illustrated and cogent pamphlet: *Your new face is your fortune - What Plastic Surgery can do for you*, in which he tried to demonstrate the importance of facial appearance for establishing a favorable first impression.

7.6.4.5 Joseph Eastman Sheehan

Joseph Eastman Sheehan, originally from Dublin, Ireland, practiced in New York and became Clinical Professor of Surgery at Columbia University (see Sect. 6.2.11.3). Regarded as one of the most renowned aesthetic surgeons in the city, he charged elevated fees: up to $10,000 for an operation [120].

7.6.4.6 Jacques W. Maliniak

Jacques W. Maliniak, founder of the *American Society of Plastic Surgeons* in 1931, was the author of *Sculpture in the Living*, published in 1934 [131]. Despite the commercial setting, the contents included technical details of the procedures shown to improve the breast, nose, and face. Numerous pre- and post-operative photos were included along with schemes of facelifting operations. He stated that: "a successful and lasting facelift requires extensive excision and wide undermining of the skin of the face" (Fig. 7.45 *left*). "The fine scars were concealed in the hair line and behind the ears. He continued by saying that the inadequate "simplified" method used by "beauty specialists" in which small elliptical excisions are made in the hairline, results in a slight stretching of the skin, which at best lasts only a few months" (Fig. 7.45 *right*).

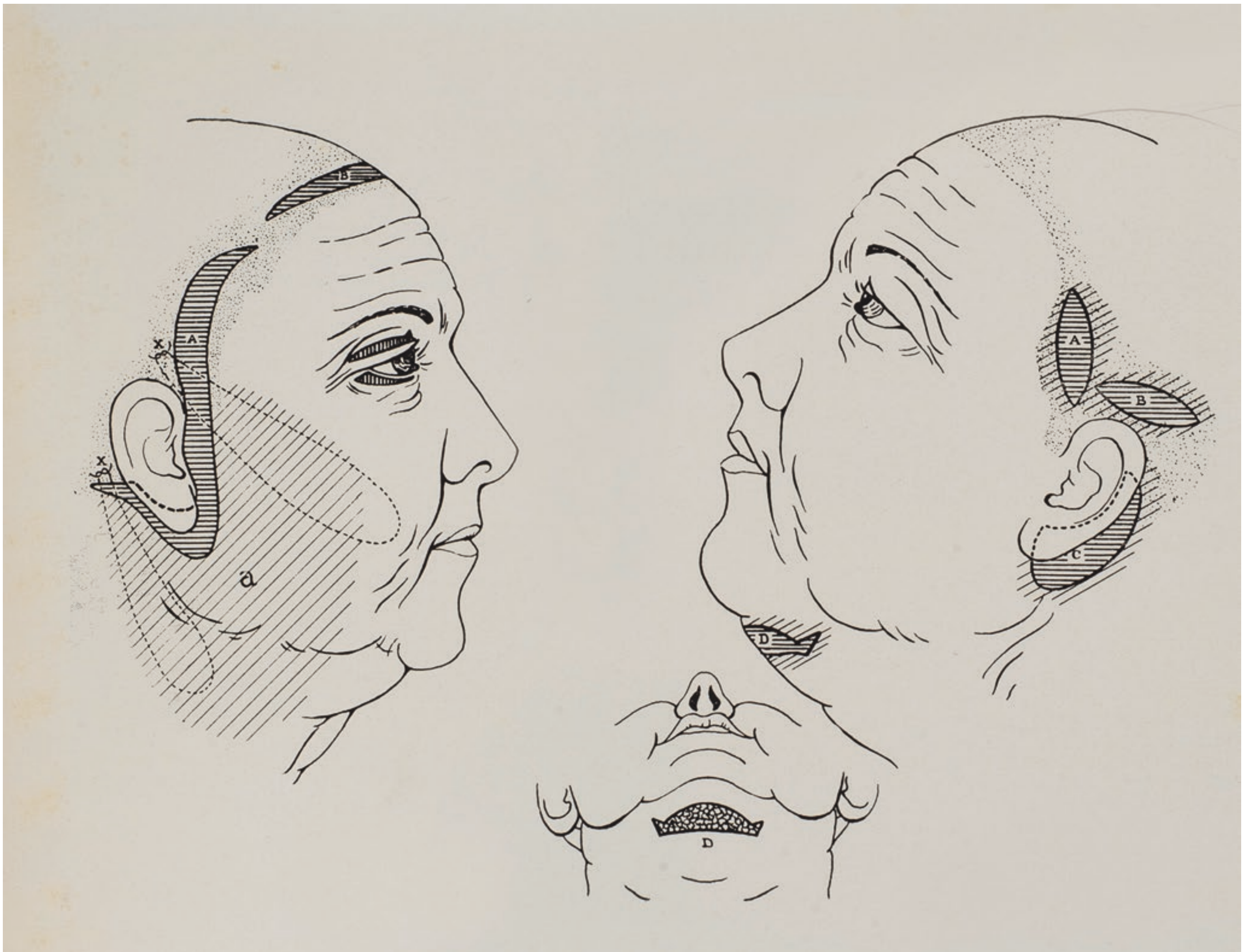


Fig. 7.45 Jacques Maliniak (1889–1976) – management of facial rejuvenation. Comparison of two techniques. *Left*: the extensive incision and the wide undermining of the skin of the face to obtain a successful and long-lasting result; *right*: "simplified" method used by "beauty specialists" with small elliptical incisions which at best could last only a few months. (From: Maliniak JW. *Sculpture in the Living*. New York, R. Pearson, 1934. p. 140–160)

7.6.4.7 Maxwell Maltz

Maxwell Maltz, an excellent surgeon, was a master of publicity and a prolific writer. Apart from four autobiographical works, the first of which was dated 1936, Maltz published at least ten books between 1960 and 1975 on cosmetic surgery [120].

7.6.5 Development of Facelifting Techniques in Europe

On the other side of the ocean, aesthetic surgery developed mainly in Paris, Berlin, Munich, and Vienna.

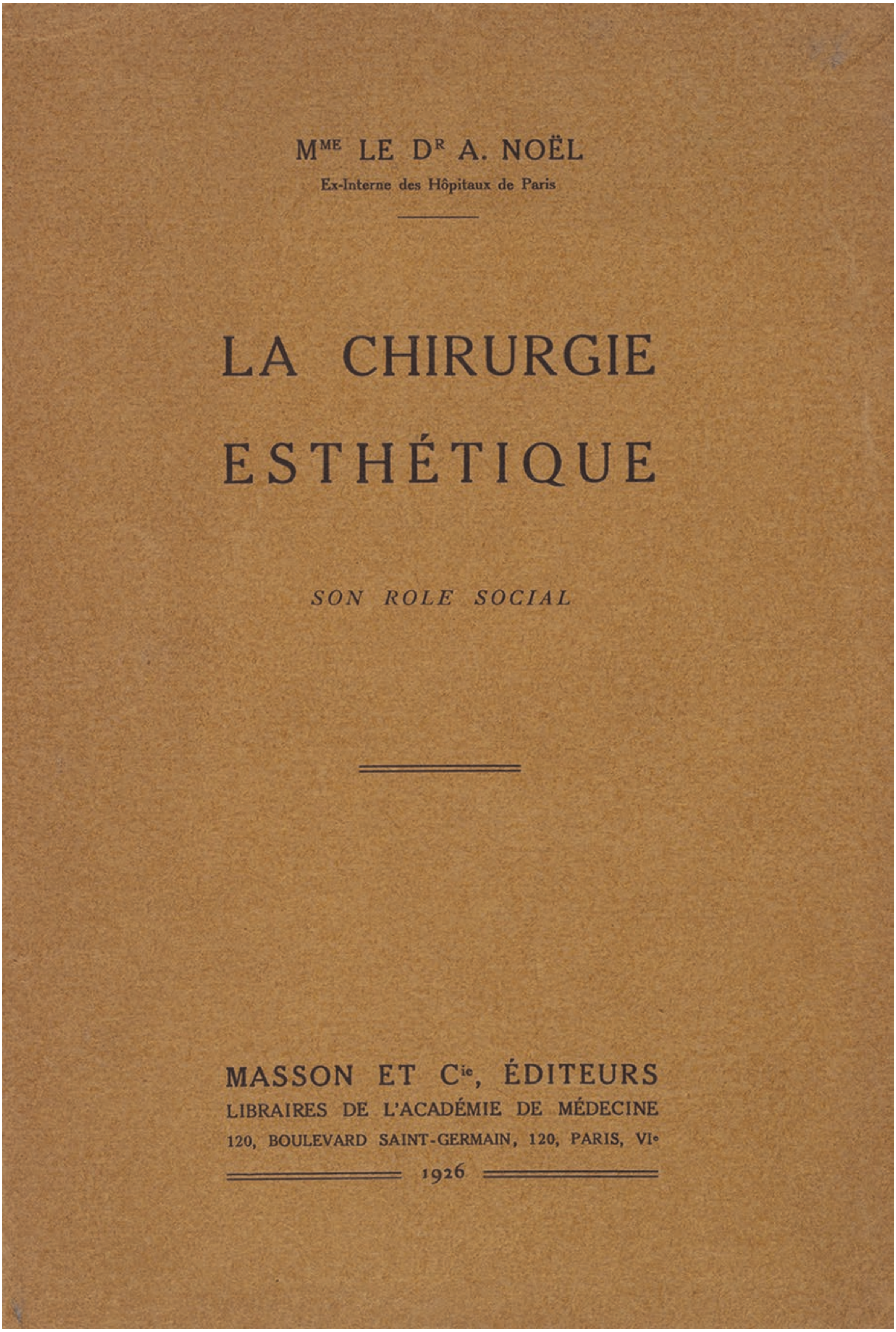
7.6.5.1 France

Numerous well-trained surgeons dedicated themselves to aesthetic surgery with amazing results for the period: **Suzanne Noël, Raymond Passot, Julien Bourguet, and Maurice Virenque** all worked in Paris.

Suzanne Noël

Suzanne Noël (1878–1954) [132, 133] was born in Laon, France, the daughter of a wealthy family. She married a dermatologist with whom she had a daughter and started her medical studies in Paris at the age of 27. She became *Interne des Hôpitaux* when she was 34, working initially at *Hôpital St. Louis* at *Val-de-Grace* military hospital, in the unit of Hippolyte Morestin, treating the facially disfigured soldiers from WWI, the *gueules cassées*. She had a very difficult life. Her husband died in 1919. She married André Noël, another dermatologist. Soon after, her only daughter died suddenly of Spanish flu, and André Noël committed suicide. Alone, but with great courage and perseverance, she quit the hospital and, at the age of 47, opened an office in the exclusive 16th arrondissement in Paris where she practiced cosmetic surgery. Her address in Rue Marbeuf, close to the Hotel George V, was visited by women wishing to improve their external appearance. Noël's operations were simple but effective, mainly related to facial rejuvenation, and mostly performed on an outpatient basis. Major procedures such as abdominoplasty or reduction mammoplasty were carried out in a private clinic. In 1926, she published *La Chirurgie Esthétique. Son rôle social* [113] (Fig. 7.46), one of the first textbooks on this topic and the first written by a woman, in which she emphasized the social importance of cosmetic surgery and the amazing results obtained by this discipline. *La chirurgie esthétique m'apparut comme un véritable bienfait social permettant aussi bien aux hommes qu'aux femmes de prolonger leurs possibilités de travail d'une manière inespérée* (Aesthetic surgery appeared to me as a true social benefit, allowing men as well as women to extend their working possibilities in an unexpected way). The book provided details of the surgical techniques used for facelifting and blepharoplasty; the instruments necessary for the operations; the pre-operative measurements (Fig. 7.47 *upper right*); the elliptical templates necessary to establish the skin resections in the forehead, temple, and pre- and retro-auricular regions; the different segmentary incisions (Fig. 7.47 *left*); the facial undermining (Fig. 7.47 *lower right*); the different types of sutures; the post-operative care; and the results obtained (Fig. 7.48). Numerous pre- and post-operative photos, taken by Noël personally, illustrate the work. To demonstrate how simple and painless her operations were, she showed a lady who had just undergone a facelift procedure combing her hair (Fig. 7.49 *upper*) and drinking a cup of coffee (Fig. 7.49 *lower*) before going home.

She was an active feminist, a suffragette, a supporter of women's right to vote: *je veux voter* (I want to vote). She was the founder of the Soroptimist Club of Europe, expanding this organization internationally. In 1928, she was awarded the Legion of Honor for her contribution to surgery and for her social involvement. She died in Paris in 1954, aged 76.



M^ME LE D^R A. NOËL
Ex-Interne des Hôpitaux de Paris

LA CHIRURGIE
ESTHÉTIQUE

SON ROLE SOCIAL

MASSON ET C^ie, ÉDITEURS
LIBRAIRES DE L'ACADÉMIE DE MÉDECINE
120, BOULEVARD SAINT-GERMAIN, 120, PARIS, VI^e
1926

Fig. 7.46 The cover of *La Chirurgie Esthétique. Son Rôle Sociale* by Suzanne Noël (1878–1954), published in 1926

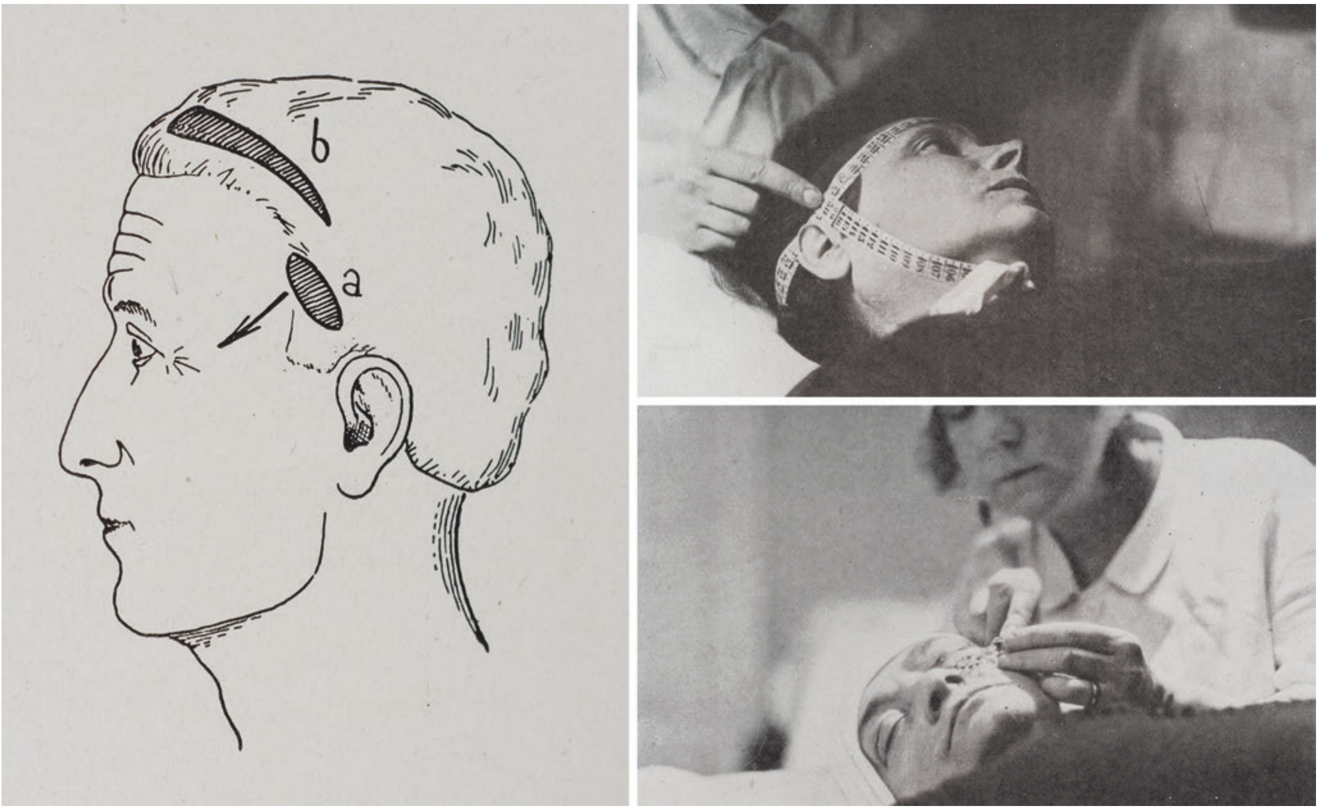


Fig. 7.47 Suzanne Noël performing a facelift. *Left*: segmentary excisions; *upper right*: pre-operative measurements; *lower right*: facial undermining. (From: Noël S. *La Chirurgie Esthétique. Son Rôle Sociale*. Paris, Masson, 1926)

Fig. 7.48 Suzanne Noël's facelift result. *Upper*: pre-operative situation; *lower*: post-operative result. (From: Noël S. *La Chirurgie Esthétique. Son Rôle Sociale*. Paris, Masson, 1926)

Fig. 7.49 Suzanne Noël's patient after undergoing a facelift procedure. *Upper*: combing her hair; *lower*: drinking a cup of coffee before leaving the clinic. (From: Noël S. *La Chirurgie Esthétique. Son Rôle Sociale*. Paris, Masson, 1926)

Raymond Passot

We have learned (see Sect. 7.3.3.2) how **Raymond Passot** (1886–1933), *Interne des Hôpitaux* of Paris, working in the unit of Hippolyte Morestin, significantly contributed to the development of aesthetic surgery, becoming one of the most renowned aesthetic surgeons in Paris. In 1919, he published an article in which he illustrated multiple elliptical skin excisions in the region of the forehead, temples, and in front of the auricle to correct facial wrinkles. He added a submental incision for the treatment of the neck. In his book *Chirurgie esthétique pure* (Pure Aesthetic Surgery), dating from 1931 [73] (Fig. 7.50), he showed a full range of operations in the field of aesthetic surgery. For facial rejuvenation, he illustrated an extended resection, beginning at the temple, behind the hairline, continuing down in front of the auricle, around the lobule in the retro-auricular sulcus. A wide undermining allowed the correction of cervico-facial wrinkles (Fig. 7.51).

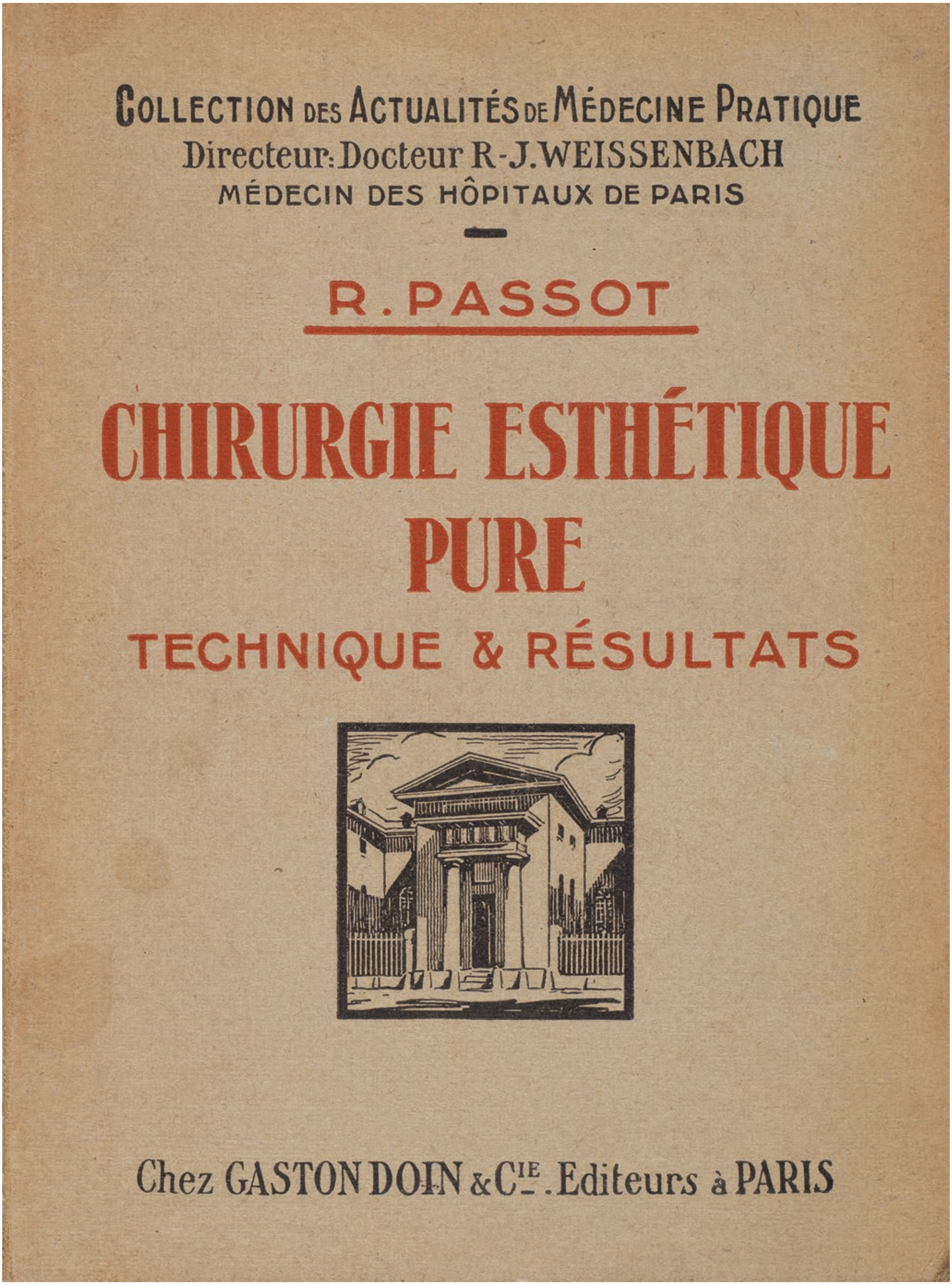


Fig. 7.50 The cover of *Chirurgie Esthétique pure* by Raymond Passot (1886–1933), published in 1931

Fig. 7.51 *Left*: Raymond Passot's facelifting technique; *center*: photograph of the pre-operative situation of a patient; *right*: post-operative result. (From: Passot R. *Chirurgie Esthétique pure*. Paris, G. Doin, 1931)

Julien Bourguet

Julien Bourguet (1876–1952), a student of the anatomist **Adrien Charpy** (1848–1911), was Associate Professor of Anatomy, and an otolaryngologist and ophthalmologist (see Sect. 7.2.3.3) in Paris, where he moved from Toulouse. He successfully dedicated himself to aesthetic surgery of the face and to facial rejuvenation in particular.

Thanks to his profound anatomical knowledge, he advocated extensive dissection of the cheek, reaching the nasolabial fold, without the risk of injuring the delicate facial structures, such as the facial and the great auricular nerves, or the Stensen duct. His incision started in the temporal region, behind the hairline, continuing in front of the auricle, behind the tragus, then turned around the earlobe, curving upward in the retro-auricular sulcus, and ending at the level of the mastoid. The skin was elevated in a postero-cranial direction, and the excess excised (Fig. 7.52). The wide dissection of the face and neck, extending the incision behind the ear, in the retro-auricular sulcus, on which Bourguet strongly insisted, was a novel concept for the period, when the technique for facial rejuvenation was usually limited to very shy segmentary, minimal skin resections without undermining and in any case not below the pre-auricular area. He presented his technique to the members of the *Paris Academy of Medicine* in 1919 [134], the same year that Passot published his method of correction of facial wrinkles with elliptical, segmentary excision [135]. In 1928, Bourguet further improved his facelifting procedure [136]. A comprehensive review of his contribution to facial rejuvenation surgery was issued by **J. Vrébos** [137] and **R.F. Mazzola** [35].

In 1936, he published *La Véritable Chirurgie Esthétique du Visage* (The Real Aesthetic Surgery of the Face) (Fig. 7.53), probably his best work, where he summarized the striking results obtained by aesthetic surgery of the nose, auricles, eyelids, lips, and chin and facial rejuvenation. Drawings and schemes illustrate the technique he used, whereas detailed self-explanatory pre- and post-operative photographs demonstrate the outcomes [138] (Fig. 7.54).

Bourguet described three anatomico-clinical situations of the platysma muscle: (a) separated, giving rise to the formation of the platysma bands, with a midline depression (Fig. 7.55); (b) interdigitated, at the larynx level, with a less extended midline depression; (c) completely fused, along the midline. Surgery was based on correcting the different clinical conditions. When the existing platysma bands are divided with a hollow midline, he advocated a submental incision with complete transection of the platysma bands, and the introduction of fat graft *en bloc*, harvested from the abdomen or buttocks, to fill in the depression. Curiously, in *La Véritable Chirurgie Esthétique du Visage*, there is no further mention regarding fat grafting for filling the midline hollow. Probably, the results obtained by this procedure were less favorable than expected. For platysma band transection, he introduced a sort of optical scalpel through a minimally noticeable incision along the neck.

In cases of heavy neck, he performed a lipectomy through a submental crease incision, with a final intradermal suture for all the exposed areas. He recommended extensive undermining for cervical lifting with correction of platysma bands, emphasizing that recurrence of the bands was possible.

On completion of the neck work, Bourguet advocated adding facelifting with wide undermining.

To the best of our knowledge, this was the first surgical management of the platysma muscle for aesthetic purposes [139]. To summarize, Bourguet should be acknowledged for having established the fundamentals of the current approach to aesthetic facial and neck surgery as early as 1919 and 1928 [134, 136].

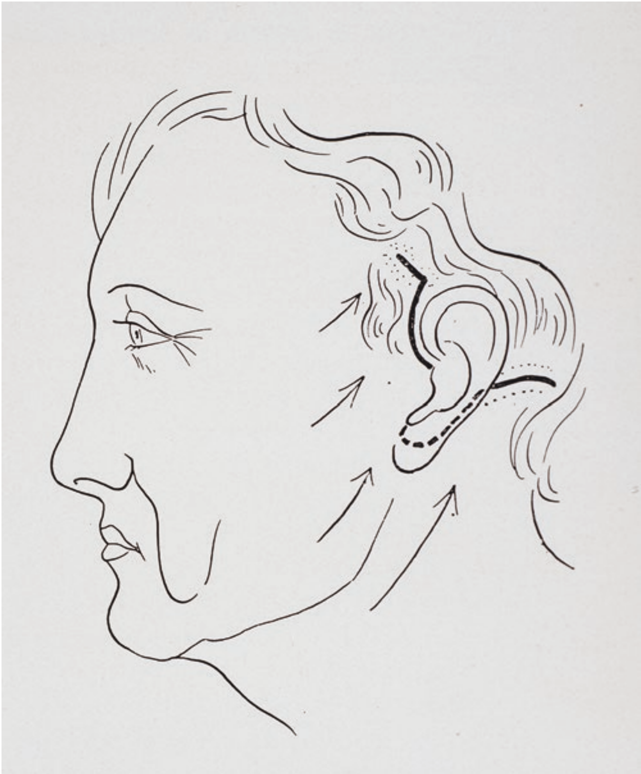


Fig. 7.52 Julien Bourguet (1876–1952)—incision for facelifting. It starts in the temporal region, behind the hairline, continues in front of the auricle, behind the tragus, then turns around the earlobe, curving upward in the retro-auricular sulcus, and ending at the level of the mastoid. The undermined skin is elevated with a postero-cranial vector, and the excess excised. (From: Bourguet J. *La véritable Chirurgie Esthétique du visage*. Paris, Plon, 1936, p. 146)

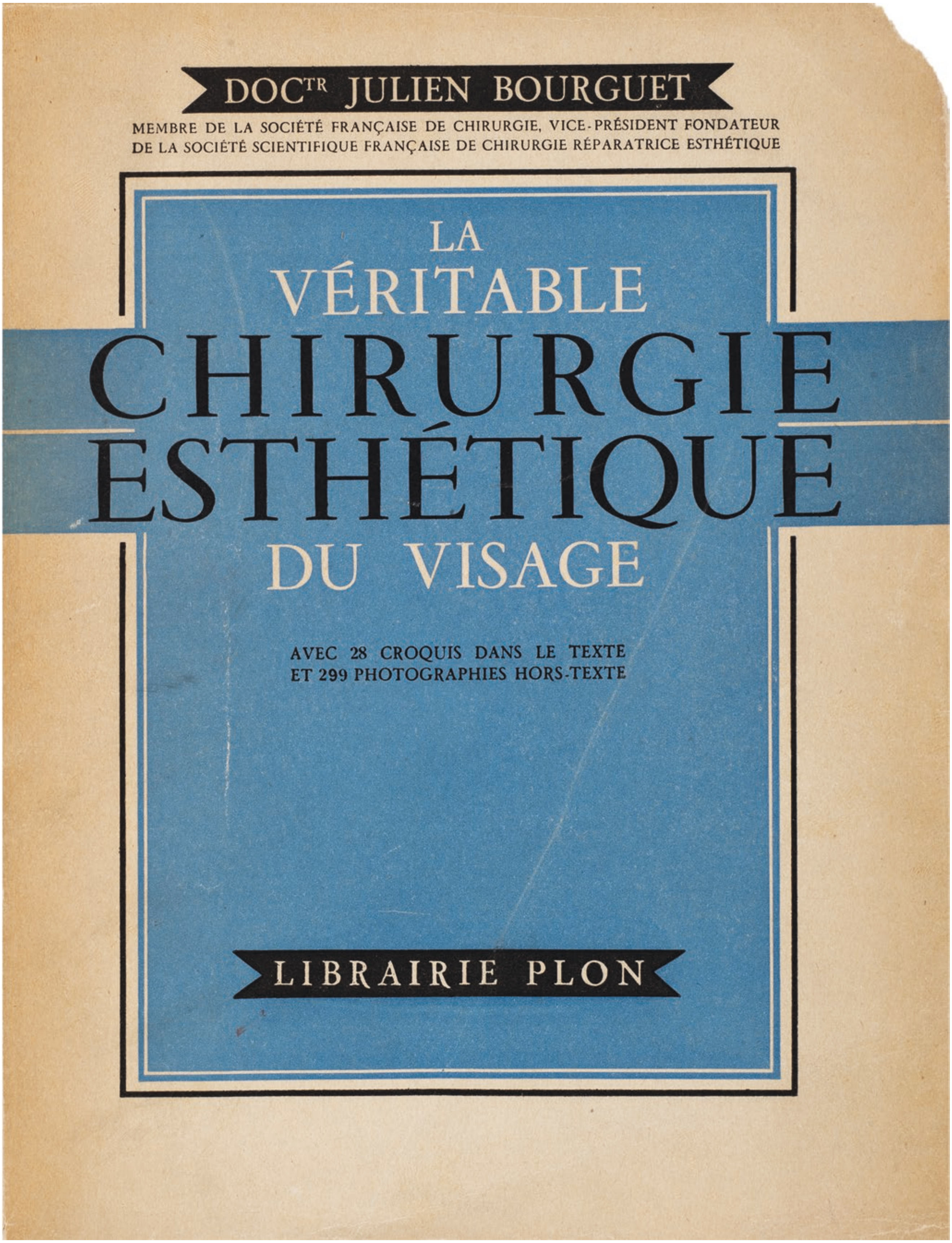


Fig. 7.53 The cover of *La véritable Chirurgie Esthétique du visage* by Julien Bourguet published in 1936

Fig. 7.54 Julien Bourguet facelifting result. *Left*: pre-operative situation; *right*: post-operative result. (From: Bourguet J. *La Véritable Chirurgie Esthétique du Visage*. Paris, Plon, 1936)

Fig. 7.55 The platysma muscle is separated along the midline, giving rise to the formation of the platysma bands, with a midline depression. From: Bourguet J. *La Véritable Chirurgie Esthétique du Visage*. Paris, Plon, 1936

Maurice Virenque

Maurice Virenque (1888–1946) was a maxillofacial surgeon from Paris and a member of the French association, *les gueules cassées* (the facial cripples) (see Sect. 6.2.1.3). Due to his vast experience in maxillofacial surgery and his great knowledge of facial anatomy, Virenque developed original approaches to the correction of the aging face. In an era when facelifting was purely by skin undermining, he advocated the plication of the deep aponeurotic layers of the face, the use of suspension loops to maintain a stable result, and the reposition of sagging tissues with a vertical vector [140].

His 1927 publication, *Traitement Chirurgical des Rides de la Face et du Cou* (Surgical Management of the Wrinkles of the Face and Neck) has great importance in the history of facelifting [141]. Regrettably, it is seldom acknowledged and quoted.

In his technique, the incision starts in the temporal region, in front of the hairline, continues in front of the auricle, then reaches the earlobe, where it ends (Fig. 7.56 *upper left*). Two loops of chromic catgut, acting as purse-string sutures, are placed on the fascia superficialis, which is plicated, moved cranially with vertical vector and anchored to a fixed point, usually the parotid aponeurosis, to avoid the downward displacement of the deep facial layers. The knot is tied under tension. A third loop is placed laterally to the orbital pillar, anchored to the parotid aponeurosis, with a knot under tension (Fig. 7.56 *upper right*). The redundant skin with vertical vector is excised (Fig. 7.56 *lower left*). The skin is approximated with interrupted sutures (Fig. 7.56 *lower right*). In the foreword of his publication, Virenque says: “Facial ptosis involves not only the skin, but also the subdermal and aponeurotic tissues and the mimic muscles. Therefore, surgical treatment should include: (1) correction of the different ptotic anatomical layers; (2) modification of two different areas, one strong and immobile, and the other mobile. Surgery consists of moving the latter to the steady area, thus achieving an aesthetic result. (…) The immobile area corresponds to the parotid region, whereas the mobile area corresponds to the naso-labial folds, the chin, the infra-maxillary, and the mid-hyoid.” Having undermined the parotid region, Virenque recommended placing deep suspension sutures between the mobile structures and the immobile, fixed parotid aponeurosis with the knot tied under tension. Probably, Virenque was the first surgeon who described plication of the deep structures. In 1999, this technique was rediscovered, improved, and popularized by **Patrick Tonnard** and **Alexis Verpaele** in Belgium. They renamed it the MACS lift [142].

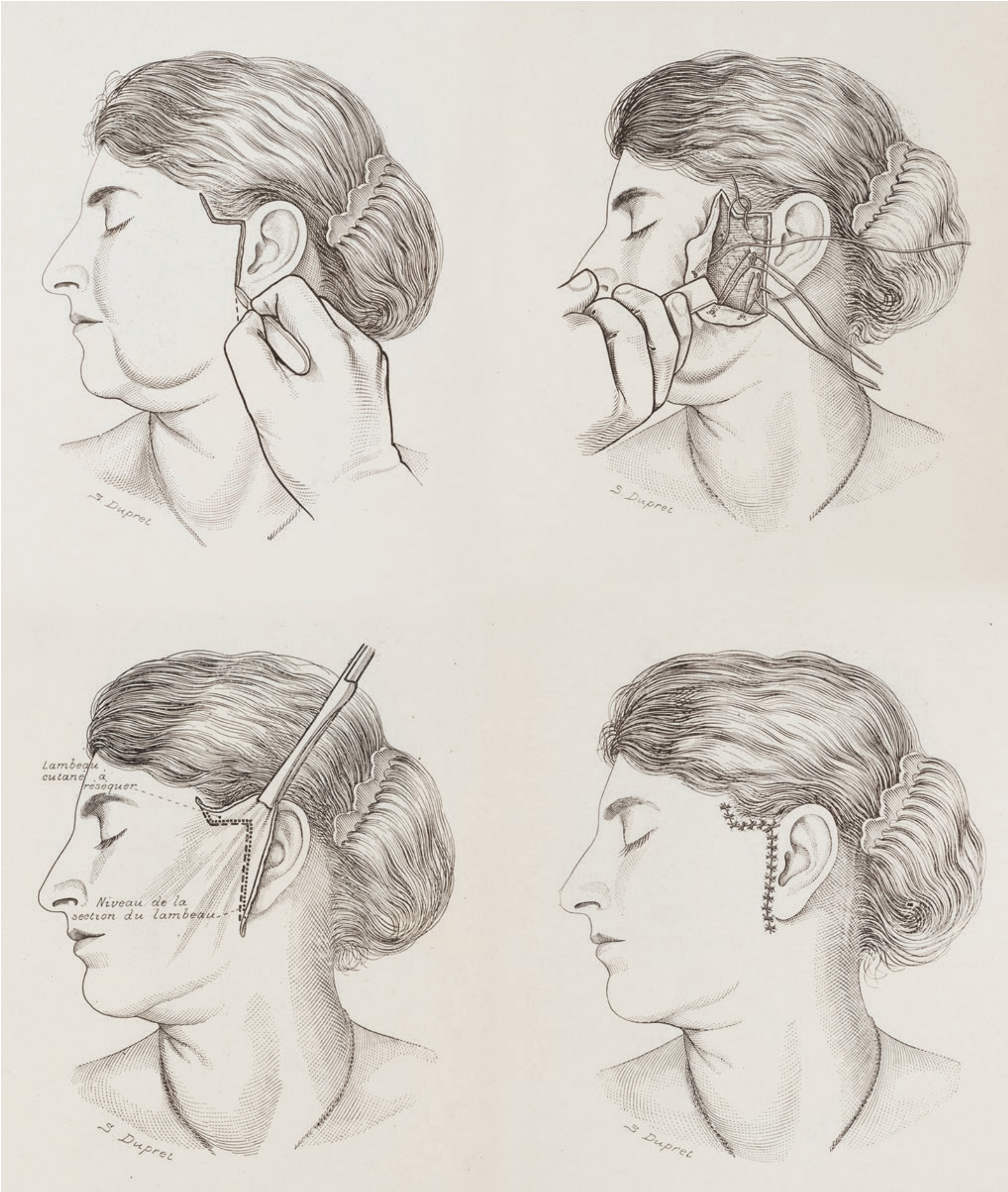


Fig. 7.56 Maurice Virenque's (1888–1946)—facelifting technique. *Upper Left*: the incision begins in the temporal region, in front of the hairline; *upper right*: three loops of chromic catgut are placed on the fascia superficialis, which is plicated, moved cranially with vertical vector and sutured to a fixed point, that is, the parotid aponeurosis; *lower left*: the redundant skin is excised with vertical vector; *lower right*: final result. (From: Virenque M. *Traitement chirurgical des Rides de la Face et du Cou.* Paris, G. Doin, 1927)

7.6.5.2 Germany and Austria

In Berlin, **Jacques Joseph** (1864–1934), the father of aesthetic rhinoplasty, was well known for his operations for facial rejuvenation and eyelid correction. The facelifting technique, illustrated in the book *Nasenplastik*, soon became one of the most popular methods. The incision started in the temporal region, behind the hairline, continued in front of the auricle, behind the tragus, then turned around the earlobe, curving upward in the retro-auricular sulcus, and ended at the level of the mastoid [30] (Fig. 7.57). Pre- and post-operative photos of a patient show the amazing result obtained (Fig. 7.58).

Similar incisions were described by **Erich Lexer** (1867–1937) in 1931 [143] (Fig. 7.59) when he was Professor of Surgery at Munich University and by **Ernst Eitner** (1867–1955) in Vienna [81].

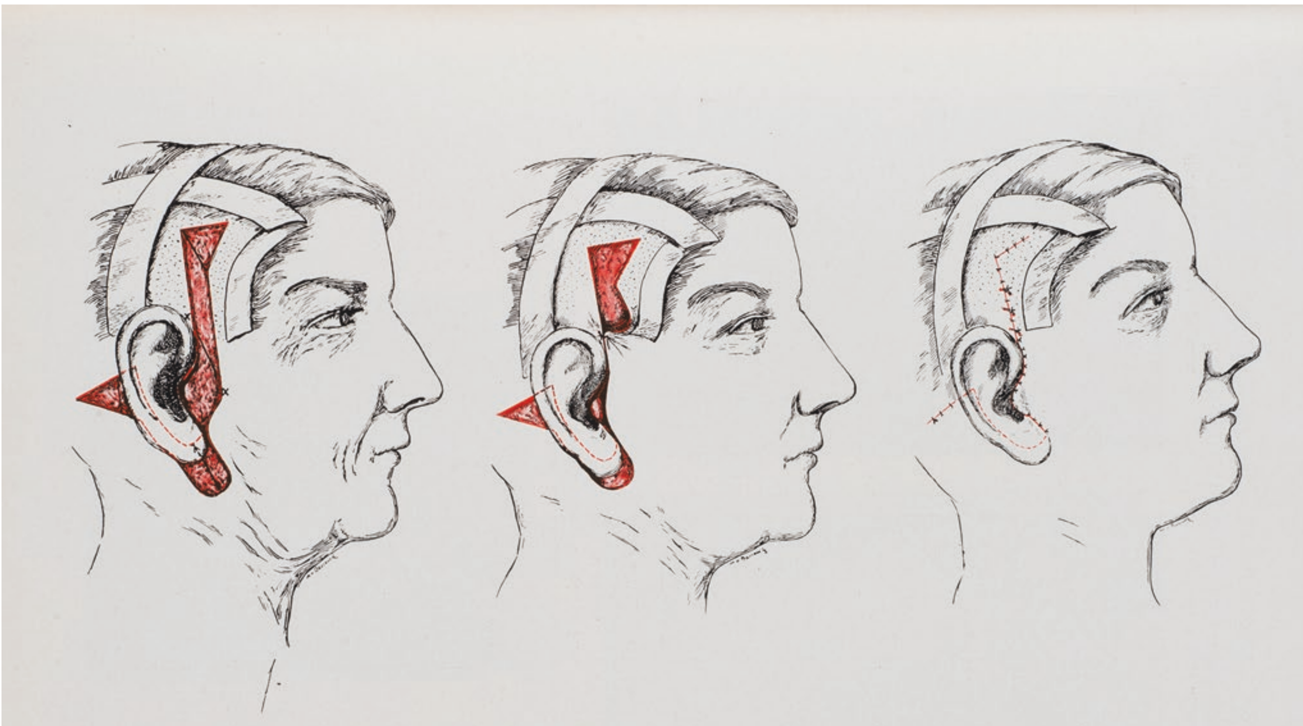


Fig. 7.57 Jacques Joseph (1865–1934)—incision for facelifting. It begins in the temporal region, behind the hairline, continues in front of the auricle, behind the tragus, then turns around the earlobe, continues in the retro-auricular sulcus, and ends at the level of the mastoid. (From: Joseph. J. *Nasenplastik und sonstige Gesichtsplastik*. Leipzig, Curt Kabitzsch, 1931, p. 626)

Fig. 7.58 Jacques Joseph's facelifting result. *Left*: pre-operative situation; *right*: post-operative result. (From: Joseph. J. *Nasenplastik und sonstige Gesichtsplastik*. Leipzig, Curt Kabitzsch, 1931, p. 624)

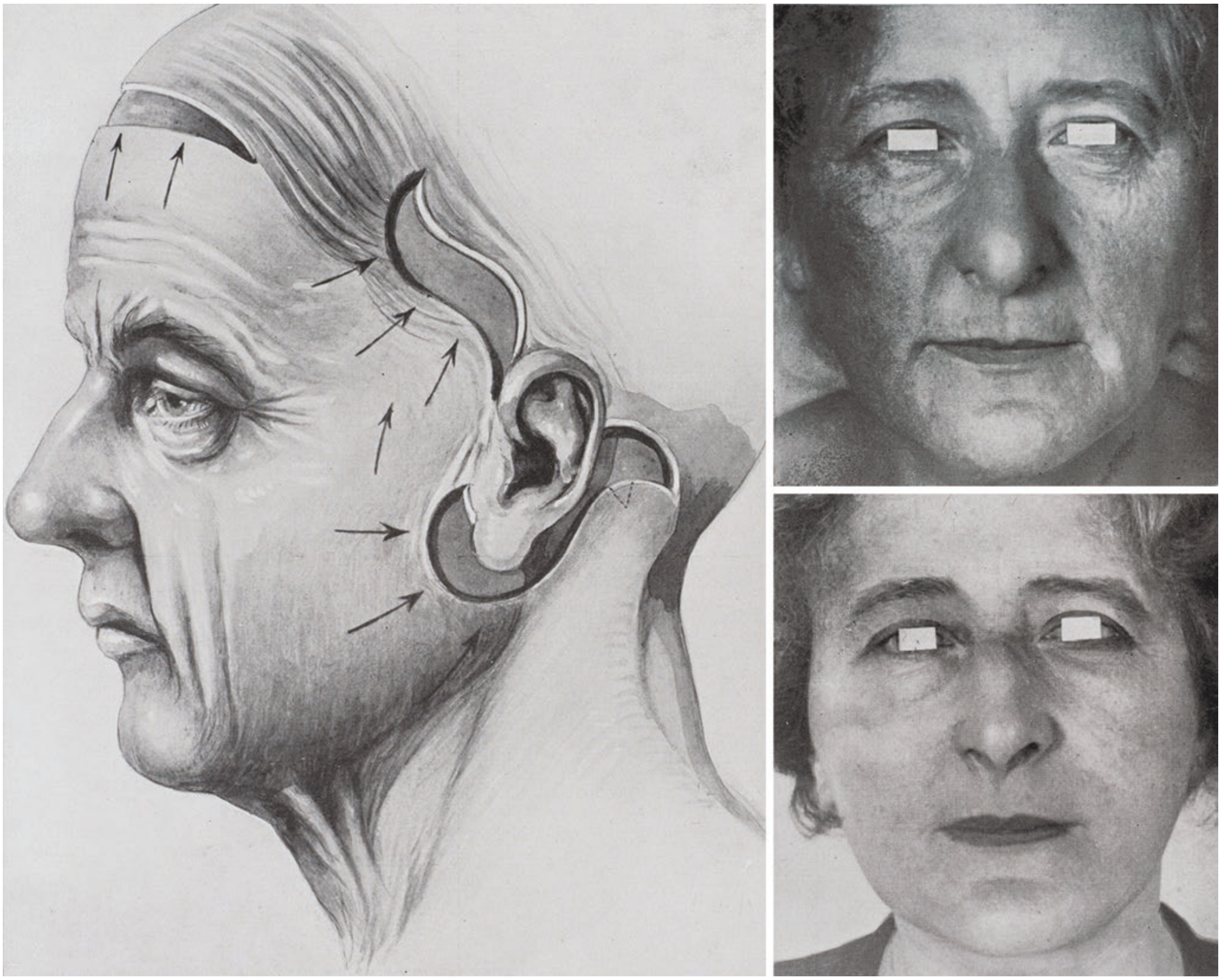


Fig. 7.59 Erich Lexer (1867–1937) *Left*: facelifting incision with the indication of the vectors; *right*: pre- and post-operative result. (From: Lexer E. *Die gesamte Wiederherstellungschirurgie.* Leipzig, A. Barth, 1931, p. 551–552)

7.7 Blepharoplasty

Surgical correction of the drooping skin overhanging the upper eyelid was first described by **Aulus Cornelius Celsus** (25 BC–AD 50) in *De Medicina* (see Sect. 7.1.1.1). **Georg Bartisch** (1535–1607) published the first illustration in the medical literature of the excision of excess skin from the upper eyelid in 1583 (see Sect. 7.1.1.2).

With the development of aesthetic surgery, the term *blepharoplasty*, used in the past to indicate a reconstructive procedure for the repair of eyelid defects, changed its meaning. Nowadays, it refers to the removal of the pendulous or protuberant upper eyelid fold and unpleasant lower lid bags.

In *Leçons orales de Clinique Chirurgicale faites à l'Hôtel Dieu de Paris. Deuxième edition entièrement refondue* (Clinical Lectures on Surgery Delivered at Hôtel Dieu of Paris. second edition entirely revised), by **Baron Guillaume Dupuytren** (1777–1835) (see Sect. 5.2.2.4), posthumously issued by his disciples **Alexandre-Jacques Brierre de Boismont** and **Edmond Marx** [144], the following attempt to correct upper eyelid drooping surgically was described: "We should say a few words about the edema of the eyelids that, after having resisted all known means, produces a drooping of the skin of that region in the long run. The skin falls down in front of the eyeball and, more or less completely interferes with vision. (…) Topical remedies used in similar cases are ineffectual. When Mr. Dupuytren was consulted, on several occasions, for lesions of this type, he thought that excision of a strip of skin would be necessary, followed by a scar that would put an end to deformity."

While the first image of excess skin folds and baggy lower eyelids was illustrated by the Austrian ophthalmologist

George Joseph Beer (1763–1821) in 1817 [7] (see Sect. 7.1.1.5) (Fig. 7.3), the term *blepharochalasis* was coined by **Ernst Fuchs** (1851–1930), Professor of Ophthalmology in Vienna, to indicate herniated orbital fat and sagging skin above the tarsus, often due to age, impairing or limiting eyesight [145].

A detailed description of the etiology and clinical characteristics of orbital fat prolapse was published by the French physician **Jules Frédéric Sichel** (1802–1868), founder of the first ophthalmic clinic in Paris. In 1844, he wrote: "(fat herniation) is caused by a certain amount of fat deposited between the skin and the orbicularis (...) most often in continuity with cellular orbital adipose tissue. (...) Frequently this fat is located under the muscle and after the excision of a strip of fat, it is necessary to incise transversely and parallel in the direction of these fibers to demonstrate the swelling and elevate it. (...) The eyelid appears flaccid and swollen and presents a tumor elastic on palpation. Most often this tumor is encircled between the border adhering to the eyelid and its wide transversal fold. Frequently it hangs in front of the lower part of the lid in the form of a bulge or a little horizontal bag. Its weight, more significant than the simple skin fold, makes the movements of the lid difficult" [146].

7.7.1 The Development of Cosmetic Eyelid Surgery

Cosmetic eyelid surgery began to develop at the turn of the twentieth century, although its explosion occurred in the interwar period. Comprehensive reports on the history of blepharoplasty were published by **Dupuis** and **Rees** in 1971 [147], **Rogers** in 1977 [14], **Stephenson** in 1977 [148], and **Mazzola** in 2016 [149].

7.7.1.1 Development of Blepharoplasty in the USA

One of the earliest contributions to remove excess upper eyelid skin and baggy eyelid was by **Charles C. Miller** (1880–1950) in 1907 in *Cosmetic Surgery* [124]. "This condition may be easily overcome by simple surgical procedures, which are performed painlessly, he said. Wrinkles, folds and bags beneath the eyes are eradicated by the removal of a crescent of skin. (…) The width of the crescent varies according to the depth of the wrinkles. The first incision should be made with a sharp scalpel along the lid. The skin should be divided entirely (…) and loosened somewhat. It should then be drawn upward, the operator observing carefully just how much must be removed, (…) then with the scissors the skin is cut away so that the crescent is made complete. Just sufficient skin is left along the margin of the lid to permit the stitches being passed in closing." He provided the first photograph in medical history showing the lower eyelid approach for removal of a crescent of wrinkled skin (Figs. 7.39 and 7.60). In the second edition of *Cosmetic Surgery*, published in 1924, Miller made considerable improvements. He recommended thirteen different incisions to correct an equivalent number of clinical situations for "bag excision," many of them the result of pure imagination [125]. Concurrent removal of fat was not reported, nor were pre- and post-operative photos supplied, only drawings (Fig. 7.61).

In 1911, **Frederick S. Kolle** (1872–1929) published *Plastic and Cosmetic Surgery*, the second book on cosmetic surgery in terms of priority [121]. Under the heading "wrinkled eyelids" he advocated the removal of "the redundant or baggy tissue by excision. (…) The superior line of incision in operations of lower eyelid should be made as close to the tarsal line as is practical, so as to show as little of the resulting scar as possible. (…) In operations of the upper lid, a somewhat widened elliptical piece of skin is excised with its inferior margin about one fourth to one half inch above the tarsal line."

Lyons H. Hunt (1882–1954) showed his results of cosmetic operations of the eyelids in his book on head and neck surgery issued in 1926 [128]. He took a subciliary approach, with a "triangular-shaped section excised from the external side. To pick up the entire amount of redundant tissue" and to close the skin defect, he used a special *plastic eye clamp* that he invented (Fig. 7.62). Despite the accurate details about excessive skin excision, no information was given for the management of fatty bags.

Fig. 7.60 First photograph in medical history showing the lower lid line of incision for the removal of a crescent of skin. (From: Miller CC. *Cosmetic Surgery. The correction of featural Imperfections.* Chicago, Oak Printing, 1907)

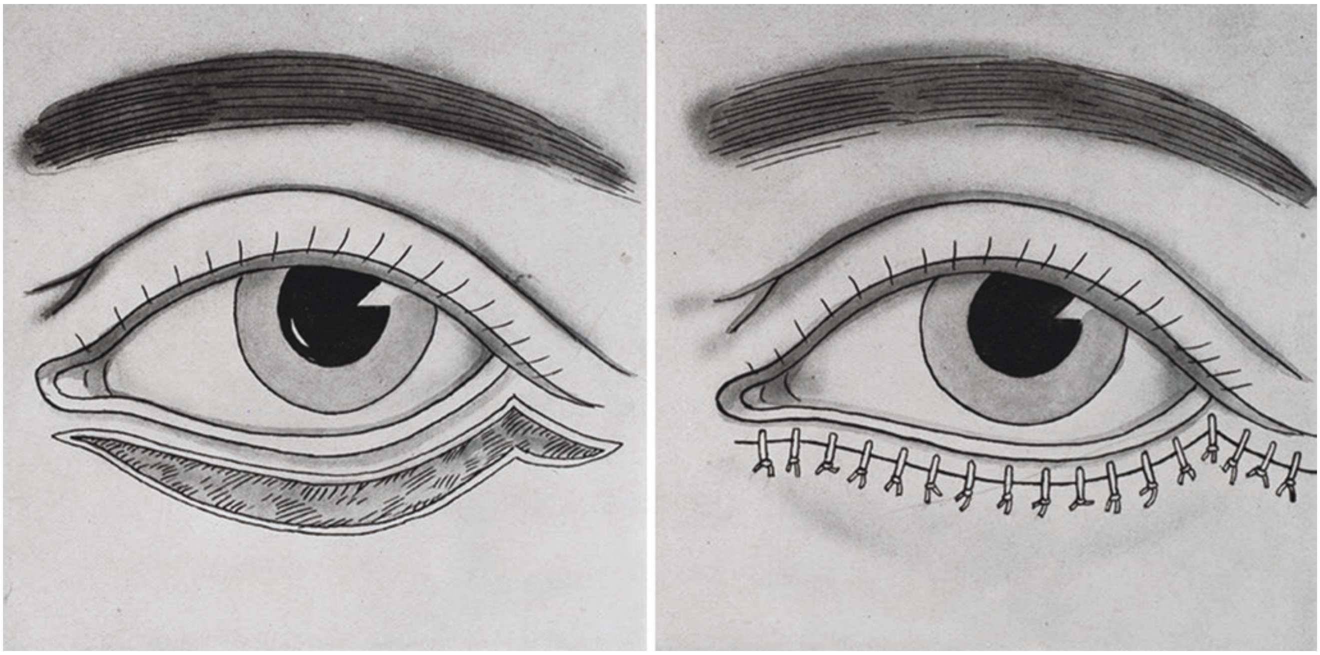


Fig. 7.61 Excision of bags from lower eyelid. *Left*: lower lid incision; *right*: post-operative result. Skin approximation is by silver clips. (From: Miller CC. *Cosmetic Surgery. The correction of featural Imperfections*. 2nd ed. Philadelphia**,** FA Davis, 1924. p. 30–31)

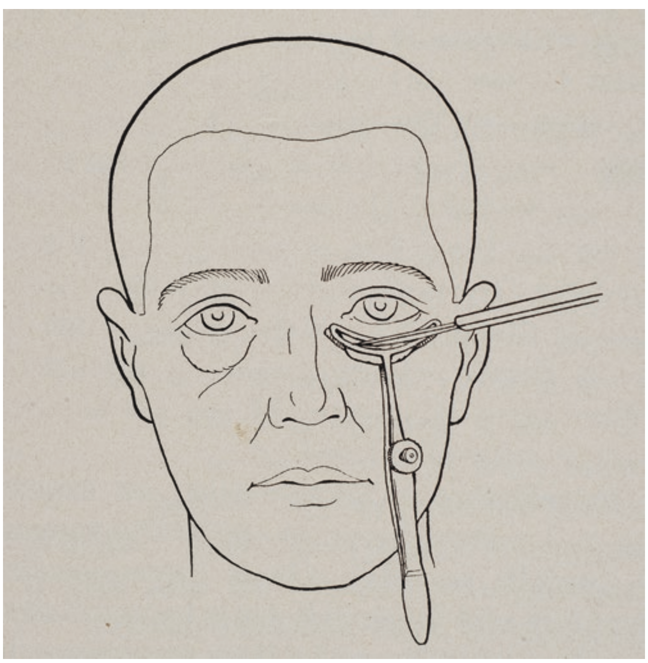


Fig. 7.62 Removal of the redundant skin from the lower eyelid, according to Lyons Hunt and using a special clamp that he invented. (From: Hunt HL. *Plastic Surgery of the Head, Face and Neck*. Philadelphia, Lea & Febiger, 1926, p. 196)

7.7.1.2 Development of Blepharoplasty in Europe

In the 1920s, Paris, Berlin, and Vienna became centers of European cosmetic surgery with leading personalities such as **Suzanne Noël, Julien Bourguet, Raymond Passot, Jacques Joseph**, and **Ernst Eitner.**

Suzanne Noël

In *La Chirurgie Esthétique. Son Rôle Sociale*, published in 1926 [113], **Suzanne Noël** showed numerous cases of blepharoplasty with before and after surgery photographs. For the lower lid, she recommended excision of the skin 2 mm below the eyelashes (Fig. 7.63).

Fig. 7.63 Suzanne Noël's operation of lower lid wrinkle removal. *Upper*: pre-operative situation; *center*: at 7 days after surgery; *lower*: at 15 days. (From: Noël S. *La Chirurgie Esthétique. Son Rôle Sociale*. Paris, Masson, 1926)

Julien Bourguet

Basically, the techniques reported for cosmetic blepharoplasty included skin removal only. No author took excision of the herniated fat into consideration. It was **Julien Bourguet** (1876–1952) who played a key role in the development of cosmetic blepharoplasty. In 1925, he described two separate compartments of fat in the upper eyelid and first proposed the transconjunctival approach, instead of the traditional subciliary incision for lower lid herniated fat identification and excision. He was probably the first one in the medical literature who published the before and after photograph of a patient operated on for cosmetic blepharoplasty [150, 151] (Fig. 7.64).

Fig. 7.64 Bourguet's patient operated on in 1925 with transconjunctival approach for lower lid fat removal. *Left*: lower lid incision; *right*: post-operative result. Probably the first image in medical literature of the before and after photograph of a patient operated on for cosmetic blepharoplasty. (From: Bourguet J. *La Véritable Chirurgie Esthétique du Visage*. Paris, Plon, 1936. p. 58–59)

Raymond Passot

Raymond Passot (1886–1933), one of the leading personalities in the field of aesthetic surgery, removed lower eyelid fat using the same Bourguet transconjunctival technique. In his book *Chirurgie esthétique pure* (1931), he gave a detailed description of this procedure on pages 178–179 [73].

Jacques Joseph

In Berlin, **Jacques Joseph** (1864–1934) illustrated a self-explanatory scheme for upper (Fig. 7.65 *upper*) and lower eyelid skin incision (Fig. 7.65 *lower*) for aesthetic blepharoplasty in *Nasenplastik* [30]. However, there was no mention of fat removal.

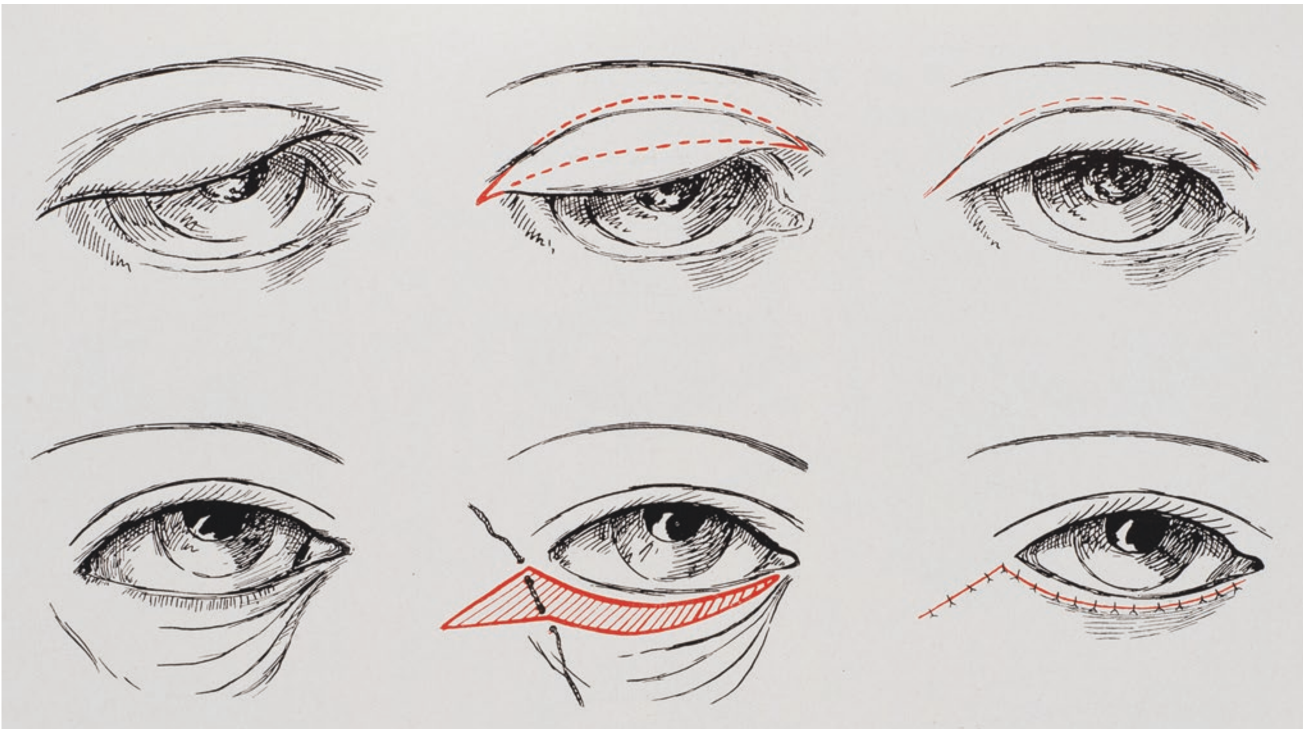


Fig. 7.65 Scheme of *Upper*: upper and *lower*: lower eyelid skin removal for cosmetic purposes according to J. Joseph. (From: Joseph. J. *Nasenplastik und sonstige Gesichtsplastik*. Leipzig, Curt Kabitzsch, 1931, p. 527)

Ernst Eitner

In Vienna, **Ernst Eitner** (1867–1955) was among the first in the medical literature to explain how to detect fat herniation in the lower eyelid orbicularis muscle and the technique for its excision [81] (Fig. 7.66).

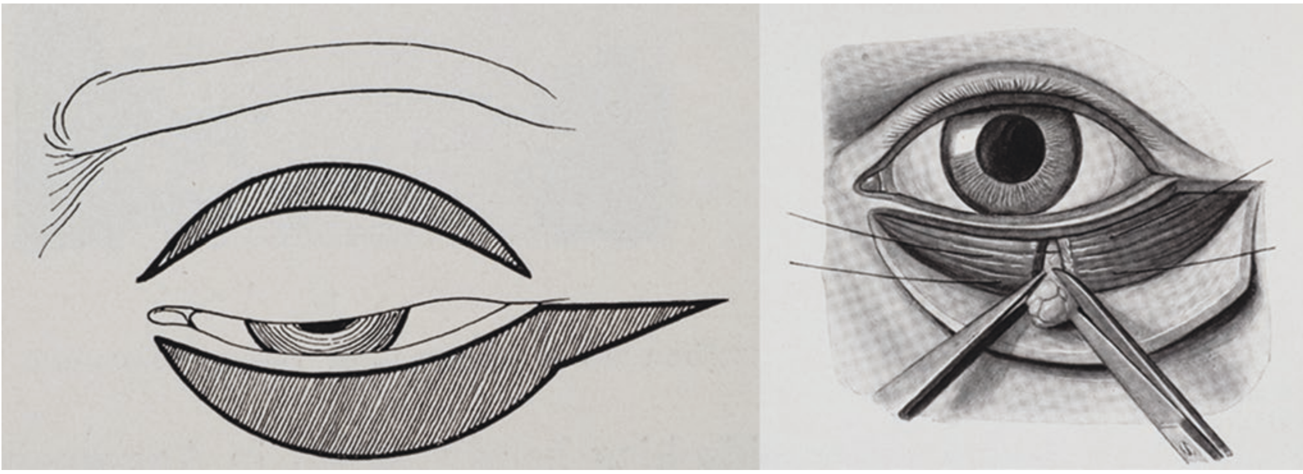


Fig. 7.66 Aesthetic blepharoplasty according to E. Eitner. *Left*: removal of upper and lower eyelid skin for aesthetic blepharoplasty; *right*: excision of lower lid fat herniation from the orbicularis muscle. (From: Eitner E. *Kosmetische Operationen*. Wien, J. Springer, 1932 p. 64–66)

7.8 Otoplasty

Comprehensive reports on the history of otoplasty were published by **Joseph** in 1912 [29], **Davis** and **Hernandez** in 1978 [152], and **Mazzola** in 2018 [153].

7.8.1 Reconstructive Otoplasty for Traumas

Reconstructive otoplasty was practiced in India by **Suśhruta** in about the sixth and fifth centuries BC. He is regarded as the legendary founder of Hindu medicine. The most typical indication was cleft earlobes as a result of earing weight, or post-traumatic amputation. Cauterization favored the approximation of the wound margins for cleft lobes, whereas surgery, using a pedicled cheek skin flap outlined in front of the ear, could restore the missing earlobe [152].

Curiously, surgical repair of the ear is not mentioned in the Edwin Smith Papyrus of ancient Egypt (see Sect. 1.3.1).

In Rome, **Aulus C. Celsus** (25 BC–AD 50) in *De Medicina* (On Medicine), written about AD 30, described an advancement flap outlined and raised for closing facial wounds and defects of the ears [1, 154] (see Sect. 1.7.1). In the Byzantine period, **Paulus of Aegina** (AD 625–690) managed partial ear loss in a way similar to that of Celsus [155, 156].

In the late Middle Ages, **Antonio Branca** (*fl.* middle of the fifteenth century), a Sicilian surgeon working in Catania, repaired post-traumatic ear defects according to **Bartolomeo Facius** (ca.1400–1457), historian to Alfonso I of Aragon, King of Naples, and a contemporary of Branca father and son. About 1456, he wrote the following: "Antonius made considerable improvements to his father's wonderful invention, for he discovered how to repair mutilated lips and ears as well as noses" [157] (see Sect. 3.3.1.5). However, no detail about the adopted technique was supplied.

During the Renaissance, in 1561, **Ambroise Paré** (1510–1590) published *La Méthode curative des Playes et Fractures de la Teste Humaine. Avec les Pourtraits des Instruments Necessaires pour la Curation d'icelles* (The Method of Treating Wounds and Fractures of the Human Head. With Illustrations of the Instruments Necessary to Treat them) [158]. In Part Two, devoted to the management of head and face wounds, he showed the surgical instruments necessary for the treatment of head traumas, as well as eye, nose, and ear prostheses. Paré strongly advocated the use of prostheses, a less invasive and quicker solution with respect to skin flaps, to replace the missing parts. The image of an ear prosthesis, made of colored *papier mâché* or leather and secured to the head by a metal band, was supplied in a later Paré publication [159] (Fig. 7.67).

On the contrary, **Gaspare Tagliacozzi** (1545–1599) favored restoration of the defective parts employing autologous tissues. Despite the fact that his name has always been associated with the art of reconstructing noses, he also illustrated the repair of a post-traumatic defect of the upper and lower third of the auricle in *De curtorum Chirurgia per Insitionem* (On the Surgery of Injuries by Grafting) [160] (see Sect. 3.3.5.2). He accurately explained the details of the reconstructive technique, very similar to the methods used nowadays: "The procedure consists of outlining a flap, engrafting it, treating it, and shaping it. We do not harvest this flap from the upper arm, but from the area behind the ear" (Book Two, Chapter 20). Once the local flap has been raised, without damaging the periosteum, and hemostasis secured, the defect of the auricle has to be carefully prepared to avoid any damage to the cartilage. The flap should then be brought into position and folded on its pedicle to repair the missing parts. The donor site is left open, healing by second intention. Tagliacozzi recommended respecting the ridges and the hollows of the auricle, to obtain a fine shape. He suggested applying a special bandage after the operation which passes in front of and behind the reconstructed auricle to maintain the dressing in place and to protect the raw area (Fig. 7.68). "The size of the defect will determine the amount of skin necessary to repair it" (Fig. 7.69). The illustrations have a special value in medical literature, being the first of a reconstructive otoplasty. Tagliacozzi affirmed that he successfully operated on a Benedictine monk, "restoring the middle and lower parts of his ear so elegantly and beautifully, that I amazed both myself and my assistants."

After Tagliacozzi, reconstructive otoplasty was seldom practiced. Almost 250 years later, in the nineteenth century, the operation was rediscovered by **Johann Dieffenbach** (1782–1847) [15] and **Julius von Szymanowski** (1829–1868) contributing to its further development. For total ear reconstruction, Szymanowski imagined a rather complicated flap, outlined in the mastoid area, elevated and folded on itself so as to cover potential raw areas. There is no mention of cartilage graft within the reconstructed auricle [16] (Fig. 7.70). In 1920, **Sir Harold Gillies** described an inferiorly based post-auricular flap for reconstruction of the lower third of the ear [161]. In 1925, **S. Pierce** advocated the use of thin tubed pedicled flaps initially from the neck and later from the supra-clavicular area to cover the costochondral cartilage grafted in that area to replace the missing auricle [162] (Fig. 7.71).

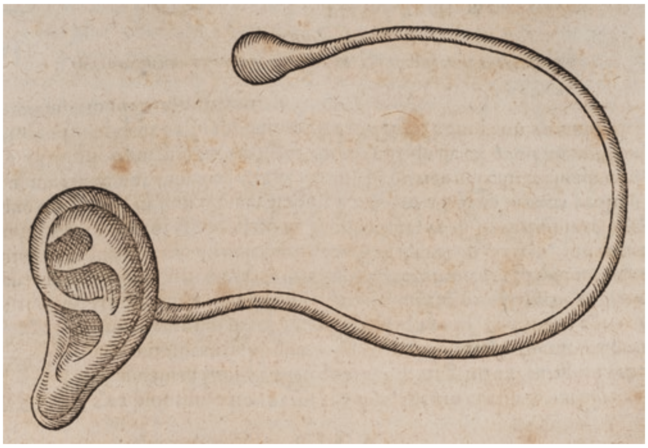


Fig. 7.67 A. Paré's ear prosthesis to replace the missing auricle. The prosthesis is connected to a metal loop to be positioned against the head. (From: Paré A. *Opera chirurgica*. Frankfurt, J. Feyerabend, 1594)

Fig. 7.68 Post-traumatic restoration of a defect of an upper or lower third of the auricle, according to Tagliacozzi. First images of reconstructive otoplasty in medical literature. *Upper left*: defect of the upper part of the auricle; *upper right*: defect of the lower part of the auricle; *lower center*: the bandage which passes in front of and behind the reconstructed auricle. (From: Tagliacozzi G. *De Curtorum Chirurgia per Insitionem*. Venezia, G. Bindoni, 1597. Figure 20)

Fig. 7.69 Post-traumatic restoration of a defect of an upper or lower third of the auricle, according to Tagliacozzi. *Upper*: reconstruction of the upper part of the auricle with a retro-auricular temporal flap; *lower*: reconstruction of the lower part of the auricle with a retro-auricular mastoid flap. (From: Tagliacozzi G. *De Curtorum Chirurgia per Insitionem*. Venezia, G. Bindoni, 1597. Figure 21)

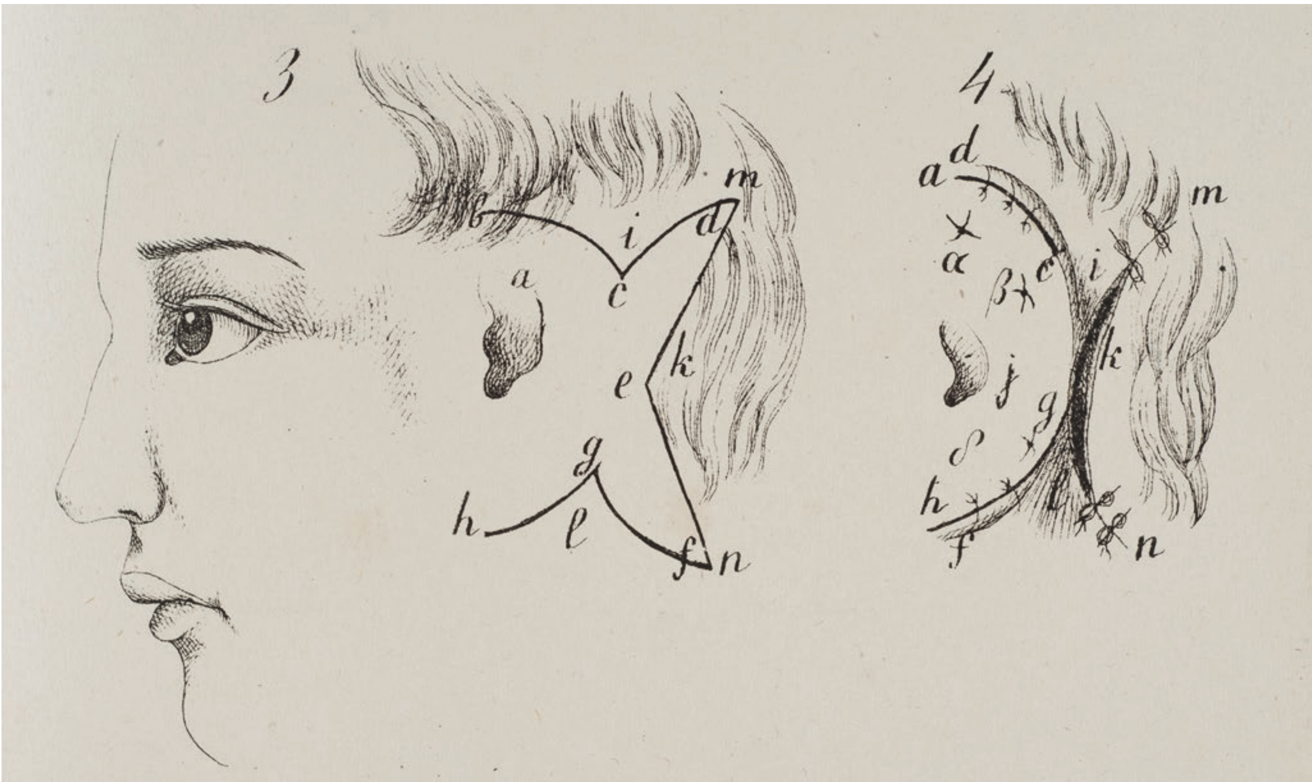


Fig. 7.70 Total auricle reconstruction with a skin flap outlined in the mastoid area according to J. von Szymanowski. (From Szymanowski J. *Operatzij na Poverchnosti Tchelovetcheskago Tela*. Kyiv, Davidenko, 1865. Plate 76)

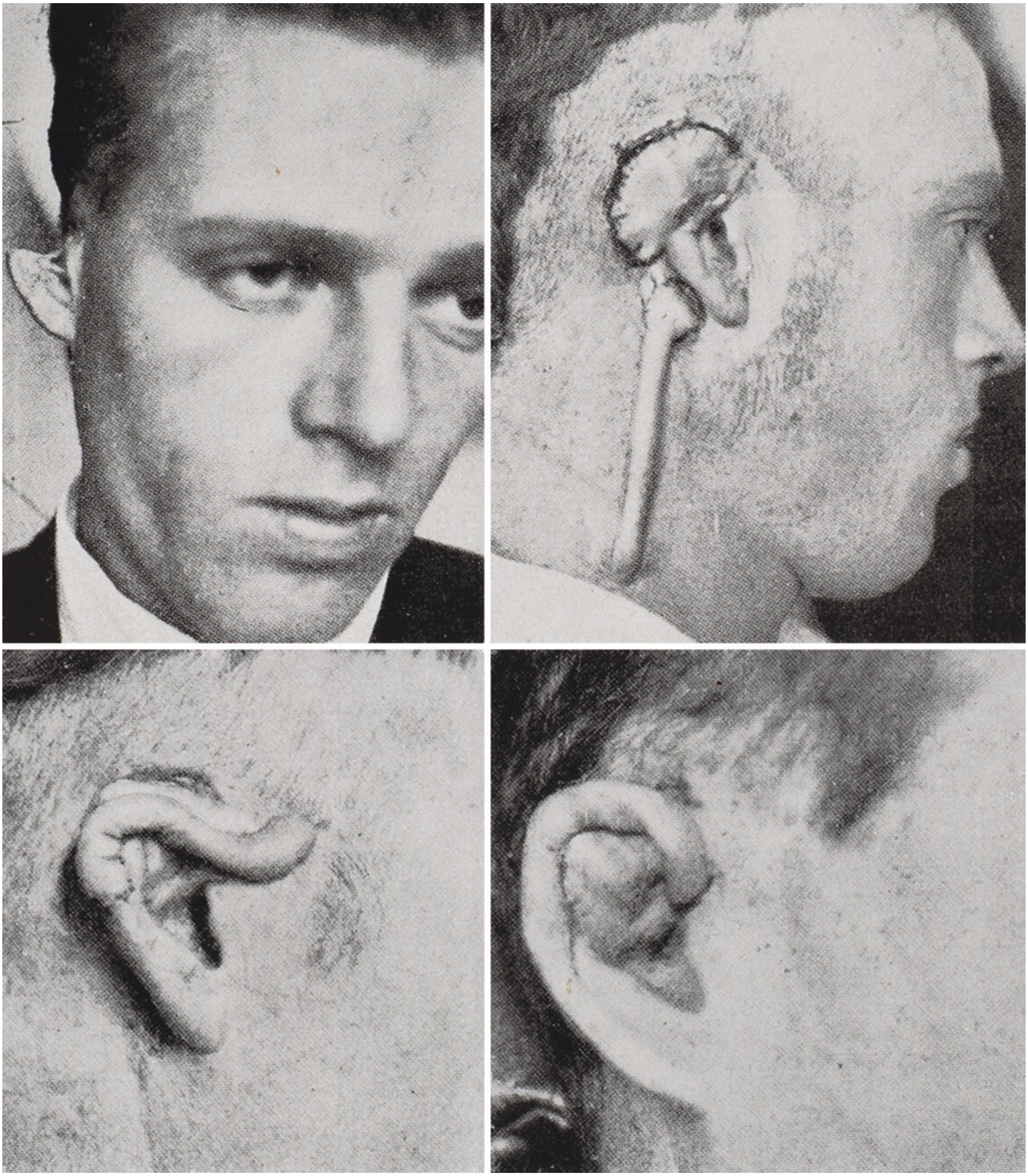


Fig. 7.71 Post-traumatic auricle reconstruction according to S. Pierce. *upper left*: pre-operative situation; *upper right*: the tubed flap is transferred from the thorax to the mastoid; *lower left*: the flap is modelled over the grafted cartilage to reconstruct the antihelix; *lower right*: result after surgery. (From: Pierce S. *Reconstruction of the External Ear. Surg Gynec & Obst*. 1930; 50: 601–605)

7.8.2 Reconstructive Otoplasty for Congenital Malformations

The typical ear malformation is represented by microtia (or small auricle). Only the auricle's rudiments are usually present, with an oblong ridge resembling the helix. Conductive hearing loss is the characteristic of the deformity, due to the absence of the external auditory meatus and of the ossicular chain. **Ambrose Paré** first illustrated auricle replacement by prosthesis [159] (Fig. 7.67). In the 1930s, **Jacques Joseph** [30] proposed the introduction of an ivory prosthesis (Fig. 7.72 *left*) in the lateral side of the neck (Fig. 7.72 *upper right*) and its upward relocation toward the mastoid area (Fig. 7.72 *lower left*). He presented the post-operative result (Fig. 7.72 *lower right*). **Sir Harold Gillies** emphasized the difficulty of providing an adequate supporting framework for congenital auricle reconstruction and summarized the different treatment options: (a) foreign body implant, with a high risk of extrusion; (b) autologous costal cartilage graft, with the possibility of warping; and (c) homologous graft using maternal ear cartilage. In 1937, he published a paper on the use of maternal cartilage for ear reconstruction and presented ten cases, six of them congenital and four post-traumatic [163].

Because of the complexity of the reconstruction, effective surgery for congenital ear reconstruction started in the 1950s when **Radford C. Tanzer** (1905–2003) developed a multistage procedure that was systematized in a relatively recent period.

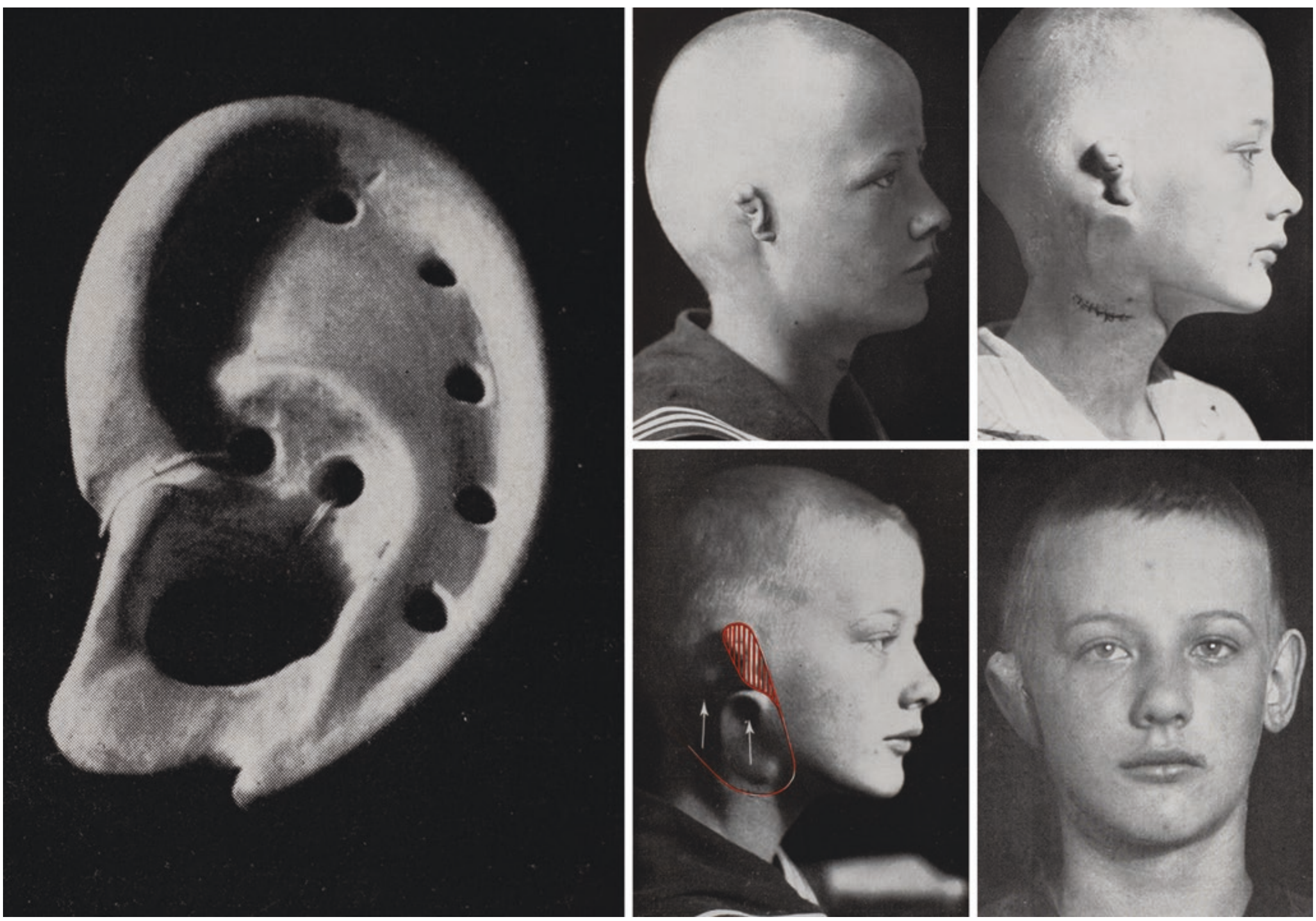


Fig. 7.72 Auricle reconstruction for congenital absence or the auricle (microtia). *Left*: the ivory prosthesis; *right*: the operative procedure. Introduction of the prosthesis in the lateral side of the neck; upward elevation of the prosthesis to the mastoid area; final result. (From: Joseph. J. *Nasenplastik und sonstige Gesichtsplastik*. Leipzig, Curt Kabitzsch, 1931, p. 727)

7.8.3 Cosmetic Otoplasty

The first otoplasty for macrotia, an operation bordering between aesthetic and reconstructive surgery, was done in 1856 by the Neapolitan **Giuseppe de Martino**. He successfully carried out the reduction of an abnormally developed auricle in two stages, using a wedge excision. The work was presented and discussed before the prestigious *Imperial Academy of Medicine of Paris* by **M. Poiseuille** and **Jobert de Lamballe** in the same year [164].

7.8.4 Correction of Prominent Ears in the USA

As we have seen (see Sect. 7.2.2), the first purely aesthetic procedure reported in the literature was the correction of prominent ears, performed in 1881 by **Edward Talbot Ely** (1850–1885), a surgeon from New York. Ely operated on a 12-year-old boy affected by bilateral prominent ears, and psychologically disturbed by this deformity, in two stages. During the first operation, under ether anesthesia, he excised an elliptical piece of cartilage (about 1–1.8 inches long and ½ inch wide) with the overlying skin from the right retro-auricular sulcus and sutured the margins together [17] (Fig. 7.73). Forty days later, he repeated the same operation on the contralateral side. Healing was uneventful. Commenting on the favorable outcome, Ely wrote, "I don't know whether this is a new operation for the deformity in question or not, but if allowed to judge from a single case, I can highly recommend it." Ely's life was tragically short. He died from pulmonary tuberculosis, aged 35 [18].

W. W. Keen, from Philadelphia, removed an ellipse of skin and underlying cartilage from the retro-auricular sulcus, without damaging the anterior surface [165]. A similar method was adopted by **George Howard Monks**, **Charles C. Miller**, and **Frederick Strange Kolle**.

George Howard Monks (1853–1933) (see Sects. 5.2.8.7 and 7.2.3.1) was one of the first surgeons who took care of the correction of prominent ears in the USA. In three patients, all children, he excised skin alone from the retro-auricular sulcus, whereas in an adult, he removed skin and a strip of cartilage, without suturing the wound, obtaining an excellent result. He concluded that in adults, skin and cartilage should be excised simultaneously and that the same technique should be applied in children with rigid cartilage [166].

Charles C. Miller [124, 125] and **Frederick Strange Kolle** [121] proposed the excision of a large ellipse of skin from the retro-auricular sulcus and mastoid and closure of the defect by sutures. Miller emphasized that cartilage excision should be done only in selected cases.

A great breakthrough in improving this operation came from **William Henry Luckett** (1872–1929). In 1910, he carefully analyzed the deformity from an anatomical standpoint, observing that "the cartilage of the concha normally bends outwards at an almost right angle from the head until it reaches the antihelix, which is formed by being folded backwards upon itself." In prominent ear, the cause of protrusion was essentially the absence of antihelix folding. He proposed the removal of a long ellipse of skin and cartilage from the whole length of the auricle with the aim of correcting this unpleasant anomaly. Reconstruction was by sutures passed through the cartilage, from above downwards, to re-establish the missing fold [167] (Fig. 7.74). Luckett concluded his paper by stating: "In an ear with a very thin flexible cartilage, I think it would be possible to reconstruct the antihelix and set the helix close to the head without excising a segment, or even incising the cartilage, simply by fluting or folding the cartilage at the proper site, and passing the suture in such a manner as to maintain the fold." His anatomical considerations remained a reference point for all otoplasty techniques that have appeared ever since. Luckett's method was later refined and popularized by **J. C. Mustardé** [168] and **S. J. Stenström** [169].

For cosmetic otoplasty, **Lyons Hunt** (1882–1954) proposed and illustrated various techniques for the management of macrotia, hypertrophic or missing earlobe, and protruding ears in 1926 [128].

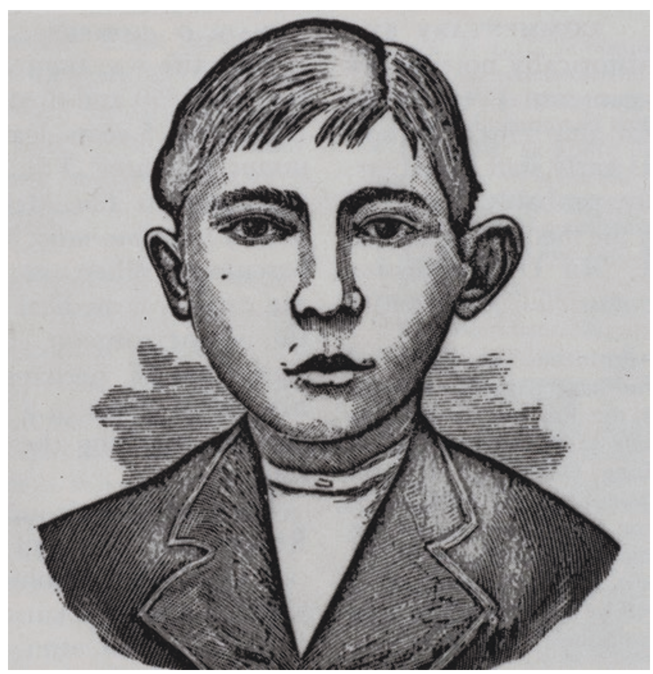


Fig. 7.73 Correction of prominent ears according to E.T. Ely (1850–1885). Result after the first stage procedure performed on the right ear. First aesthetic procedure in medical literature. (From: Ely ET. *An operation for prominence of the auricles. Arch Otology*. 1881; 10: 97)

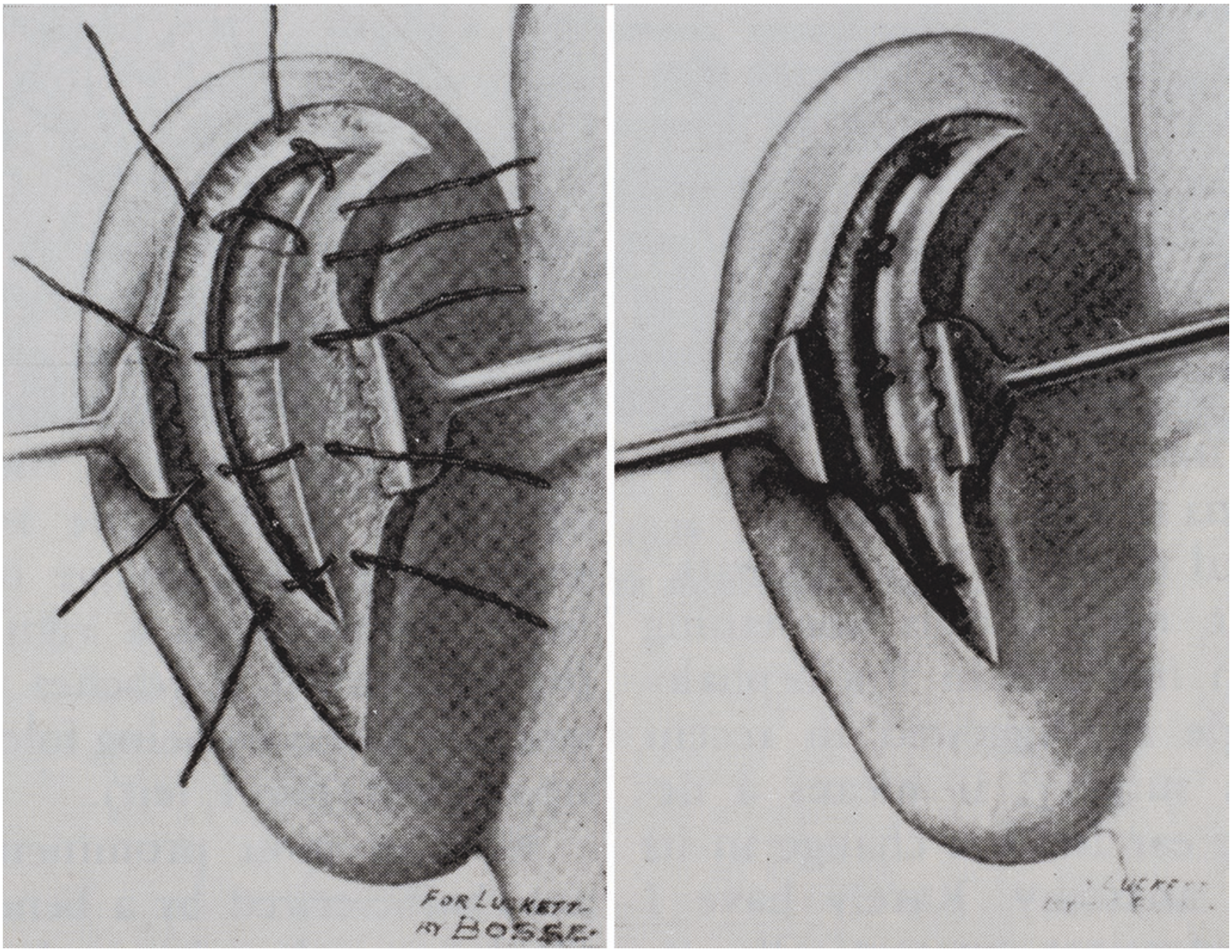


Fig. 7.74 Correction of prominent ears according to W.H. Luckett (1872–1929). Removal of a long ellipse of skin and cartilage to create the missing antihelix fold. (From: Luckett WH. *A new operation for prominent ears, based on the anatomy of the deformity. Surg Gynec & Obst*. 1910; 10: 635–637)

7.8.5 Correction of Prominent Ears and Aesthetic Otoplasty in Countries Other than the USA

Jacques Joseph (1865–1934) was among the first surgeons to perform aesthetic otoplasty in Europe. He began his medical career as an orthopedic assistant to **Professor Julius Wolff** who was head of the University Orthopaedic Clinic at *La Charité Hospital* in Berlin (see Sect. 7.2.3.2). One day in 1896, a 10-year-old boy visited Joseph in his office. He didn't want to attend school anymore, being severely psychologically disturbed by his protruding ears. Eager to take care of the poor boy, Joseph was seeking a solution to help him. Was the Orthopaedic Clinic the correct place for an aesthetic procedure? How to obtain Professor Wolff's permission? After a long internal debate, he finally decided to proceed with the operation. Through a posterior approach, he exposed the concha, removed a strip of cartilage along with the redundant skin from the retro-auricular sulcus, sutured the margins and covered the ears with a heavy bandage. A few months later, he presented the result obtained before the *Berlin Medical Society* [170]. Professor Wolff did not appreciate the unauthorized procedure, and despite the successful outcome, he fired Joseph immediately so that, at 31, he had to move into private practice—but this was fortunate. He dedicated himself to the management of nasal and ear deformities, achieving outstanding results from almost every operation he undertook and publishing numerous papers on these topics. In 1912, he was asked to contribute to the famed *Handbuch der Speziellen Chirurgie des Ohres und Oberen Luftwege* (Textbook of Specialist Surgery of the Ear and Upper Airway) [29]. His comprehensive chapter on otoplasty was illustrated with numerous drawings and photographs of patients operated on for different cosmetic otoplasties, such as correction of prominent ears (Fig. 7.75), or reduction of excessive growth of the earlobe (Fig. 7.76), or macrotia. During his long professional career, he did not limit his horizon to the correction of ear and nose deformities, but continuously developed new techniques of a reconstructive or aesthetic nature.

In 1903, instead of excising a strip of cartilage in the traditional way, **Hippolyte Morestin** folded the cartilage and maintained it in position with chromic sutures, 7 years before **W. H. Luckett** and 60 years before **J. C. Mustardé** [168, 171].

Long-term, two complications were noticed: the disappearance of the retro-auricular sulcus, caused by the excision of a strip of skin, and relapse of the obtuse auriculo-temporal angle.

To contrast this tendency, the Austrian **Robert Gersuny** advocated the fixation of the conchal cartilage to the periosteum of the mastoid, a technique that has been reproposed over the years with stitches [73, 172–174], or with strips of fascia [175].

Ernesto Malbec (1903–1991) from Argentina [176], **Ernst Eitner** (1867–1955) from Austria [81], **Julien Bourguet** (1876–1952) from France [138], and **Antonio Prudente** (1906–1965) from Brazil [177] made significant contributions to the development of the technique, with skin and cartilage excision but with different designs, obtaining successful outcomes. In particular, Bourguet emphasized the importance of the antihelix plication (Fig. 7.77).

Fig. 7.75 Correction of prominent ears according to Jacques Joseph (1865–1934). *Left*: pre-operative situation; *right*: result after surgery. (From: Joseph J. *Korrektive Nasen- und Ohrenplastik.* In: Katz L, Preysing H, Blumefeld F (eds.) *Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege*. Würzburg, Kabitsch, 1912. p. 175)

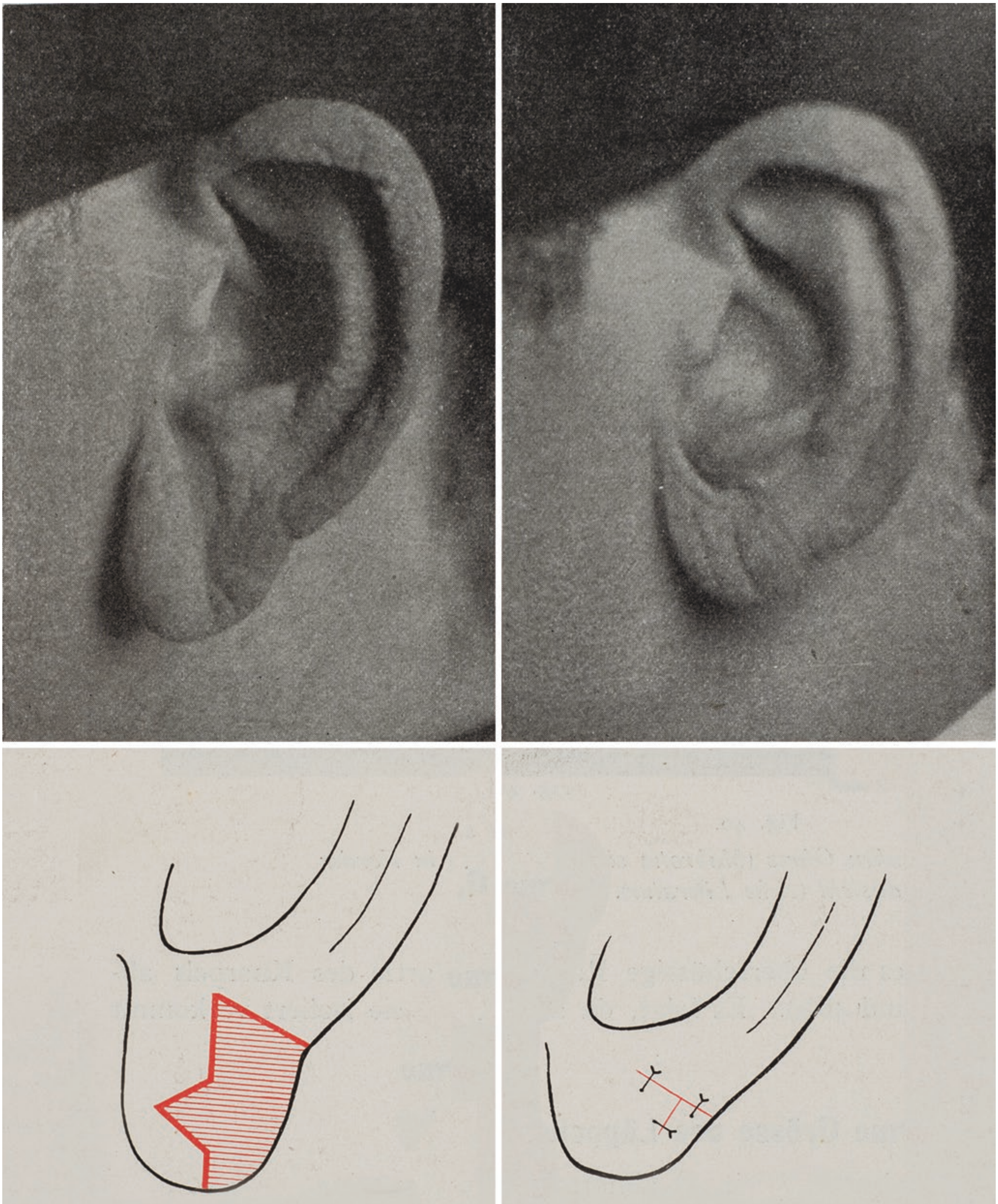


Fig. 7.76 Reduction of earlobe hypertrophy. *Left*: pre-operative situation; *right*: result after surgery; *lower*: scheme of the adopted procedure. (From: Joseph J. *Korrektive Nasen- und Ohrenplastik*. In: Katz L, Preysing H, Blumefeld F (eds.) *Handbuch der speziellen Chirurgie des Ohres und der oberen Luftwege*. Würzburg, Kabitsch, 1912. p. 170)

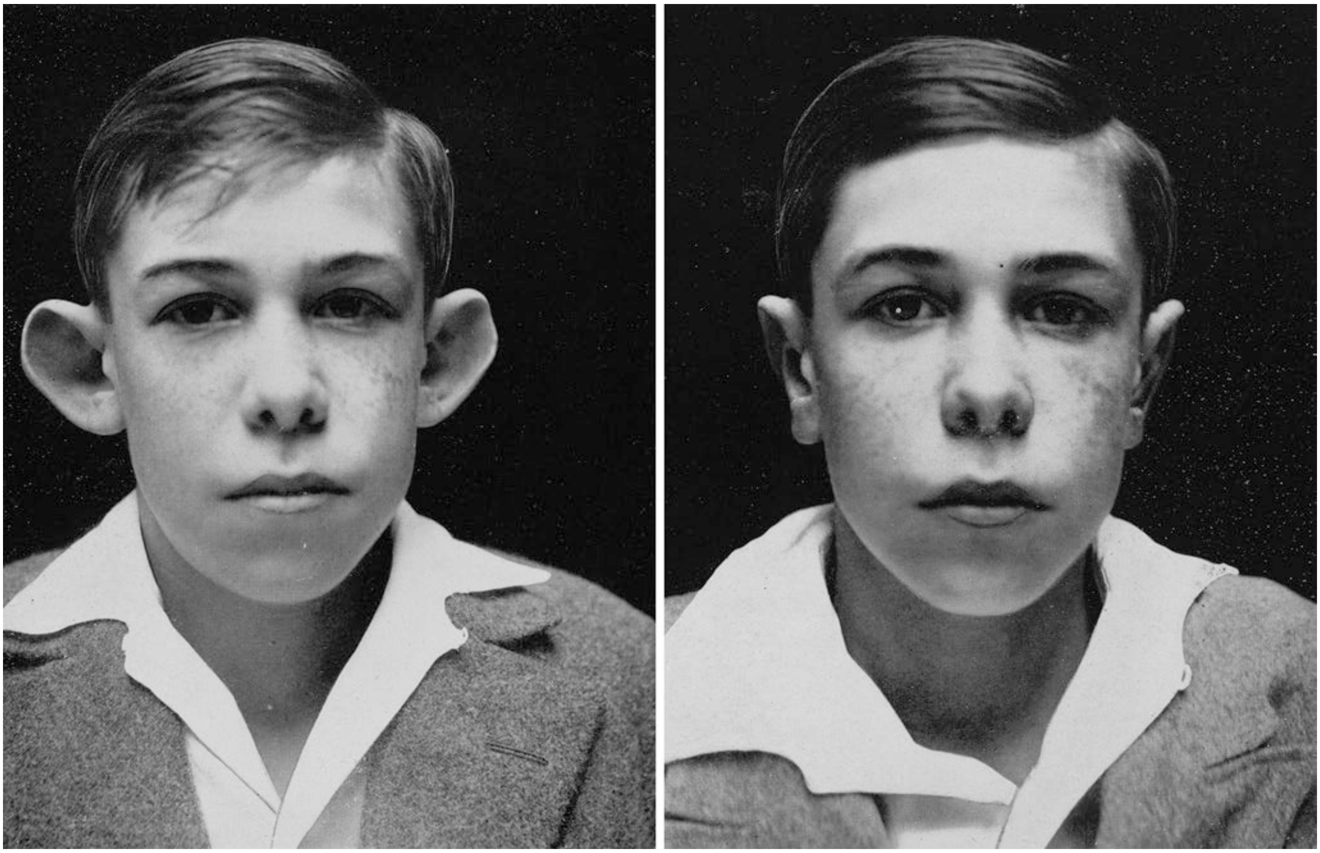


Fig. 7.77 Correction of prominent ears according to Julien Bourguet (1876–1952). *Left*: pre-operative situation; *right*: result after surgery with plication of the antihelix fold. (From: Bourguet J. *La Véritable Chirurgie Esthétique du Visage*. Paris, Plon, 1936. p. 44–45)

7.9 Conclusions

Cosmetic surgery appeared at the end of the nineteenth century with simple, minimally invasive procedures, usually performed on the face, under local anesthesia and on an outpatient basis. Initially, surgeons who considered themselves "reputable" disregarded the emerging specialty, believing that placing healthy patients at risk was counter to the ethical principles of the medical profession. Thus, cosmetic surgery became the territory of quacks and charlatans. Most Americans and Europeans condemned cosmetic surgery, which was regarded with suspicion. Moral, familial, religious, and last but not least economic reasons were the causes of this position. However, in the interwar period, the culture of beauty and the desire for perfection prevailed.

The natural reaction against the tragedy of WWI and the drama of the *gueules cassées* was the most likely explanation. Plastic surgery, which included *in se* either the reconstructive or cosmetic concept, rapidly took shape, also thanks to the recognition of plastic surgery as an independent surgical specialty. The "reputable" plastic surgeons in the USA and in Europe started to dedicate themselves to cosmetic surgery obtaining fine results. Over the years, plastic surgery expanded considerably, managing different areas of the human body beyond the face, such as breast, arms, and abdomen; improving the nose, ears, eyelids, aging faces, pendulous breasts, and pendulous abdomens. The social role of the discipline was emphasized by **Suzanne Noël** in her book *La Chirurgie Esthétique. Son Rôle Sociale* [113].

During the interwar period, cosmetic surgery saw an incredible boom in the USA, primarily in New York and Chicago, and in Europe, particularly in Paris, Berlin, and Vienna. Practically speaking, all the most common procedures for facial rejuvenation, reduction mammoplasty, and nasal deformities were established, creating the basis for the development of modern aesthetic surgery.

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The Impact of Anatomy on the Evolution of Surgery

8

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The Impact of Anatomy on the Evolution of Surgery: Salient Events in Anatomy

- In remote ages, anatomical knowledge is gained through the study of animals. Human dissections are not practiced. *On Anatomy* by **Hippocrates** (ca.460–375 BC) is regarded as the earliest tract on this topic that we possess, whereas the numerous treatises on animal anatomy and physiology written by **Aristotle** (384–322 BC) are considered to be the origin of comparative anatomy.
- About 330 BC, a School of Medicine is established in Alexandria where anatomy is taught. **Herophilus of Chalcedon** (ca.335–280 BC) is the first physician who systematically performs dissections of animals and possibly of humans, whereas **Erasistratus of Chios** (ca.304–259 BC) is a physiologist more than an anatomist.
- In Rome, **Claudius Galenus** (or Galen) (ca.AD 129–199) bases his anatomical knowledge on the dissection of animals, studying their bone structure, muscles, and nerves. He describes the recurrent laryngeal nerve, eponymously named Galen's nerve, whose section causes dysphonia.
- At the Medical School of Salerno (ninth–thirteenth centuries), dissections are not carried out at any time. For the study of anatomy, the school uses Copho's *Anatomia porci* (Anatomy of the Pig) as a textbook.
- Universities are founded in the second half of the eleventh century. The first university in Europe is established in 1088 in Bologna. Cadaveric dissection is allowed in Bologna beginning in 1281. Physicians, surgeons, and students are entitled to attend cadaveric dissections. **Mondino de' Luzzi** (1270–1326) is the first lecturer in anatomy. In 1316, he writes *Anothomia*, the first tract entirely devoted to anatomy.
- Thanks to the discovery of printing in 1436, Mondino's *Anothomia* remains popular for over two centuries and is re-issued several times.
- Numerous surgeons come to Bologna to improve their surgical knowledge through cadaveric dissections. Among them, two French surgeons, **Henri de Mondeville** (ca.1260–1320) and **Guy de Chauliac** (ca.1298–1368) regard anatomy as a fundamental part of surgery.
- In the Italian Renaissance, painters and sculptors such as **Leonardo da Vinci** (1452–1519), **Michelangelo Buonarroti** (1475–1564), **Albrecht Dürer** (1471–1528), and **Raphael Sanzio** (1483–1521) perform dissections personally in order to reproduce human forms and proportions correctly in their works of art.
- No anatomical illustrations have come to us from ancient times, although some may have existed. Until the fifteenth century, anatomical images in manuscripts are diagrams and sketches. With the discovery of printing, anatomical illustration is introduced. In 1491, the medical encyclopedia *Fasciculo de Medicina* by **Johannes de Ketham** (*fl.* fifteenth century) contains the first image of a cadaveric dissection to illustrate the *Anothomia* by Mondino de' Luzzi.
- Pre-Vesalian anatomy includes all the anatomical textbooks printed in the first decades of the sixteenth century, before the *Fabrica* by Andres Vesalius. *Commentaria … super Anatomia Mundini* (Commentary on the Anatomy of Mondino) is the first illustrated pre-Vesalian anatomical textbook, issued in 1521 by **Berengario da Carpi** (ca.1460–1530), followed in 1537 by *Anatomiae, hoc est, corporis humani dissectionis* (Anatomy, or the Dissection of the Human Body) by **Johannes Dryander** (1500–1560), and by *De Dissectione Partium Corporis Humani* (Dissection of the Parts of the Human Body) by **Charles Estienne** (1504–1564) in 1545.
- In 1543, **Andreas Vesalius** (1514–1564) publishes *De Humani Corporis Fabrica* (On the Structure of the Human Body) an epoch-marking textbook which provides a complete detailed description of the human body with artistic illustrations drawn by **Johannes Stephan van Calcar** (ca.1499–1546), a disciple of Titian.
- In 1537, Vesalius is appointed Lecturer of Anatomy and Surgery at Padua University, initiating the great school of anatomy in Padua that lasts for almost a century having **Realdo Colombo, Gabriele Fallopio, Hieronymus Fabricius ab Aquapendente, Giulio Casserio, Adrianus Spigelius**, and **Johannes Vesling** as teachers. In about 1650, after Johannes Vesling's death, the anatomical school of Padua comes to an end.
- Under Fabricius (1562–1609), Padua is regarded as one of the most celebrated international teaching centers for medicine in Europe, equipped with an anatomical theater that he builds. Among his students are: **William Harvey** (1578–1656) from England, **Adrian van der Spieghel** (1578–1625) from Belgium, **Caspar Bauhin** (1560–1624) from Switzerland; **Peter Paaw** (1564–1617) from The Netherlands; **Caspar Bartholin** (1585–1629) from Denmark; and **Olaus Worm** (1588–1654) from Denmark.
- In the sixteenth century in Rome, the tradition of anatomy is established by **Bartolomeo Eustachio** (ca.1510–1574) and by his disciple **Juan Valverde de Hamusco** (ca.1525–1587), and in the seventeenth century, by **Pietro Berrettini da Cortona** (ca.1596–1669).
- In the seventeenth and eighteenth centuries, anatomical dissection is practiced in different European countries.
  - In *Italy*, in Milan, **Gaspare Aselli** (1581–1625) discovers lacteal circulation; in Venice, **Giovanni D. Santorini** (1682–1737) describes mimic muscles; in Bologna, **Antonio M. Valsalva** (1666–1723) illustrates the inner ear in *De Aure humana Tractatus* in 1704; in Tuscany, **Paolo Mascagni** (1755–1815)

describes lymphatic circulation in a splendid atlas, *Vasorum lymphaticorum historia et Ichnographia*, published in 1787; and in Pavia, **Antonio Scarpa** (1752–1832), a great anatomist and surgeon, publishes *Delle Ernie* in 1809, in which he shows the abdominal fascia which eponymously bears his name.
- In *Germany*, the Swiss **Albrecht von Haller** (1708–1777) is one of the most learned personalities of all time—a scientist, physiologist, anatomist, botanist, poet, and prolific writer—he is also an avid book collector.
- In *Denmark*, **Thomas Bartholin** (1616–1680) describes lymphatic circulation sharing priority with the Swedish **Olof Rudbeck** (1639–1702).
- In *The Netherlands*, mainly in Leiden and Amsterdam, great anatomists including **Frederik Ruysch** (1638–1731), **Govard Bidloo** (1649–1713), and **Bernhard Albinus** (1697–1770) write amazing illustrated anatomical atlases.
- In *France*, in Paris, **Guichard Joseph Duverney** (1648–1730) and **Joseph Winslow** (1669–1760) teach anatomy in the newly built St. Côme Anatomical Theater. **Jacques Fabien Gautier d'Agoty** (ca.1717–1786) publishes impressive colored atlases about cadaveric dissection, using the mezzotint technique.
- In *England*, **William Harvey** (1578–1657) discovers blood circulation. In 1628, he publishes *De Motu cordis et Sanguinis in Animalibus*, one of the most important works in the history of medicine. **Thomas Willis** (1621–1675) makes important studies of brain anatomy, describing the arterial anastomotic system forming the circle which eponymously bears Willis' name. **William Cowper's** (1666–1709) name is unpleasantly associated with a story of piracy when he publishes Bidloo's anatomical plates under his name, without authorization. **William Cheselden** (1688–1752) issues *Osteographia* in 1733, with drawings obtained from a *camera obscura*. **John Bell** (1763–1820) publishes *Anatomy of the Muscles, Bones and Joints* in 1793 with macabre illustrations of anatomical dissections.

• In the nineteenth century, lithography, a cheaper technique for printing illustrations, is introduced.
• In *France,* in 1821, **Jules Cloquet** (1790–1883) issues *Anatomie de l'Homme* (Anatomy of Man) with 300 plates, the first anatomical textbook using lithography.
• **Jean-Baptiste Bourgery** (1797–1849) publishes *Traité complet de l'Anatomie de l'Homme*, a monumental eight-volume large folio work with more than 700 colored lithographic plates over a 23-year period, from 1831 to 1854, showing the whole anatomy of the human body with original dissections. At Bourgery's death (1849), *Traité complet* is finished by his student **Nicholas Henry Jacob**.
• In *England,* **Charles Bell** (1763–1820), a great neuroanatomist and surgeon, describes facial palsy in 1821, eponymously named Bell's palsy.
• **Joseph Swan** (1791–1874) publishes the most complete textbook on neuroanatomy in English literature in 1830.

8.1 The Relationship Between Anatomy and Surgery

The very nature of the different organs, their interactive relationships, the complicated vascular and nervous networks, and the roles played by muscles related to the physiology of movement, could only be perceived through dissections. Without them, knowledge of the composition of the human body remained an obscure matter and anatomy a neglected branch of medicine. Dissections of the human body started in the second half of the thirteenth century. Before that, anatomical knowledge was gained through the study of animals.

In this chapter, we shall review the birth and development of the study of anatomy and its evolution through the centuries, the origin of anatomical illustration, and the role that anatomy played in the progress and growth of surgery: in other terms, the close relationship between anatomy and surgery. From earliest times, cadaveric dissections and anatomical illustrations provided practical and useful information for surgeons.

Before starting a surgical operation, surgeons would refer to anatomical texts to study the figures in-depth, to have clear knowledge of what they were going to cut, what type of structures they would encounter under the surface of the skin, the connections to adjacent structures, and of course the location of vessels and nerves to avoid potential damage. With the progress of surgery, a more and more detailed and precise record of human anatomy became increasingly necessary.

8.2 The Remote Origins of Anatomy

8.2.1 Greek Anatomy

The greatest medical figure from antiquity was **Hippocrates** (ca.460–375 BC) (see Sect. 1.5.1), a physician, not an anatomist, despite the fact that he wrote two tracts with anatomical relevance. In the first one, *Wounds of the Head*, he reported on the different forms of skulls and types of head sutures [1], and in the other, *On Anatomy*, included in the *Corpus Hippocraticum* (Hippocratic collection), is a fragment of a more detailed work, regrettably lost, most likely the earliest tract on this topic that we possess [2].

The philosopher **Aristotle** (384–322 BC) wrote numerous treatises on animal anatomy and physiology such as *De Animalium motione* (On the movement of Animals), *De Animalium incessu* (On Animal gait), and *De generatione Animalium* (On Animal generation). For this, he is regarded as the founder of comparative anatomy. He probably never performed human dissections; nevertheless, he left manuscripts with schematic diagrams representing the human aorta, the vena cava, and the genito-urinary system [3]. He advocated that teaching of anatomy should be done through *paradigms, schemes and diagrams* (Book One, Chapter 7 of *De generatione Animalium*). Despite the Greeks being against cadaveric dissection for scientific purposes, Aristotle played an important role in the development of anatomy, acknowledging its key role. He was the tutor of **Alexander the Great** (356–323 BC), the founder of the Egyptian city of Alexandria in 331 BC, the cultural center of his empire, which housed one of the most important libraries of the period, estimated with more than 400,000 volumes.

8.2.2 The Medical School of Alexandria

In Alexandria, about 311 BC, a School of Medicine was established where anatomy was studied and possibly autopsies were practiced, although there is no evidence to support this theory.

Herophilus of Chalcedon (ca.335–280 BC) was the first scientist to systematically perform dissections of animals. It is not clear whether he dissected human cadavers. He recognized the brain as the central organ of the nervous system and divided nerves into motor and sensory. He made a sharp distinction between arteries and veins, and gave details about the uterus and the liver. He recorded his findings in over nine works which are all now lost.

Erasistratus of Chios (ca.304–259 BC) was a physiologist more than an anatomist. He studied not only the structure of the organs of the human body, but also their function. He described the brain with its convolutions, the cerebral ventricles, the meninges, and the heart and its ventricles.

8.2.3 Roman Anatomy

Aulus Cornelius Celsus (25 BC–AD 50), regarded as a writer not a physician, was the author of *De Medicina* (On Medicine), compiled in about AD 30, in eight volumes [4] (see Sect. 1.7.1). The surgical part, Volumes 7 and 8, includes the anatomical description of the eye and of the skeleton, possibly derived and adapted from a lost original Greek work of the Hippocratic collection [2].

Claudius Galenus (or Galen) (ca.AD 129–199) (see Sect. 1.7.2) was the greatest physician after Hippocrates. His anatomy should be regarded under two aspects: descriptive and philosophical. The physiology of the human body was illustrated in *De usu partium* (On the usefulness of parts), composed between AD 165 and 175, whereas the anatomy in *De Anatomicis Administrationibus* (On Procedures in Anatomy) was mainly based on the dissection of animals such as pigs and apes. He studied the structure of bone and muscles, showed that nerves arise from the brain or spinal cord, and observed that the section of the recurrent laryngeal nerve, eponymously named Galen's nerve, caused dysphonia [2].

With the downfall of the western Roman Empire in AD 476, interest in anatomy declined and then disappeared almost completely as the Dark Ages began. The deterioration of the study of anatomy paralleled the general decay of the sciences and the arts.

8.2.4 Arabic Domination

Alexandria, already in decline, was invaded by the Arabs in AD 642 who established their supremacy over Syria, Mesopotamia, Egypt, and Spain. In Cordoba, Toledo, and Seville (Spain), they established teaching academies. By tradition, Arabs were bibliophiles, and the positive result was that the cultural heritage derived from Greek works was preserved. They founded libraries in various cities and medical manuscripts were translated into Syriac. Thus, Galen's writings on anatomy reached us partly through the original Greek sources and partly through the translation made from the Arabic into Latin. However, the Arabic physicians did not add much to anatomical texts because of the strong opposition to performing human dissection, forbidden by the Koran.

8.2.5 The Medical School of Salerno

Around the ninth century, a medical school was established in the Gulf of Paestum, close to Naples, probably by the monks of the neighboring Benedictine monastery of Monte Cassino (see Sect. 2.2). Medical texts, with other medical material, were housed there and the monk **Constantine the African** (ca.1020–1087), born in Carthage, began a series of translations from the Arabic into Latin. He composed *Liber pantegni* (The whole Art), derived from *Kitah al-maleki* (the Royal book), an encyclopedic treatise by the Persian **Hali Abbas**. At the Salerno medical school, Constantine's works and Galen's anatomy were the basic texts. The school was a multilingual training center for medical students, something similar to the school in Alexandria, created fifteen hundred years earlier. Salerno made no significant contributions in the field of anatomy. Dissections were not carried out there at any time. As a textbook for anatomy, the school used **Copho of Salerno's** *Anatomia porci* (Anatomy of the pig). In 1230, a decree issued by Frederick II, King of Sicily and Holy Roman Emperor (1194–1250), obliged students to study the human body for 1 year [5].

8.2.6 Translation of Medical Texts

In the twelfth century, various translators were dedicated to rendering not only the works of Hippocrates and Galen from Arabic into Latin, but also different medical manuscripts, such as the text of the Persian **Hali Abbas** (died 994) containing an important anatomical section, based on Galen. The most important translator was **Gerard of Cremona** (1115–1185), living in Toledo (Spain), who rendered into Latin numerous philosophical and medical manuscripts, in particular the *Canon* by **Avicenna** (980–1037), and the anatomy by the Persian **Rhazes** (died 932). The *Canon* was a medical work that included pharmacology, classification of diseases, surgery, and anatomy. The anatomical section was by far the most consulted text on the subject in the Middle Ages—for more than 500 years.

8.3 The Rise of the Universities: Bologna University and the Teaching of Anatomy

We have already examined (see Sect. 2.3) the profound impact that the founding of universities had in the development of social and political life and in the expansion of culture, certainly the most significant contribution to civilization of the Middle Ages [5]. The oldest university, at least in Europe, was in Bologna, established in 1088, where initially law, theology, and philosophy were taught. As of 1156, an organized Medical Faculty existed. However, the *Studium* of medicine was not officially established until 1295 [2]. The texts used were those of Avicenna, Rhazes, Hippocrates, and Galen. We have seen how surgery developed in Bologna, about the first half of the thirteenth century, with **Hugh Borgognoni of Lucca** and his son **Theodoric Borgognoni,** Bishop of Cervia (see Sect. 2.4.1.1). Their anatomical knowledge came directly from the Arabic texts. There is no evidence of dissection in that period. In the absence of human cadavers, dissections were still performed on animals, usually pigs. **Guglielmo da Saliceto** (ca.1210–1277), the most relevant figure of the period, wrote *Chirugia* in 1275 (see Sect. 2.4.1.2). In Book Four, dealing with anatomy, he described for the first time the motor nerves devoted to voluntary and involuntary muscular contraction.

Cadaveric dissection was allowed in Bologna beginning in 1281, significantly contributing to the development of the study of anatomy. The first female dissection was carried out in 1315 by Mondino [5]. In other cities, dissections occurred much later: in Padua in 1341, in Venice in 1348, in Montpellier in 1376, and in Paris in 1404 [5]. Cadavers were the corpses of executed criminals.

8.3.1 Mondino de' Luzzi: The Formal Organization of Cadaveric Dissections

Born in Bologna, **Mondino de' Luzzi** (1270–1326) studied medicine at the university there, from where he graduated about 1290, becoming a lecturer in anatomy and dissecting a human body in public. He was a disciple of the well-known physician **Taddeo Alderotti** (ca.1223–1303). In 1316, he wrote *Anothomia*, the first tract entirely devoted to anatomy. Before that, anatomy was incorporated within treatises on surgery, to emphasize the importance of the existing relationships between anatomy and surgery.

The text, in Latin, was difficult to read as it had a very complicated nomenclature, derived from Arabic. The anterior abdominal wall was named *Mirach* (Fig. 8.1); the anterior layer of peritoneum, *Syphac*; the omentum, *Zirbus*; the oesophagus, *Meri*; and the veins *basilica*, *cephalica*, and *saphena*. Anatomical description followed the precise sequence in which interior organs appear during dissection and dictated by a problem of decomposition. Mondino began with the parts related to digestion, i.e., the alimentary tract, liver, spleen, and the great abdominal vessels, because they deteriorate more rapidly. He continued with the genital organs; then the thorax and its contents; then the head, from the skull to the cranial base followed by the vertebral column. Dissection concluded with the extremities, less prone to early decay. Mondino introduced several innovations such as the injection of colored liquids into the vessels to highlight the vascular network.

Cadaveric autopsies were performed only in winter to avoid warm weather and usually lasted 3 or 4 days. They were done either in public or privately before groups of physicians or medical students in lecture halls or in the open air to avoid unpleasant smells (Fig. 2.5). The duty of the cadavers' procurement, usually of executed criminals, rested with students. When dissection occurred in the lecture hall, the corpse was placed on a table. For better preservation, cadavers were first dried in the sun. Skeletons and bones were obtained by maceration. Attendance at dissections followed a rigid protocol. The *professor* with his robes, in a chair, a sort of elevated pulpit with a reading desk, supervised and commented on the dissection, while the *ostensor*, with a long stick, pointed out the incision lines and the interior organs. Finally, the *demonstrator* was in charge of the actual dissection. Students and physicians, in academic dress, stood around watching the event, took notes and learned [6] (Fig. 8.2).

Mondino's descriptions were very basic and often inaccurate. The stomach was considered spherical, the liver with five lobes, the uterus divided into seven cells, the heart with three ventricles (Fig. 8.3), and the brain cavity with three ventricles, or vesicles (Fig. 3.12).

Thanks to the invention of printing, about 1436, Mondino's *Anathomia* remained popular for over two centuries and was re-issued numerous times, either included in a medical encyclopedic tract, the *Fasciculus Medicinae* [6], or in dedicated textbooks [7, 18]. Since its first publication in 1478 in Pavia, the medical historian **Ludwig Choulant** (1791–1861) recorded at least 12 editions of Mondino's work, largely used in Bologna and Padua Universities [8].

Fig. 8.1 The *Myrach*, the Arabic term used by Mondino to indicate the abdominal wall. The diagram shows the crossaction of the abdominal musculature. (From: Mondino de' Luzzi. *Anathomia Mundini* cum *Postillis*. Torino, Francesco Silva, 1501)

Fig. 8.2 Colored dissection scene illustrating Mundinus *Anothomia*, drawn either by Gentile Bellini (1429–1507) or by his brother-in-law Andrea Mantegna (1431–1506). Mundinus, in the chair, supervises and comments on the dissection, while the *ostensor*, with a long stick, points out the incision lines, and the *demonstrator* is in charge of the dissection. Students and physicians in academic dress stand around and watch. A basket on the floor is prepared for the interior organs. (From: (Ketham J.) *Fasciculo de Medicina*. Venezia, Johannes & Gregorius de Gregoriis, 1493)

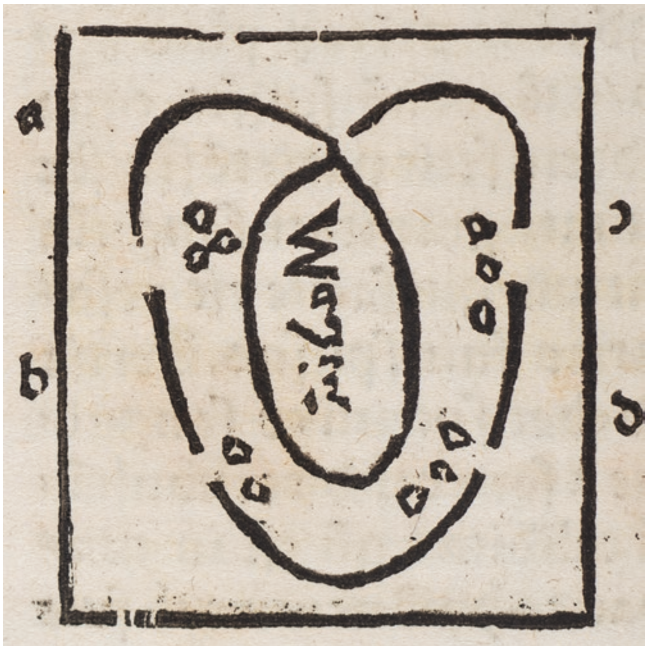


Fig. 8.3 Diagram of the heart with three ventricles, the middle of which is marked *Medium*, printed with reversed letters. Valves are highlighted in the two lateral ventricles in front of the four orifices. Probably the first printed representation of the heart sectioned, very important in the history of the anatomical illustration. (From: Mondino de' Luzzi. *De Omnibus humani Corporis interioribus Menbris* [sic] *Anathomia*. Strasbourg, Martin Flach, 1513)

8.3.2 Official Recognition of Dissections in Bologna

Usually, the right to dissect required negotiation between civil and religious authorities. From the thirteenth century onward, the study of anatomy remained mainly in the hands of the medical school in Bologna where dissections received official recognition in 1405 when they were included in the Statute of Bologna University [2]. Physicians, surgeons, and students were entitled to attend cadaveric dissections. In Padua, official recognition wasn't granted until 1429.

Despite the growing tolerance of the church, dissections were quite rare outside Bologna, even in the latter part of the Middle Ages. Anatomy remained a rather neglected branch of medicine. Teaching of anatomy in France, England, and Germany was poor, not comparable to the Italian medical schools in Bologna and Padua. This may explain the large attendance by foreign students who enrolled in Bologna and Padua Universities to study medicine.

8.3.3 Mondino's Successors and Disciples

After Mondino's death, various lecturers succeeded him in his chair. Apart from **Bertruccio** (died 1347), none contributed significantly to the progress of the study of anatomy. Two French surgeons studied anatomy in Bologna before returning to France: **Henri de Mondeville** (ca.1260–1320) and **Guy de Chauliac** (ca.1298–1368). While Mondino and Bertruccio considered anatomy as part of general medicine, Henri and Guy saw anatomy as part of surgery. Both of them emphasized the importance of the study of anatomy for the surgeon. In the introduction of his *Chirurgie* (Surgery), written between 1306 and 1320, Henri says: "Every artisan has to know the material with which he interacts, otherwise he makes mistakes while working. The surgeon is the artisan of health for the human body; thus, he must know the nature and composition of the body, hence anatomy" [9].

8.3.4 Guido da Vigevano

In 1345, **Guido da Vigevano** (ca.1280–1349), probably a student of medicine at Bologna University, where he learned dissection techniques from Mondino, wrote *Anothomia*, dedicated to King Philip VI. The manuscript, preserved in the Condé Museum in Chantilly (France), is illustrated with 18 full-page, colored figures of cadaveric dissection. The text and images were first reproduced by **Ernest Wickersheimer** in 1926 [10]. Corpses, possibly suspended, are in standing position, to facilitate the representation of the contents of the human body. Dissection follows Mondino's rigid sequence (Fig. 8.4).

Little is known regarding Guido's life. He was born in Vigevano (near Milan), and after his graduation from Bologna University, he practiced medicine in Pavia. In 1323, for political reasons, he migrated to France, where, about 1335, he became the physician to Queen Jeanne of Burgundy and to King Philip VI of Valois. He died in Paris about 1349 [5, 11, 12].

Fig. 8.4 Guido da Vigevano (ca.1280–1349) cadaveric dissection from his *Anothomia* written in 1345. *Upper left*: the incision for opening the abdomen; *upper right*: the incision for opening the thorax. The dissector is bent over the cadaver, indicating that the corpse was suspended; *lower left*: the inner abdomen and chest organs, are fully exposed; *lower right*: the opening of the skull to expose the dura, pia mater, and brain. (From: Wickersheimer E. *Anatomies de Mondino dei Liuzzi et de Guido de Vigevano*. Paris, E. Droz, 1926)

8.4 From the Middle Ages to the Renaissance

A great incentive to expand the study of anatomy and to increase the number of dissections came from the artists. Painters and sculptors of the Italian Renaissance became interested in anatomy for the sake of reproducing human forms and proportions accurately in their works of art. We have ample evidence that, besides **Leonardo da Vinci**, also **Michelangelo Buonarroti** (1475–1564), **Albrecht Dürer** (1471–1528), **Raphael Sanzio** (1483–1521), and other artists, used the scalpel to improve their illustrations of the human body, and left drawings of their own dissections [2]. They studied muscles and their movement, and specific parts of the body such as the face, hands, extremities, breast, and abdomen.

8.4.1 Anatomy and the Arts

Knowledge of anatomy was an essential requirement of the Italian theory of art. By performing cadaveric dissections, artists like **Antonio Pollaiuolo** (ca.1431–1498) and **Leonardo da Vinci** achieved incredible perfection in representing the human body's proportions.

8.4.1.1 Leonardo da Vinci

The best known artist of the Renaissance, **Leonardo da Vinci** (1452–1519), started his painting apprenticeship in 1476 in Florence in the *bottega* (workshop) of **Andrea del Verrocchio** (ca.1435–1488), a painter, sculptor, and goldsmith. Apart from painting, Verrocchio trained Leonardo in anatomy and under Verrocchio's direct supervision, he began a series of anatomical drawings depicting the ideal human form.

For a certain period, Leonardo lived in Rome, and in 1487, he was called to Milan to the court of Ludovico Sforza, nicknamed il Moro (the Moor) (1452–1508). Here he created remarkable works of art, among them the famous fresco, *The Last Supper*, for the *Refettorio* (refectory) of the Church of Santa Maria delle Grazie in Milan. During this time, he made a series of dissections at Ospedale Maggiore of Milan, focused mainly on osteology and myology. Toward the end of 1499, when French troops invaded Milan, he returned to Florence where, besides his primary interest in painting and sculpture, he dedicated himself to science, military engineering, hydraulics, mechanics, biology, the physics of flight, and last but not least—to the anatomy of the human body.

From 1502 to 1506, he dissected more than 30 cadavers in the mortuary of the Hospital Santa Maria Nuova with the specific aim to improve his art and to correctly represent the human figure. He studied the head, the brain, the extremities, the hand, and the action of the muscles—those of the shoulder in particular. He made great use of his anatomical knowledge in his artwork. The hands of the figures in his paintings are an unsurpassed example of perfection. After Florence, he moved back to Rome, and from 1513 to 1516 he continued the dissections at Santo Spirito Hospital, concentrating on the interior organs, the heart and blood circulation.

In 1517, Leonardo moved to France at the invitation of King Francis I, and was given the honorific title of *premier peintre, architecte, et mecanicien du roi* (first painter, architect, and engineer of the King). He was housed in the Château du Clos Lucé, near Amboise, the King's residence on the Loire river, providing him with ample comforts. Here he created numerous artworks for the King—and here he died and was buried in 1519, aged 67.

Leonardo's anatomical drawings include the human skeleton, one of the most outstanding aspects of his work, the head, face, palate (Fig. 9.15), extremities, bones, muscles, female genital organs, human fetus, viscera, course of the nerves, heart, and vascular system. He studied the mechanical functions of the skeleton and the physiology of movement [11] (Fig. 8.5). The drawings, made with a fine pen, were far ahead of their time. For accuracy of representation, his illustrations of the muscular system are among the best drawings (Figs. 8.6 and 8.7). In that period, anatomy was still at the beginning, and ideas about the human body were much confused [11, 12]. He is rightly considered the inventor of anatomical illustration.

At Leonardo's death, the drawings were inherited by his disciple, **Francesco Melzi**, and remained in his possession until his death in 1570. The medical historian **Ludwig Choulant** related that Leonardo's drawings were later acquired by King Charles I of England and kept in a separate closet, hidden at Kensington Palace, until Richard Dalton (ca.1715–1791), appointed Royal Librarian by the Prince of Wales, the future King George III, discovered them at the bottom of a chest [12]. They were properly mounted, but once again remained neglected until 1872 when **Gaetano Milanesi** and **Gustavo Uzielli** brought them to light [13]. Thus, 200 pages of Leonardo's unsurpassed drawings, now in the Royal Collection at Windsor Castle, were left completely unknown for a long period of time, and despite their groundbreaking accuracy of every anatomical detail, they played no role in the development of anatomy. A facsimile reproduction of a selection of the anatomical drawings was an immense task, first undertaken in 1898–1901 by **G. Piumati**, who prepared the critical and literal transcriptions of the text in a two-volume publication. **Theodore Sabachnikoff** sponsored the project [14]. The entire corpus was reprinted by Keele and Pedretti in 1979 [15].

From 1510 to 1511, Leonardo collaborated in his studies with **Marc'Antonio della Torre** (1481–1511), an anatomist and physician from Verona who was appointed Lecturer of Internal Medicine at Pavia University in 1509. Here he met Leonardo, and they began a project to publish a textbook of anatomy together. The illustrations (Figs. 8.5, 8.6 and 8.7) are possibly the result of this cooperation. Unfortunately, della Torre's sudden death from the plague in 1511 precluded the realization of this book, which could have significantly changed the course of anatomy [16]. Thus, appreciation of Leonardo's contribution to anatomy and physiology is primarily a twentieth-century phenomenon.

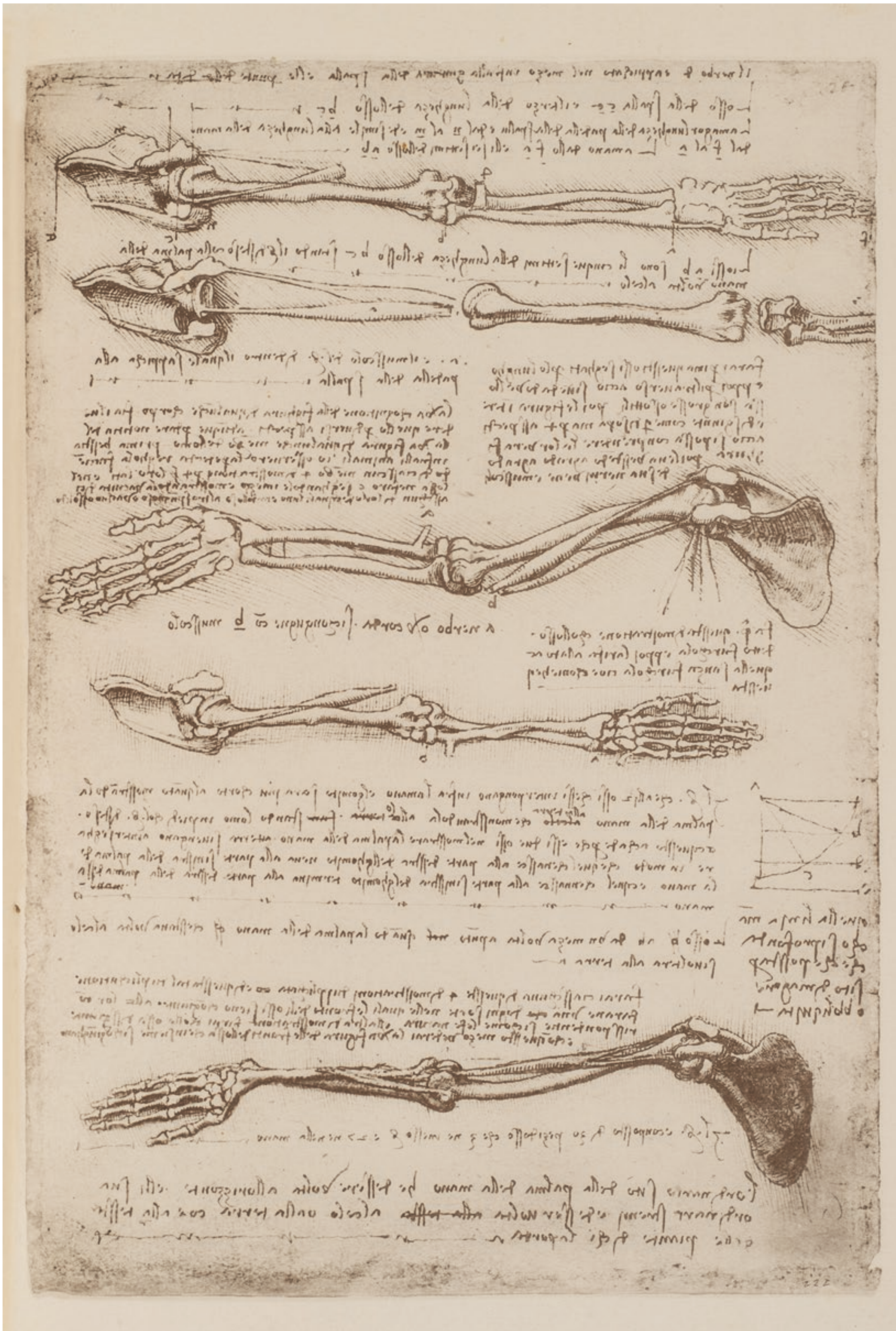


Fig. 8.5 Leonardo da Vinci (1452–1519). The bones and the movements of the upper extremity. The page illustrates the bones of the arm on pronation and supination. About 1510. (From: Leonardo da Vinci. *I manoscritti di Leonardo da Vinci della Reale Biblioteca di Windsor: dell'Anatomia, fogli A-B pubblicati da Teodoro Sabachnikoff*. Paris, E. Rouveyre, 1898)

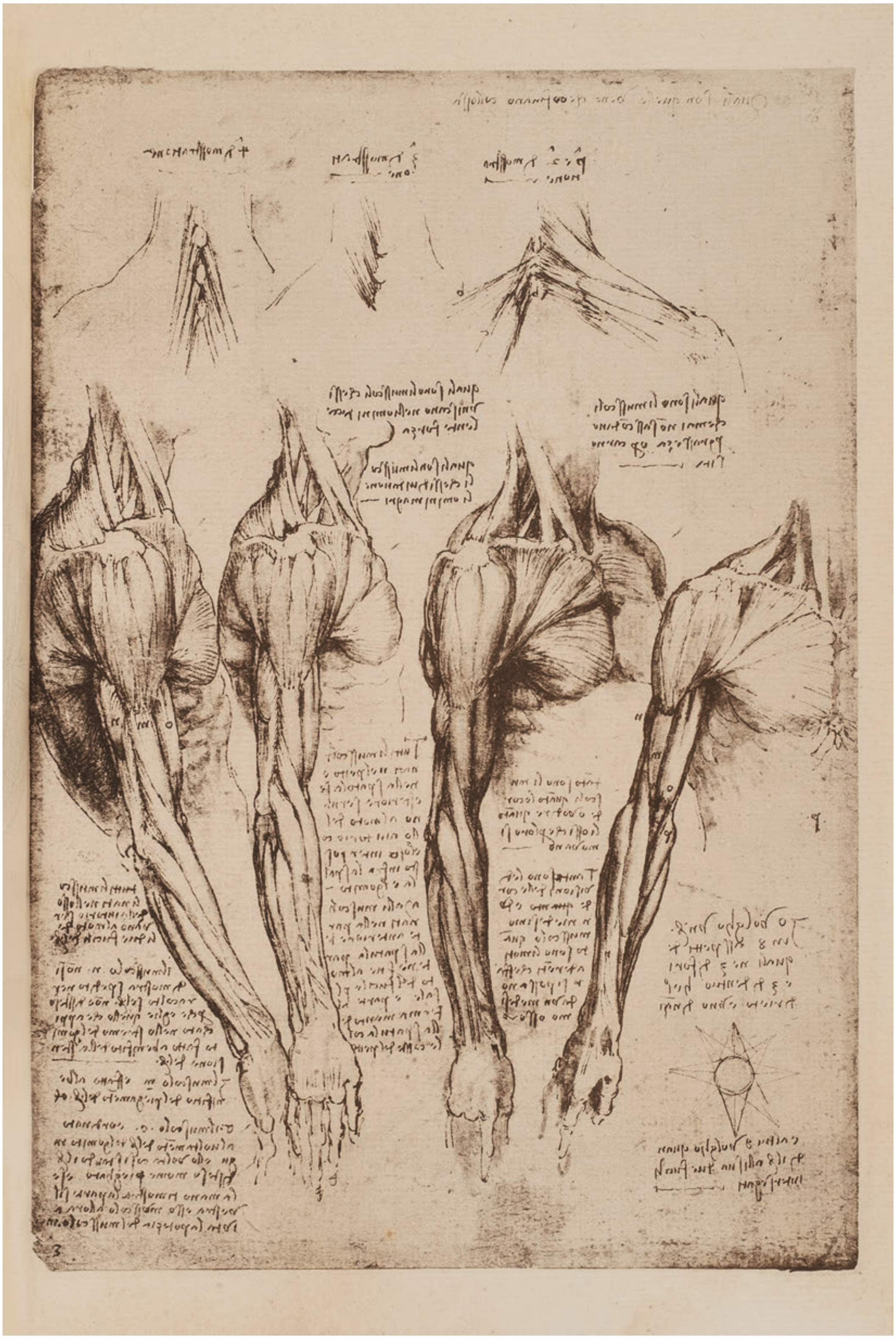


Fig. 8.6 Leonardo da Vinci. The muscles of the neck and shoulder region. The three upper figures represent the muscles attached to the spinous processes of the cervical vertebrae. The four lower figures show the superficial layer of the muscles of the arm, either lateral or anterior aspect. The sterno-mastoid and the pectoralis major are accurately illustrated. About 1510. (From: Leonardo da Vinci. *I manoscritti di Leonardo da Vinci della Reale Biblioteca di Windsor: dell'Anatomia, fogli A-B pubblicati da Teodoro Sabachnikoff*. Paris, E. Rouveyre, 1898)

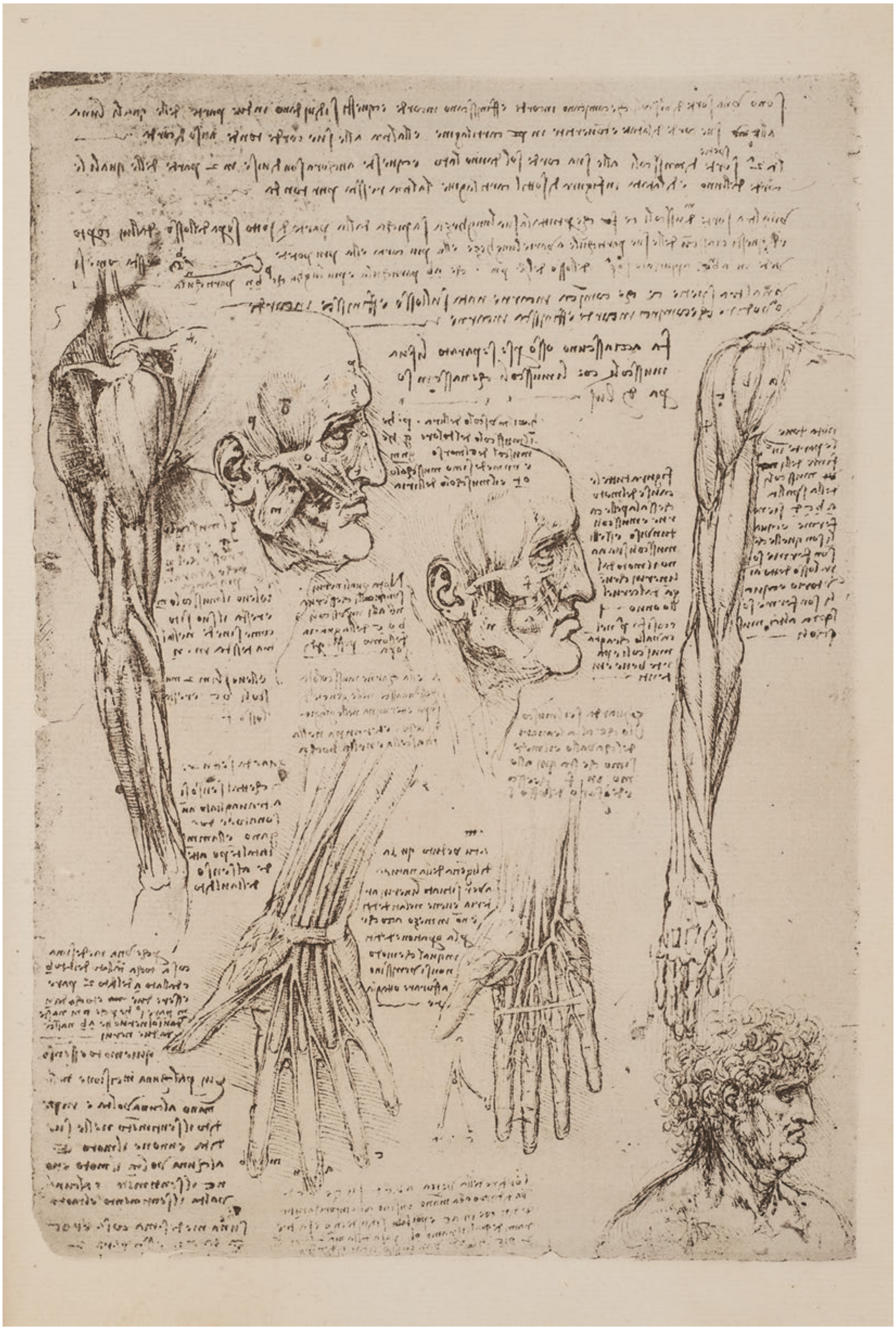


Fig. 8.7 Leonardo da Vinci. The muscles of the upper extremity, face, and hand. At the top of the page the clavicle with the subclavian muscle, the superficial layer of the muscles of the arm on lateral and front view. In the middle, the profile view of the face with the mimic muscles, including the zygomatic and buccinator. The temporalis and masseter muscles are depicted. In the lower part, the hand, with the median and ulnar nerve and the palmar aponeurosis. In the lower corner, the profile view of a face prior to its dissection. About 1510. (From: Leonardo da Vinci. *I manoscritti di Leonardo da Vinci della Reale Biblioteca di Windsor: dell'Anatomia, fogli A-B pubblicati da Teodoro Sabachnikoff*. Paris, E. Rouveyre, 1898)

8.4.1.2 Albrecht Dürer

Painter, engraver, and mathematician, **Albrecht Dürer** (1471–1528) was born in Nüremberg [12]. The son of a goldsmith, he studied painting in the workshop of **Michael Wohlgemut** also in Nüremberg. Considerably influenced by the Italian Renaissance and by the art of the Venetian painters, in 1495 Dürer moved to Venice, where he remained for 1 year. While in Venice he showed great interest in anatomy, performing cadaveric dissections to study the human body, its proportions and symmetry. In fact, in Germany, strict regulations impaired dissection of corpses.

In 1505, he made a second trip to Venice, where he remained for 18 months and met Leonardo da Vinci. Back in Germany, he continued his activity as a painter and engraver. In 1511, he became the *protégé* of Maximillian I, Holy Roman Emperor, who ordered several paintings. In the last period of his life, Dürer studied mathematics, perspective, and the proportions of the human body, and published two important works on this subject: *Unterweisung der Messung* (Treatise on Mensuration) in Nüremberg in 1525 and *Von menschlicher Proportion* (Proportions of the human body) in four books, posthumously issued in 1528. He died on April 6, 1528, probably from malaria. For the versatility of his mind as well as for his interest in paintings, science, and anatomy, Dürer has often been associated with Leonardo da Vinci.

Before establishing his own theories, Dürer referred to a geometrico-mathematical concept, crucial in determining the key points of the proportions and symmetry of the human figure. He designed dedicated mechanical instruments to measure individual parts of the body. Mathematical and geometrical rules were applied for the first time to calculate the canon of proportions and the principles of aesthetics. The aim of his system of anthropometry was to provide the artist for the first time with precise means to range the different forms of human figures mathematically evaluated [12]. He presented his theories in a textbook, *Von menschlicher Proportion* (On human Proportions), which was written and illustrated by Dürer himself and posthumously issued in the vernacular in 1528, a few months after his death. It was translated into Latin in 1532, by the humanist **Joachim Camerarius** (1500–1574), with the following title, *De Symmetria Partium in Rectis Formis humanorum Corporum* (On the Symmetry of the Human Body) and personally supervised by **Agnes Frey**, Dürer's widow. The original blocks of the first German edition were used. The book established Dürer's fame throughout Europe [17]. Without this translation, Michelangelo would never have appreciated Dürer's theory of proportion.

<u>Books One and Two</u> deal with the proportions and symmetry of the whole human body, in fat, medium build, and thin adult figures, as well as those of infants including calculations of the total or partial measurements of the upper and lower limbs, hand, foot, and face, using a precise mathematical scale. For him, the essence of true form was primarily a mathematic figure (i.e., straight line, curve, circle), constructed arithmetically or geometrically, to which the canon of proportion should be applied. Particular care was given to the analysis of the face, of the hand, and of the foot. The work, directed to painters, sculptors, engravers, goldsmiths, and others, was influenced by the mathematical and architectural studies of **Euclides** (fourth–third centuries BC), **Vitruvio** (70–23 BC), **Leonardo da Vinci** (1452–1519), **Piero della Francesca** (1415–1492), and **Luca Pacioli** (1446–1517).

In performing facial analysis, Leonardo da Vinci and Luca Pacioli divided the face horizontally into thirds. Unlike Leonardo, Dürer used more detailed parameters in applying the same basic principles to the division of the face in thirds. To understand it, we must examine his schemes of the facial profile. The ideal length of the nose should be comprised between a line drawn in the supratarsal fold with the eye in a forward gaze, and a line, parallel to the previous one, drawn on the underside of the nostril. This represents one third of the face; the other two thirds being represented by the forehead, and the chin/mouth (*see* Fig. 8.8 *left*). The same meticulous and rigid mathematical measurements were used for the hand (*see* Fig. 8.8 *upper right*), for the foot (*see* Fig. 8.8 *lower right*), and for the entire human body (*see* Fig. 8.9). These measurements constitute the quintessence of Dürer's theory of proportion and one of the leitmotifs of the Renaissance canon of beauty.

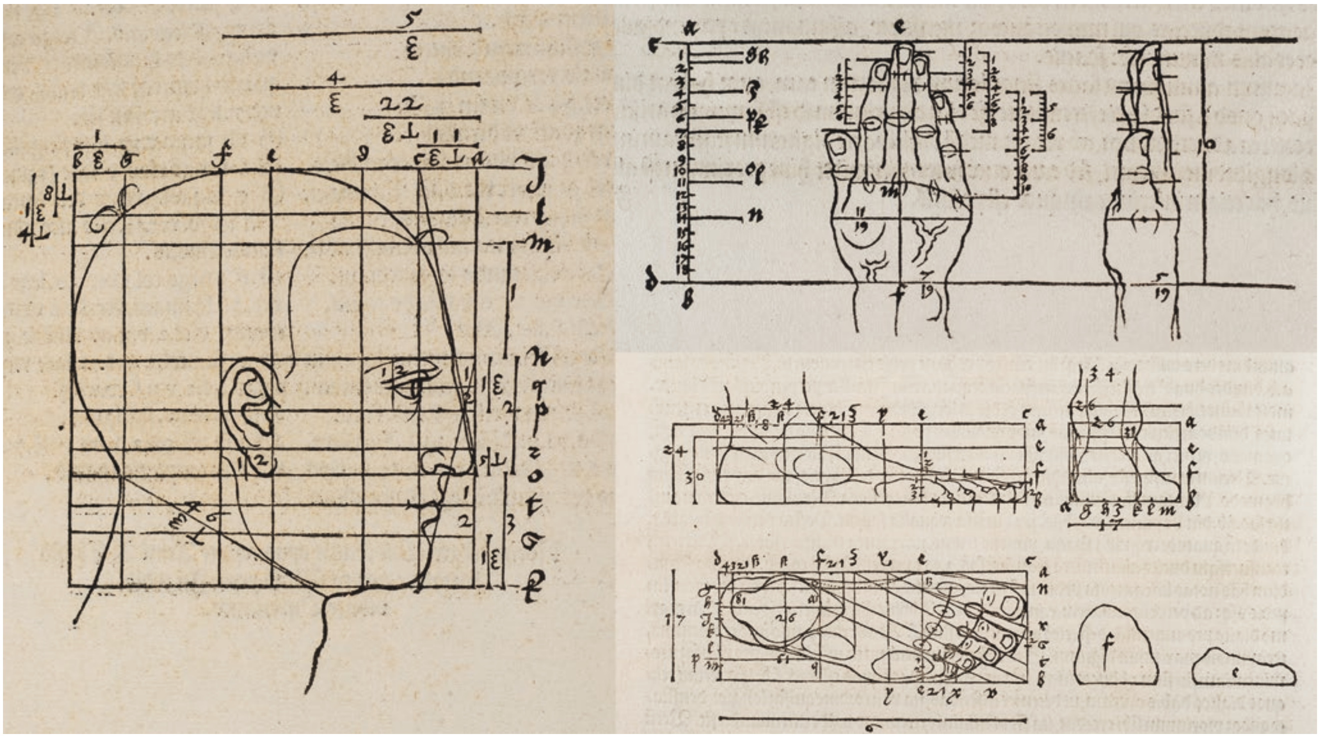


Fig. 8.8 The proportions of the face, hand, and foot. *Left*: The length of the nose. Ideally it should be comprised between a line drawn in the supratarsal fold, with the eye in a forward gaze, and another, parallel to the previous one, drawn on the underside of the nostril. The nasal length represents one third of the face; the other two thirds are the forehead, the chin/mouth; *upper right*: mathematical measurements of the proportions of the hand; *lower right*: mathematical measurements of the proportions of the foot. (From: Dürer A. *De Symmetria Partium in Rectis Formis humanorum Corporum*. Nüremberg, in the house of Dürer's widow, 1532)

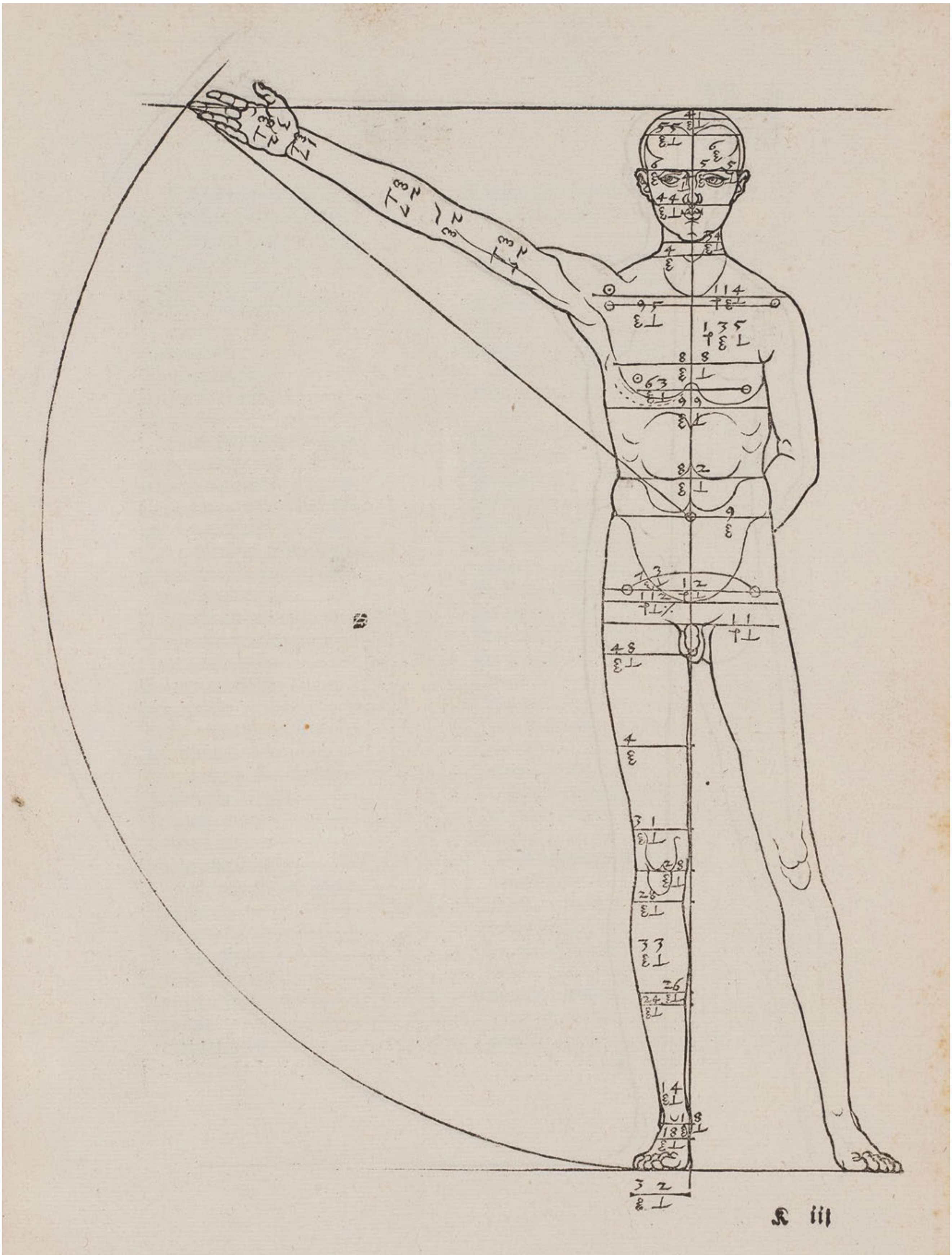


Fig. 8.9 The proportions of the human body. Mathematical measurements of the proportions of the male human body. (From: Dürer A. *De Symmetria Partium in Rectis Formis humanorum Corporum*. Nüremberg, in the house of Dürer's widow, 1532)

8.4.2 The Beginning of Anatomical Illustration

One of the first printed textbooks on anatomy, and probably the most important and complete after Mondino's *Anothomia*, was *Historia Corporis Humani, sive Anatomice* (History of the Human Body, or Anatomy) by **Alessandro Benedetti** (ca.1444–1525). Born in Legnago (Verona, Italy), Benedetti studied medicine in Padua and graduated about 1475. He practiced medicine in various Greek islands for more than 17 years. Upon his return to Italy, he was appointed as Chair of Anatomy and Surgery in 1490 at Padua University [2]. He is best remembered for having planned and built the first anatomical theater, a temporary construction, to be erected during the winter, the season of dissections. The model was a classical Roman amphitheater, round in shape and provided with seats that could easily be dismantled when the period of anatomical dissections was over [11]. Benedetti died in Venice about 1525, aged 81.

Historia Corporis Humani was accurately prepared by Benedetti in 1483 and dedicated to Maximilian I of Germany, Holy Roman Emperor, in a letter dated 1497; however, the book did not appear until 1502 [18] (*see* Fig. 3.55). The work, without illustrations, is divided into five books, with a complete description of the anatomy of the body from head to toe. In Book Four, he describes the nose and in particular the technique of nasal reconstruction performed by the Brancas of Sicily. As we have seen (see Sect. 3.3.1.6), this text plays an important role in the history of plastic surgery because it is one of the few detailed accounts of the operation, written by a contemporary of the Brancas [19]. In Book Five, Chapter 35, Benedetti strongly supports the importance of dissections for medical students to increase their knowledge of the human body. "They should attend anatomical theaters," he said, "without relying entirely upon oral or written descriptions."

Until the fifteenth century, the most common technique used to represent anatomical images in manuscripts was by diagrams and sketches (see Sect. 8.2.1). They were often inaccurate and unreliable due to the inexactitude of the amanuenses. In the fifteenth century, with the discovery of printing, things changed considerably (see Sect. 2.5). Initially crude and imprecise, anatomical illustration improved gradually over the years. **Choulant** called them *graphic incunabula* of anatomy [8]. Emphasis was given to the importance of cadaver dissection to learn the composition of the human body. The first printed medical textbook was *Fasciculo de Medicina* by **Johannes de Ketham**, an encyclopedia containing the image of a cadaveric dissection to illustrate the *Anothomia* by Mondino de' Luzzi, included in the text. The book, first issued in 1491 by the Venetian printing house of Gregorius de' Gregoriis and reprinted numerous times, is a masterpiece of medical illustration [6] (Fig. 8.2). Other examples are the open air dissection woodcut on the title page of the 1493 edition of **Mundinus'** *Anothomia* [20] (Fig. 2.5), probably number four in terms of priority, and the image included in *De Proprietatibus rerum* (On the Properties of Things), an encyclopedia on natural sciences by **Bartholomeus Anglicus** (*fl.* 1200–1272) [21] (Fig. 8.10).

The uses of early medical illustration fall into three main categories:

1. *Institutional*. Included in this group are the different types of dissection images [6, 20, 21] (Figs. 2.5, 8.2 and 8.10).
2. *Representation of the anatomy of the human body for surgical needs.* First, the abdominal musculature from *Conciliator* (Conciliator), in the 1496 edition by **Petrus de Abano** (1250–ca.1315) [22] (Fig. 8.11); then the image of the skeleton, published in *Cirurgia* (Surgery), 1497 by **Hieronymus Brunschwig** [23] (Fig. 8.12); followed by the front and coronal view of the eye, which is the oldest schematic representation of the eye [12] (Fig. 8.13); and by the illustration of the dissected neck with the trachea, and the thoracic and abdominal viscera (Fig. 8.14), both printed in *Margarita philosophica* (Pearl of Wisdom) in 1508 by **Gregor Reisch** (1467–1525) [24]; and finally, the bloodletting man, a manikin, indicating the phlebotomy sites, useful for surgeons, from *Summula… per Alphabetum super plurimis Remediis* (Summary of Prescriptions Alphabetically arranged) (ca.1500), by **Jacques Despars** (ca.1380–1458) [12, 25] (Fig. 8.15).
3. *Philosophical or astrological influence.* In the Middle Ages, all medical procedures, such as phlebotomy, venesection, and surgery were governed by astrology: the phases of the moon, the position of the sun, and the zodiacal signs influenced a physician's daily work. A typical image of the period was the *zodiac man*, whose purpose was to highlight the most favorable moment of the year before undertaking a specific medical treatment or beginning a new enterprise. The *zodiac man* was first printed in **Johannes de Ketham's** *Fasciculus Medicinae* in 1491 and reissued numerous times over the years. The naked standing male figure of the *zodiac man*, sometimes with dissected abdominal and thoracic organs, was surrounded by the 12 zodiac signs, each one corresponding to a specific part of the body [6, 12] (Fig. 8.16).

Another philosophical-astrological image that pervaded the entire Middle Ages and a large part of the Renaissance was the illustration of the brain ventricles, displayed in the form of three large and often interconnected circles. The ventricles were considered to be the seat of three of the main mental faculties: the *anterior* was common sense, the *middle* was cognitive function, and the *posterior* was memory and imagination. They probably first appeared in *Philosophia Naturalis* by **Albertus Magnus** (1193–1280) and were reissued over the years [26] (Figs. 8.17 and 3.12).

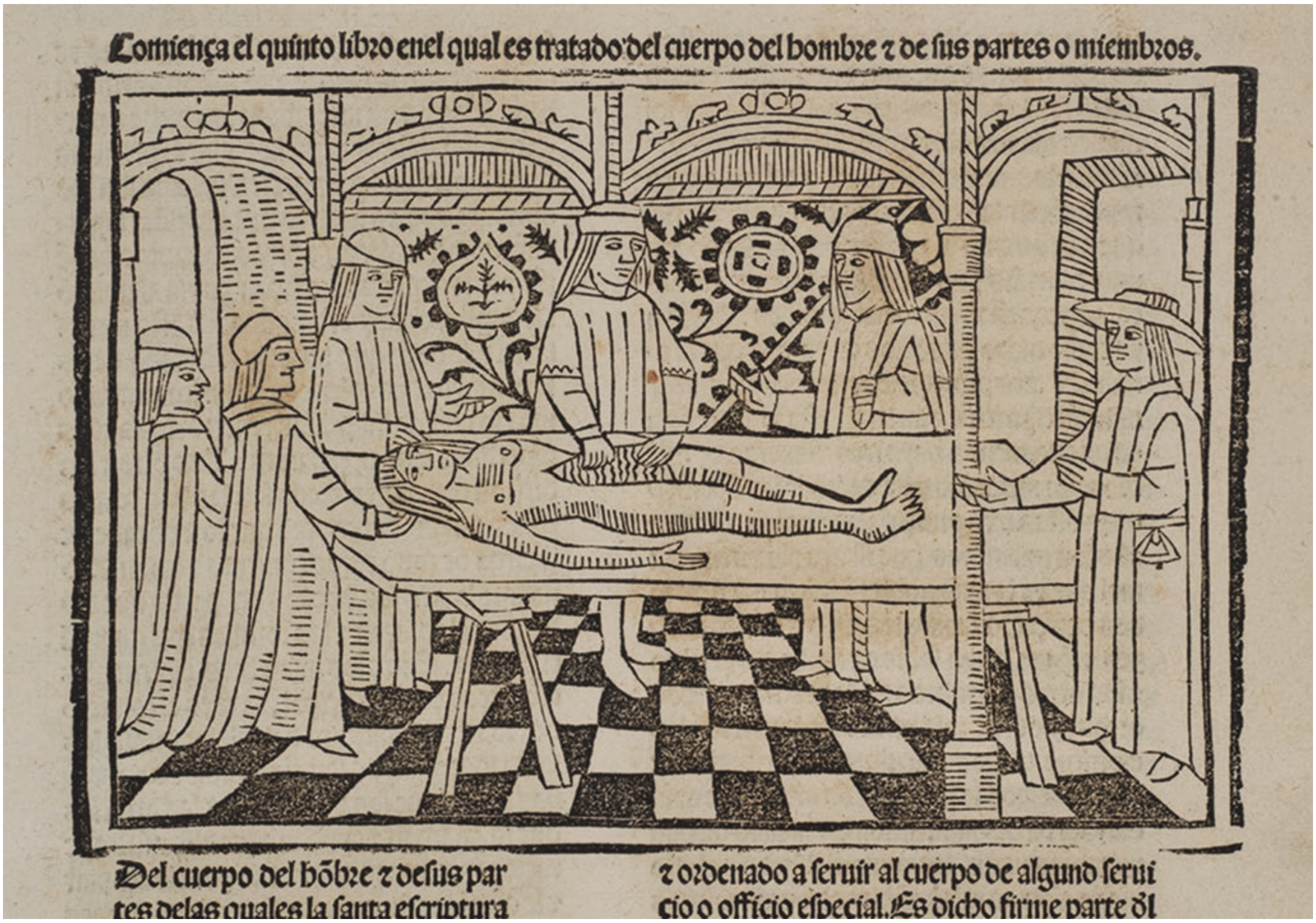


Fig. 8.10 Dissection scene illustrating Book 5 of *De Proprietatibus rerum*, an encyclopedia on natural sciences by Bartholomeus Anglicus (*fl.*1200–1272). The cadaver has the abdominal cavity widely opened. According to Singer, the scene is number five in terms of priority. (From: Bartholomeus A. *De Proprietatibus rerum.* Toulouse, Henrique Meyer, 1494)

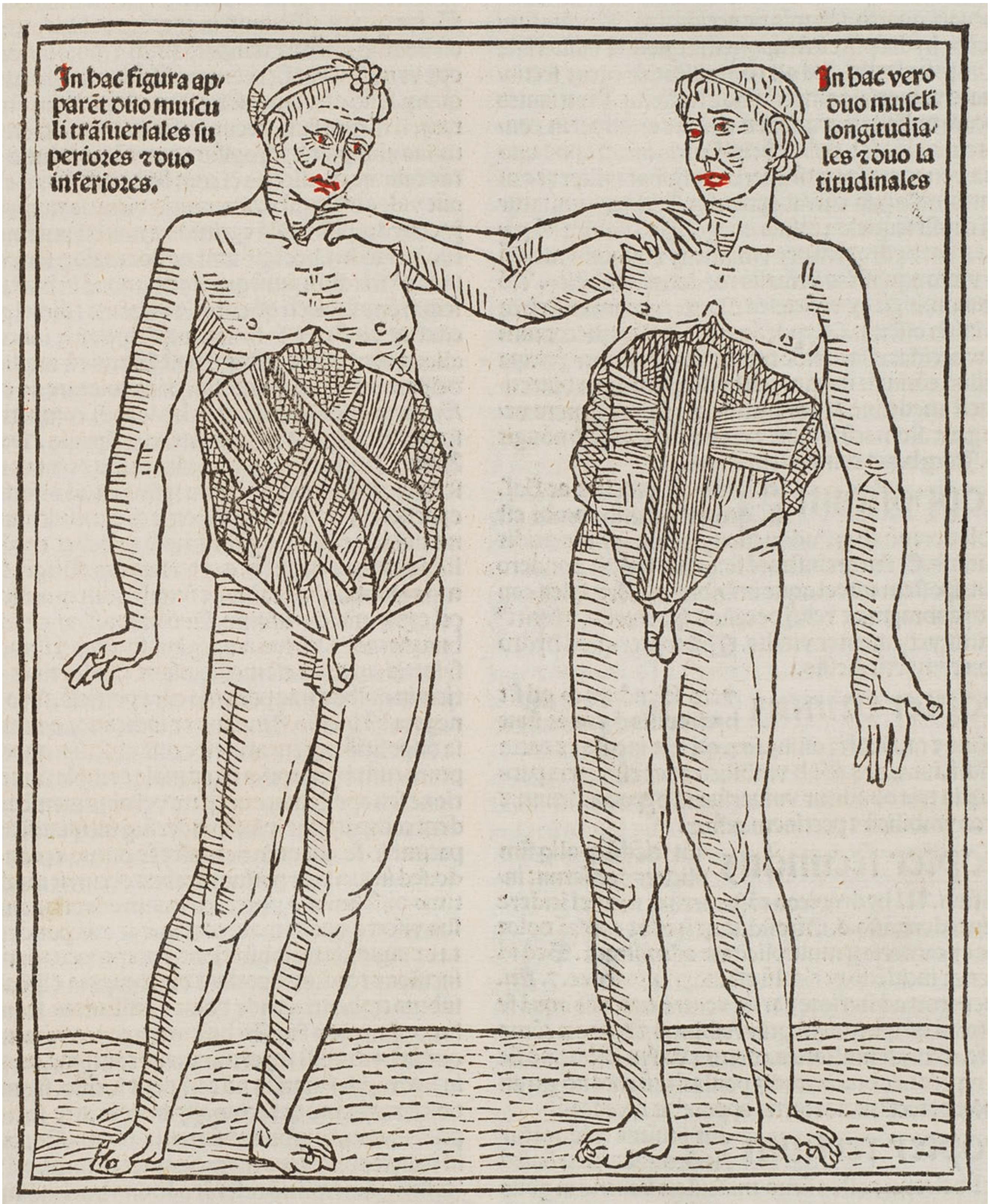


Fig. 8.11 The abdominal musculature. Large anatomical woodcut representing two standing male nude figures holding each other by their shoulders. Their abdomen is fully dissected and the superficial and deep muscular layers visible, with the rectus, obliquus externus and transverse muscles. It is among the earliest printed anatomical images and the first one exhibiting the abdominal muscles. (From: Petrus de Abano. *Conciliator*. Venezia, Bonetus Locatellus for Octavianus Scotus, 1496)

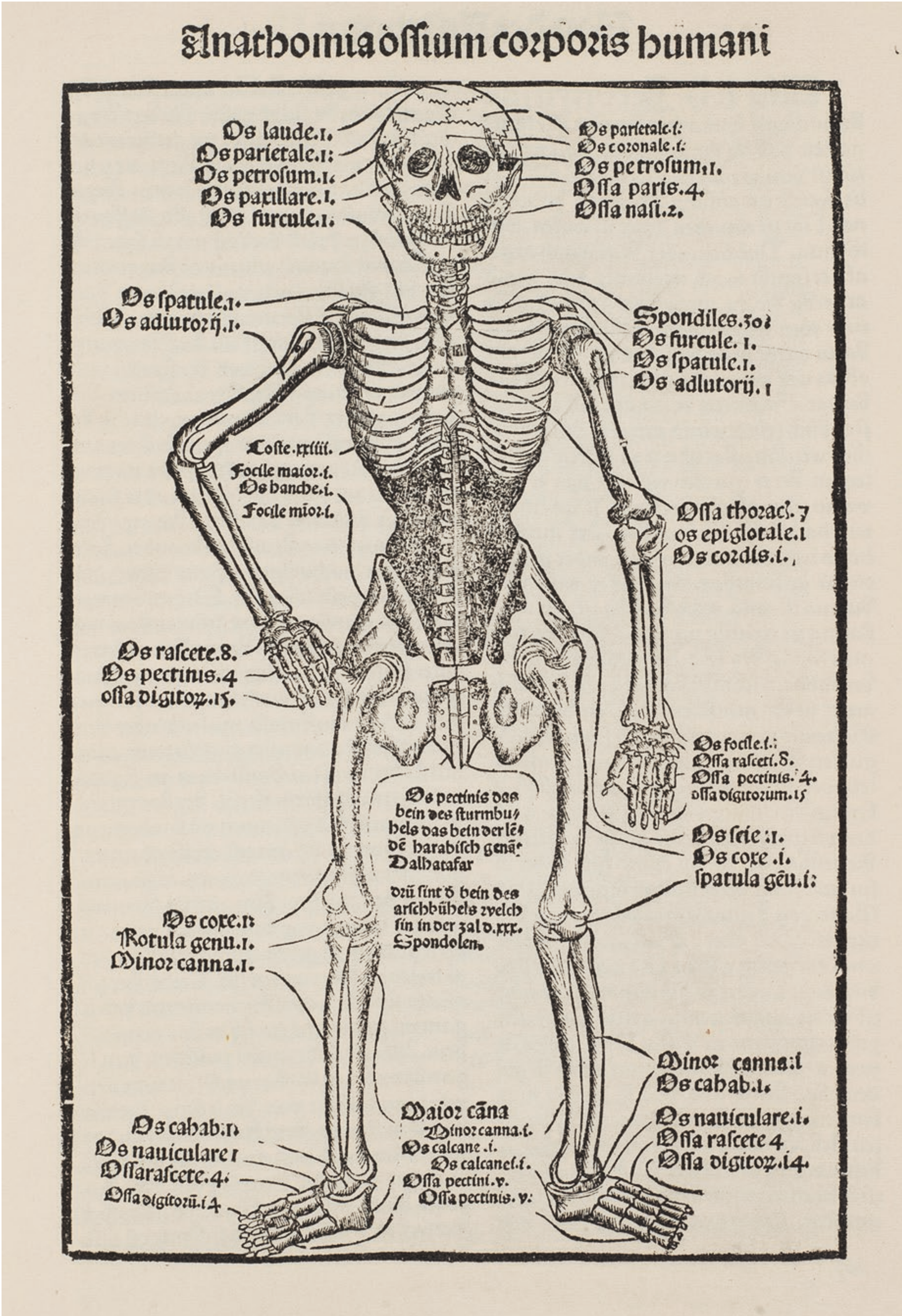


Fig. 8.12 The human skeleton. One of the first printed anatomical representations of a human skeleton, illustrating the section on anatomy of the *Buch der Cirurgia* (Book of Surgery) by Hyeronimus Brunschwig (ca.1450–1512). (From: Brunschwig H. *Das ist das Buch der Cirurgia*. Strasbourg, Johann Grüninger, 1497)

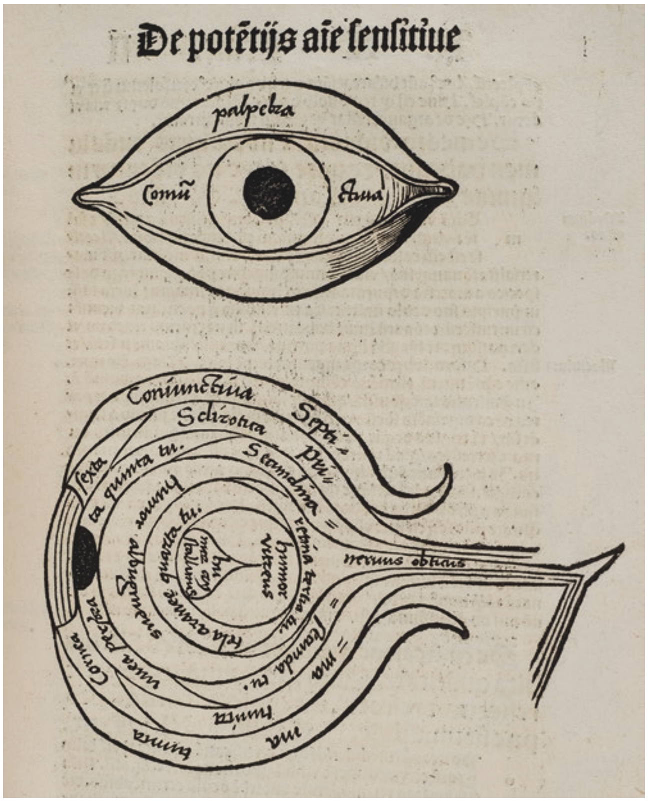


Fig. 8.13 The structure of the eye. On the same page, the external view of the eye with the eyelids and the cornea, and the coronal image of the bulbus, the conjunctiva, the retina, and the optical nerve are reproduced. Made for teaching purposes, although simple and incomplete, it constitutes the oldest printed illustration of the anatomy of the human eye. (From: Reisch G. *Margarita Philosophi*ca. Basel, M. Furter and J. Schott, 1508)

Fig. 8.14 The viscera. The image displays the contents of the thoracic cavity, with the right lung and the heart and abdomen, with the liver, stomach, spleen, intestine, kidney, and bladder on a black background, separated by the diaphragm. The trachea is shown in the dissected neck. The Latin names of the organs are marked directly on them. One of the first illustrations of the internal organs of the human body. (From: Reisch G. *Margarita Philosophi*ca. Basel, M. Furter and J. Schott, 1508)

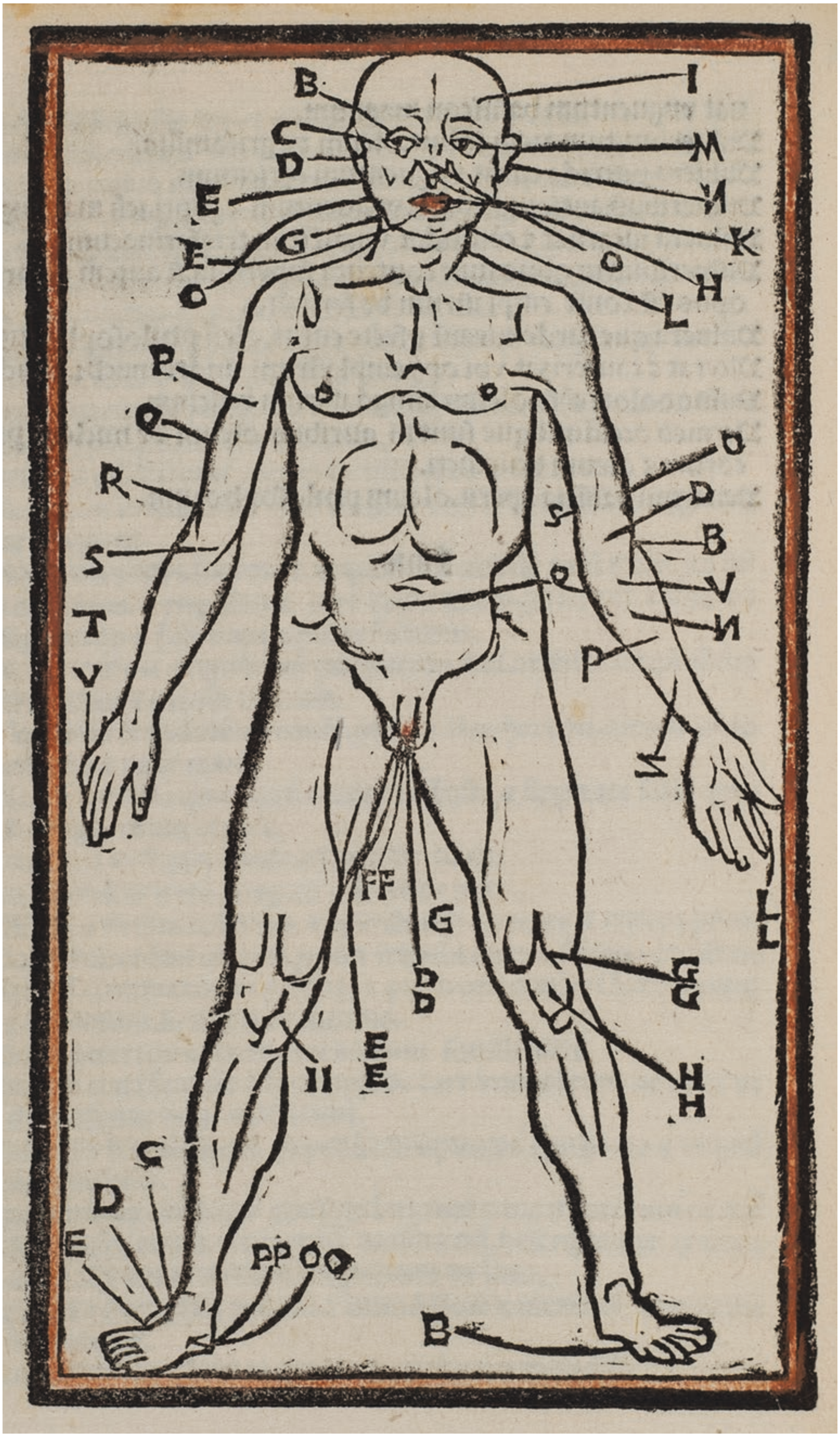


Fig. 8.15 Naked bloodletting manikin to indicate the proper phlebotomy sites, although the veins are not shown. The venesection diagram by Jacques Despars (ca.1380–1458) is among the earliest illustrations of the human body, useful to physicians and surgeons. (From: Despars J. *Summula… per Alphabetum super plurimis Remediis*. Lyons, (Johannes Trechsel), (ca.1500))

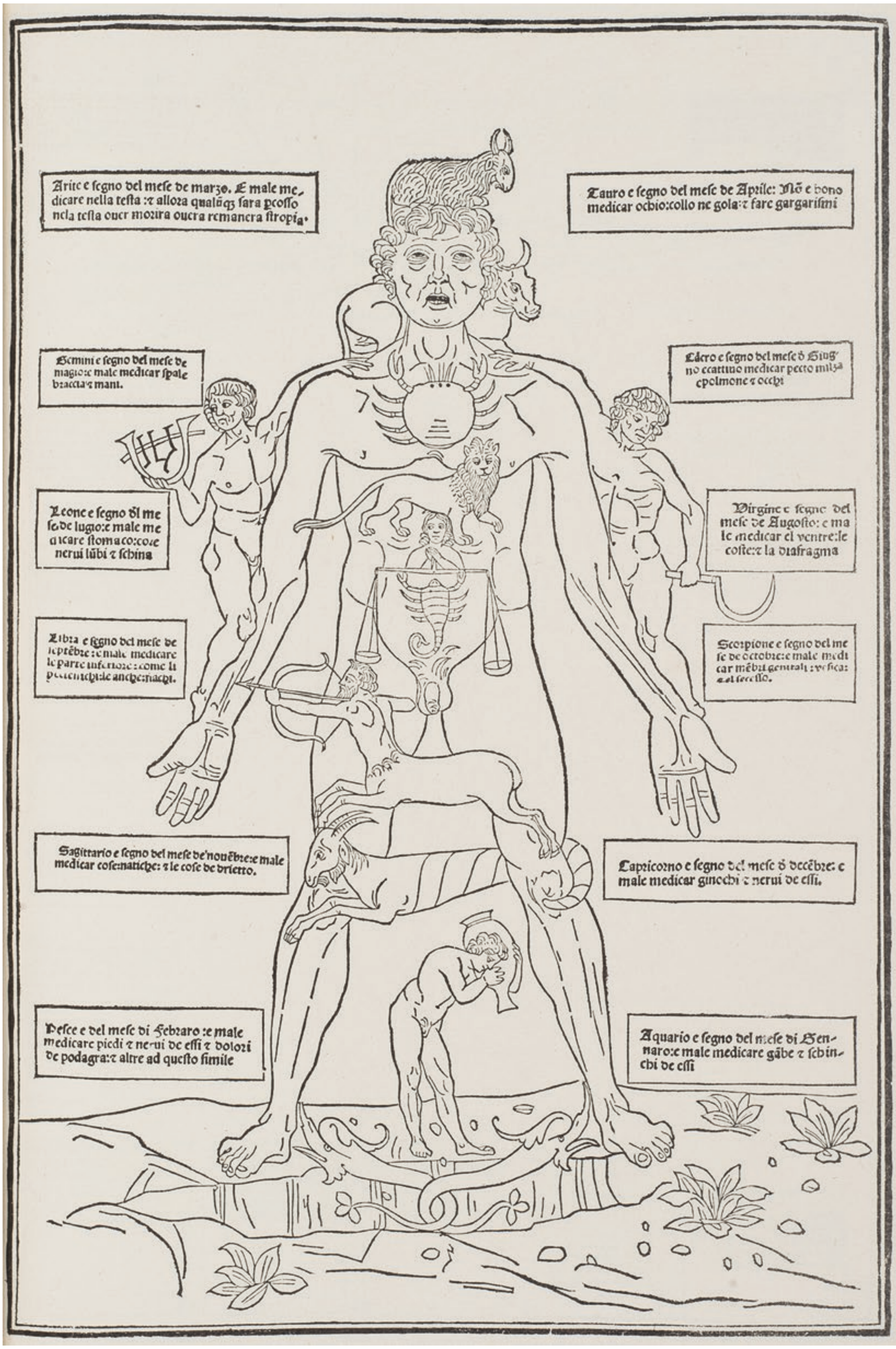


Fig. 8.16 The Zodiac man. A rather crudely drawn male figure standing in a garden. The 12 signs of the zodiac are drawn on the body. Concise information as to what month each zodiac's sign corresponds to and which is the best moment of the year for treating that specific part of the body are indicated in the cartouches. Possibly the first printed representation of the zodiac man. (From: (Ketham J.) *Fasciculo de Medicina*. Venezia, Johannes & Gregorius de Gregoriis, 1493)

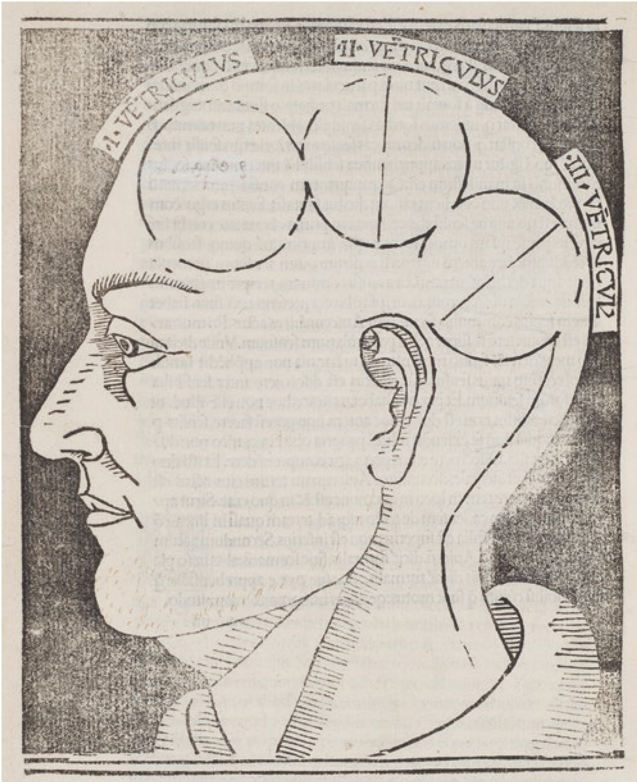


Fig. 8.17 The brain ventricles. The image shows the profile of a human face with the indication of the ventricles, considered the location of three of the main mental faculties. The anterior ventricle is the seat of common sense; the middle, of cognitive function; the posterior, of memory. One of the first printed representations of the brain ventricles. (From: Albertus Magnus. *Philosophia Naturalis*. Brescia, Battista de Farfengo, 1493)

8.4.2.1 From Diagrams to Anatomical Illustration: From Woodcuts to Engraving

In the first decades of the sixteenth century, the format of anatomical texts changed completely. Medical students, particularly those interested in doing surgery, complained about the lack of figures in medical textbooks devoted to anatomy. Schemes and diagrams, used since Aristotle's time (see Sect. 8.2.1) and later by **Henri de Mondeville**, and so often deplored by medical students, were gradually substituted by more detailed and accurate anatomical illustrations. The turning point came when **Jacopo Berengario da Carpi** published the first illustrated anatomical text in 1521, continued with **Johannes Dryander** (1537) and **Charles Estienne** (1545), and culminated with **Andreas Vesalius** (1543). This was a true scientific revolution in the study of anatomy.

Substantial money was invested by printing houses to produce new illustrated texts. Initially, images were produced as single leaves, the so-called *fugitive sheets*, to be examined on a table or hung on a wall where dissection took place. Later, they were inserted in the printed book, and the woodcut was the technique of choice until the middle of the sixteenth century when copper engraving was introduced. The advantage of copper engraving was greater accuracy of detail. Lines were far more precise. Thus, by the second half of the sixteenth century, copper engraving became the primary choice for anatomical images. However, disadvantages were numerous mainly related to the costs. Copper was expensive, engraving was more complex and took longer to prepare, and text had to be printed separately. Despite this, the change-over from woodcut to engraving produced a rewarding final result in terms of the layout of the book. Copperplates began to be used for anatomical texts by **Thomas Geminus** (see Sect. 8.4.4.2), and continued with **Valverde de Hamusco, Eustachi,** and others.

8.4.3 Pre-Vesalian Anatomy

Andreas Vesalius was the most important anatomist of the sixteenth century and *Fabrica* was his masterpiece. All the anatomical textbooks printed in the first decades of the sixteenth century are usually classified as Pre-Vesalian Anatomy.

8.4.3.1 Jacopo Barigazzi (Berengario da Carpi)

Nicknamed Jacopo Berengario da Carpi, **Jacopo Barigazzi** (ca.1460–1530) was born in Carpi near Modena (northern Italy). He graduated in 1489 from Bologna and from 1502 to 1527 was appointed Lecturer in Anatomy and Surgery at Bologna University (see Sect. 3.1.3.1 for a short biography) [27, 28]. In 1521, Berengario published *Commentaria… super Anatomia Mundini* (Commentary on the Anatomy of Mondino), a very influential anatomical text of more than 1000 pages (528 leaves), commenting on and discussing Mondino's fourteenth-century manuscript, to which he added 21 anatomical figures based on his own direct observations. Hence, *Commentaria* deservedly played a key role in the history of anatomical illustration, being the first textbook of anatomy with images from nature [29]. The following year, Berengario published *Isagoge breves* (Concise Introduction) for the use of students at Bologna University, thus satisfying their persistent request to obtain a text that could throw a new light on the fabric of the human body. *Isagoge*, nicknamed by Berengario *Anatomia parva*, was a detailed 144-page (72 leaves) work on human anatomy, an abridged version of *Commentaria*, as well as a guide for dissection [30]. However, should the reader be "unhappy about this work," the author says on leaf seven, he should refer to *Commentaria* to obtain more information.

With respect to *Commentaria*, *Isagoge* had new observations. Only some regions or parts of the body were illustrated, such as the muscles of the abdomen, of particular relevance for plastic surgery (Fig. 8.18), the female genital organs (Fig. 8.19), the vertebral column, the superficial veins of the upper and lower limbs, the superficial muscles of the entire body as they appear in a skinned man (*écorché*) (Fig. 8.20), the skeleton (Fig. 8.21), and the bones of the hand and foot. The plates of the female genital organs, visible in the open abdominal cavities of three different female figures, are an amazing combination of art and medicine. Berengario tried to draw the attention of the reader by placing a drape behind the nude female body. The *écorchés* in standing position were probably prepared for the use of artists rather than for anatomists, but at the same time favored students for wound management and for establishing the proper site for surgical incisions. The image of the skeleton, in rear view, has a curious detail. It holds a skull in either hand: the one on the left shows the calvarium, the other on the right shows the profile. In this way, using a single plate, the author could cleverly illustrate the skull from three different views.

In 1523, Berengario issued a second edition of *Isagoge*, to which he added two images of the human brain, seen from above with a detailed illustration of the ventricles. It represents the first printed view of the cerebral ventricles made from an actual dissection (Fig. 8.22).

Berengario's contribution to anatomy, based upon direct observation and experimental demonstration, was significant. He was the first to describe the vermiform appendix, the arytenoids as separate cartilages, and the thymus gland. However, he denied the existence of the so-called *rete mirabile* (admirable network), a complex vascular network, by tradition located at the base of the human brain, and considered by Galen to be responsible for changing the blood's vital spirit (*spiritus vitalis*) into the psychic spirit (*spiritus animalis*), stored in the brain ventricles. In *Commentaria* (1521) *(folio CCCCLIX r/v),* he wrote the following: "Thus I believe that Galen imagined the rete mirabile, but never saw it, and I believe that all others after Galen who spoke of the rete mirabile did so based on the strength of Galen's opinion, rather than on their demonstration of it."

Berengario was an indefatigable physician, surgeon, and anatomist. Between 1521 and 1523, he issued a series of three textbooks on anatomy with woodcuts, the first works since Galen to display new anatomical information.

The great majority of woodcuts included in his books are original and executed from life with great accuracy under Berengario's direct supervision. Care of anatomical details proves that Berengario had personally performed a great number of human dissections. He claimed more than 100.

The name of the artist, although extensively studied, remains unknown. The work has been attributed to either **Ugo da Carpi** (ca.1480–1532), a well-known printmaker, or to the Italian mannerist painter and sculptor **Amico Aspertini** (ca.1475–1552), but there is no proof [27, 28]. The plates remain an unsurpassed example of sixteenth-century anatomical illustration and a considerable breakthrough with respect to the more naïve and crude representation of the previous images of the abdominal wall musculature that appeared in *Conciliator*, by **Pietro de Abano** (1496), or the skeleton published in *Cirurgia* (Surgery), by **Hieronymus Brunschwig** (1497).

Fig. 8.18 The abdominal musculature. The standing figure of a man, with the legs far apart, holds the elevated abdominal skin with his hands in front of a landscape with grass and a tree. The dissected rectus abdominis muscle is hanging downwards. The remaining abdominal musculature is visible. The external oblique muscle is depicted in its anatomical position. (From: Berengario da Carpi J. *Isagogae Breves*. Bologna, Benedictus Hectoris, 1522)

Fig. 8.19 The female genital organs. A woman seated on a plinth in the open air, with her legs far apart shows her genital organs, the uterus, and the vulva. A heavy drapery is hanging *écorché* behind. (From: Berengario da Carpi J. *Isagogae Breves*. Bologna, Benedictus Hectoris, 1522)

Fig. 8.20 The superficial musculature of the entire body in a skinned man (*écorché*). The muscles of the neck, thorax, abdomen, and extremities are accurately drawn. The standing figure holds a heavy rope, by which cadavers were typically suspended for dissection. Behind is a hilly landscape with a single tree. (From: Berengario da Carpi J. *Isagogae Breves*. Bologna, Benedictus Hectoris, 1522)

Fig. 8.21 The rear view of the skeleton. The standing skeleton holds in either hand a skull, one showing the calvarium, the other the profile. In this way, with a single plate, Berengario could illustrate the skull in three different positions. (From: Berengario da Carpi J. *Isagogae Breves*. Bologna, Benedictus Hectoris, 1522)

Fig. 8.22 The human brain from above. The top image shows the elevated dura mater with an untouched left hemisphere, whereas the right hemisphere has been dissected. The dorsal aspect of the lateral ventricle and the choroid plexus (*vermis*) are visible. The bottom image provides the elevated pia mater and a detailed view of the ventricles, with the *anterior* (lateral), *medium* (third), and *posterior* (fourth) clearly indicated. The *medium* ventricle is adjacent to the *embotum* (infundibulum and pituitary stalk). (From: Berengario da Carpi J. *Isagogae Breves*. Bologna, Benedictus Hectoris, 1523 f. 56r)

8.4.3.2 Johannes Dryander

Among the pre-Vesalian anatomists, **Johannes Dryander** (1500–1560), also known as Eichmann, deserves special consideration. He was a physician, anatomist, mathematician, and astronomer and the first anatomist to restrict his anatomical studies to a specific area of the body═the head. He was born near Marburg, Germany [12, 28], and studied medicine at Erfurt University and in Paris where he met Vesalius. From this friendship, it was agreed that dissections should be carried out personally and on human cadavers only.

In 1533, Dryander graduated from the University of Mainz, becoming personal physician to Johannes III von Metzenhausen (1492–1540), Archbishop of Trier. Two years later, he was appointed Professor of Mathematics and Medicine at the University of Marburg and successfully obtained permission to dissect human cadavers from the Prince of Hesse. He was a prolific writer and died in Marburg in 1560, aged 60 years.

In 1536, he published *Anatomia capitis humani* (Anatomy of the Human Head) in Marburg, a 14-leaf essay regarded as the first illustrated work entirely dedicated to the anatomy of the head. The following year he issued a more extensive 36-leaf text *Anatomiae, hoc est, corporis humani dissectionis pars prior* (Anatomy, or part one of the dissection of the human body) [31]. However, only Part One was published and no other volume appeared.

The text reports a lecture delivered by Dryander at the University of Marburg on the 25th of October in 1536, in which he praises Prince Philip of Hesse (the dedicatee of the work), for allowing public dissection of the corpses of criminals and advocating state support for the study of anatomy. In this book, he recorded the dissection of the different layers of the scalp (skin, fascia, galea, and pericranium), of the meninges (dura and pia), and of the brain, following a precise hierarchy which starts with the removal of the scalp and skull cap, and continues with the exposure of the different layers of the brain, the cerebellum, and the skull base (Fig. 8.23).

The plate illustrating the ventricles, inspired by **Magnus Hundt's** *Antropologium* (1501), aims at explaining how the brain functions, and at localizing the following three mental faculties in the ventricles: common sense, cognitive function, and imagination. The organs of vision, hearing, olfaction, and taste are numbered and related to the different areas of the brain. The plate showing the oral cavity constitutes the first representation of the hard and soft palate and of the floor of the mouth (Fig. 8.24). The term *inevitabile fatum* (inevitable fate), often repeated in the book, warns the reader about death symbolized by the human skull (Fig. 8.25). The anatomy of the chest, lungs, and heart is added as an appendix, possibly a foreword to the unpublished Volume Two. All the plates were drawn after the author's own dissections. Some were signed with a compass (the symbol of the Apostle St. Thomas) and the monogram GVB or VB or G. They have been ascribed to either the school of **Hans Brosamer** (ca.1495–1554), painter and engraver, or to the engraver **Georg Thomas** (*fl.* sixteenth century).

In 1541, Dryander published *Anatomia Mundini*, an illustrated edition of Mundinus' anatomy with woodcuts coming from different sources [32]. Of the 46 figures, 18 were copied from Berengario da Carpi's *Commentaria… super Anatomia Mundini* (1521) [29]; 20 were taken from his own *Anatomia* (1537) [31]; 6 were plagiarized from Vesalius' *Tabulae Anatomicae sex* (1538) [12]. Apparently, only two representing the alimentary canal and the intestines are original and of good quality. However, it is possible that they were prepared for Vesalius and stolen when Dryander met Vesalius in Paris. In fact, in the preface of *Fabrica*, Vesalius complained that a man in Marburg copied and published some illustrations from the *Fabrica* without permission [12].

Fig. 8.23 Dissection of the human head. The skull cap has been removed, the dura and pia mater elevated and turned down on each side. The cerebral hemispheres are exposed. Dissection instruments are illustrated. The monogram GVB is shown below the dissected head. (From: Dryander J. *Anatomiae, hoc est, corporis humani* dissectionis. Marburg, Euchario Cervicorno, 1537)

Fig. 8.24 The oral cavity. First representation of the hard and soft palate, tonsils, and floor of the mouth. Separately, the dissection of the tongue, larynx, and epiglottis are shown. At the bottom, the signature of a compass. (From: Dryander J. *Anatomiae, hoc est, corporis humani* dissectionis. Marburg, Euchario Cervicorno, 1537)

Fig. 8.25 The human skull resting on a sundial and an hourglass. The skull, with metopic and coronal sutures clearly visible, rests on an hourglass. The plinth bears the date 1536 and the signature of a compass. The inscription *inevitabile fatum* (inevitable fate) warns the reader about death. (From: Dryander J. *Anatomiae, hoc est, corporis humani* dissectionis. Marburg, Euchario Cervicorno, 1537)

8.4.3.3 Charles Estienne

The most important pre-Vesalian anatomy publication was *De Dissectione Partium Corporis Humani* (Dissection of Parts of the Human Body) by **Charles Estienne** (*Lat*. Carolus Stephanus) (ca.1504–1564) [33]. The book had a very troubled history [12, 28]. It was conceived when the author was in his late twenties. Some plates are dated 1530–1532, which proves that the work was begun long before its publication. At the beginning of the project, Estienne associated himself with the surgeon Estienne de la Rivière (*Lat*. Stephanus Riverius) with the aim of making dissections and illustrations together. By 1539, the work was completed to the middle of Book Three. Even the printer **Simon des Colines** (ca.1475–1546), Charles' stepfather, was eager to publish it. Regrettably, its appearance was delayed by a lawsuit brought by Estienne de la Rivière against Charles Estienne, because his name was removed from the title page. Estienne de la Rivière lost the trial, but the book was considerably postponed and not issued until 1545, instead of the planned 1541 publication, that is, 2 years after the appearance of *De Humani Corporis Fabrica* by **Andreas Vesalius** (1514–1564), Charles Estienne's contemporary. In terms of the quality of the illustrations and scientific value, *Fabrica* was without any doubt far superior to *De Dissectione* so it overshadowed the appearance of Estienne's book, which, once published, had little success. This was unfortunate because Estienne's work was one of the first textbooks fully illustrated on the dissection of the whole human body.

The human corpses, arranged in unusual, dramatic positions, are surrounded by amazing landscapes, with trees, flowers, hills, villages, and architecture. The work is divided into three parts. Book One shows mainly osteology, with skeletons standing in different positions, but also standing figures showing veins, arteries, and nerves, a skinned muscleman (Fig. 8.26), and the surface anatomy (front, rear, and profile) of a human body. Book Two deals with the anatomy of the abdomen, abdominal musculature, inspired by Berengario, and with the underlying visceral organs. The illustration of the thorax follows, showing the superficial and deep layers of the muscles and inner organs. Then comes the neck, with the esophagus, larynx, and oral cavity. Book Two ends with eight amazing illustrations of the dissection of the head and brain in successive stages. They are considered among the most detailed dissections compared to any that had previously appeared, particularly the difference between the convolutional patterns of the cerebellum and cerebrum. Additional cadavers are displayed either sitting on a chair or bending over a table. The first two corpses have the skull cap hanging from a branch of a tree (Fig. 8.27). Book Three is concerned with obstetrics and gynecology and is accompanied by ten impressive figures, some of them inspired by Berengario. They show the reproductive female apparatus as well as the pudenda (Fig. 8.28). The book ends with the dissection of the eye, limbs, and vertebral column. Had this work been published in 1539, when it was completed, it would have received greater appreciation. Despite this, Estienne's anatomy contained numerous original contributions such as the first printed illustration of the venous and nervous systems, the tripartite description of the sternum, the valvulae of the hepatic veins, and the dissection of the brain, more detailed than had previously been shown.

The woodcuts bear different signatures: some of them the monogram SR (possibly **Stephanus Riverius**), five the Lorraine cross, the mark used by the workshop of the engraver **Geoffroy Tory** (ca.1480–1533), while others are signed by **Mercure Jollat** (ca.1490–1550), artist and woodcutter. An interesting feature of the illustrations is that more than 35 of them have mortises with the underlying anatomical details and some of them even two. Altogether, there are 62 full-page woodcuts, but 6 of them are repeated, so that the total blocks number 56 [12, 28].

Little is known about **Charles Estienne's** early life [28]. He was probably born into a family of Parisian printers and editors about 1504, but we do not know exactly where. At his father's death, in 1520, Charles decided to study medicine, but also botany and horticulture. In the meantime, his mother married **Simon des Colines**, the renowned Parisian publisher, and the future editor of Charles' book. In 1542, Charles, a student of the Parisian anatomist **Jacobus Sylvius** (1478–1555), graduated in medicine and practiced until 1550, when he had to take care of the family printing house. However, he did not succeed in this job, bankrupted it, and was imprisoned. He died in jail in 1564, aged 64.

Fig. 8.26 The superficial musculature of the entire body in a skinned man (*écorché*). The muscles of the face, neck, thorax, abdomen, and extremities are illustrated. The standing figure holds a heavy stick on its left hand. Behind is a hilly landscape. (From: Estienne C. *De Dissectione Partium Corporis Humani*. Paris, Simon des Colines, 1545)

Fig. 8.27 Dissection of the human head. The skull cap has been removed, and it is suspended on a tree branch. The dura mater and the cerebral hemispheres are exposed. Behind a hilly landscape with a single tree. (From: Estienne C. *De Dissectione Partium Corporis Humani*. Paris, Simon des Colines, 1545)

Fig. 8.28 The *gravida* (pregnant woman). The illustration of a seated pregnant woman with the legs far apart and the abdominal cavity opened to show the uterus, containing an embryo, other reproductive organs, and the vulva. Behind an ideal city with architectural buildings. A man is observing the scene from a window. (From: Estienne C. *De Dissectione Partium Corporis Humani*. Paris, Simon des Colines, 1545)

8.4.4 The Revolution in Anatomy

The true scientific revolution in anatomy began with Andreas Vesalius.

8.4.4.1 Andreas Vesalius

The son of an apothecary, **Andreas Vesalius**, was born in Leuven (Belgium) in 1514. At the age of 15, he enrolled at Leuven University where he studied liberal arts. In 1533, he moved to Paris to study medicine under **Jean François Fernel** (ca.1497–1558), **Günther von Andernach** (ca.1505–1574), and **Jacques Dubois** (1478–1555) (better known as **Jacobus Sylvius**). In 1536, he had to leave Paris due to the onset of war between Francis I and Charles V, and he returned to Leuven. To complete his medical studies, he went to Padua where, in 1537, he graduated in medicine, aged 23. One day after his graduation, he was appointed Lecturer of Anatomy and Surgery at that University, and taught anatomy, performing dissections in the anatomical theater and soon became one of the most experienced anatomists. His lessons were well attended by large audiences, with students coming from all over Europe.

In 1538, he prepared a series of six large anatomical illustrations named *Tabulae Anatomicae*, or *Tabulae sex* (Six Plates). They were unanimously greatly appreciated, but were soon plagiarized and unauthorized publications appeared in various cities. Vesalius collected extensive anatomical material with the aim of publishing a revolutionary textbook. After 5 years of intense investigations, dissections performed in Padua and Venice, continuous studies and research, the manuscript was finally completed in 1543. At the same time, the numerous anatomical illustrations, superbly drawn by **Johannes Stephan van Calcar** (ca.1499–1546), a disciple of Titian, were finished and the blocks prepared in Venice under Vesalius' direct supervision. Text and blocks were sent to the publisher **Johannes Oporinus** (1507–1568) in Basel (Switzerland) for printing. Vesalius himself left Padua and travelled to Basel to coordinate the details of the publication of his seminal work entitled *De humani Corporis Fabrica* (On the Structure of the Human Body), dedicated to the Emperor Charles V, which appeared in June of 1543, when he was 28 [34]. In the same year, he published a less expensive abridged version of *Fabrica*, the *Epitome*.

In 1544, at the invitation of Cosimo I de' Medici, Duke of Florence, he taught anatomy at Pisa University, demonstrating public dissections. From Pisa, he moved to Speyer on the Rhine, where the court of the Emperor Charles V was residing. He became the personal physician to Charles V and was appointed a count palatine. In 1555, he published a revised edition of *Fabri*ca. For reasons that are not clear, he participated in a pilgrimage to the Holy Land. During his return voyage to Europe in 1564, he died in a shipwreck off the small island of Zakynthos (Greece), aged 49 [35].

De humani Corporis Fabrica is divided into seven books. It is preceded by a famous title page showing a crowded dissection scene occurring in a typical Renaissance style anatomical theater. Vesalius, Professor of Anatomy, stands in the center of the crowd, surrounded by students, physicians, nobles, university professors, and church authorities. He is lecturing to a large audience, and his hands are engaged in demonstration in front of a cadaver. Under the dissecting table, two assistants are preparing the instruments (Fig. 8.29). The dedication page to the Emperor Charles V follows.

The book continues with the portrait of Vesalius, aged 28, proudly dissecting an arm and a hand, considered among the most challenging and intriguing structures of the human body for demonstration (Fig. 8.30).

<u>Book One</u> is devoted to the anatomy of bones and joints. Three superb full-page skeletal figures in different positions show the bones (Fig. 8.31). Then follows an image of the cranium. The sphenoid, malleus, and incus are illustrated for the first time; however the stapes is omitted. <u>Book Two</u> concerns the muscles. A series of 14 full-page musclemen show the different planes of the human body, dissected layer by layer, with the muscles either removed or turned down. The amazing figures are illustrated from the front and the back (Fig. 8.32). They constitute, without any doubt, some of the greatest achievements and most spectacular examples of anatomical illustrations. The background, in the style of **Domenico Campagnola** (ca.1500–1564), another pupil of Titian, reproduces beautiful Paduan landscapes of the Euganean hills, with trees, foliage, city ruins, Roman thermae, and a river with a bridge over it. <u>Book Three</u> describes the vascular system. Numerous detailed diagrams of the venous system are included to comply with the blood-letting practice of the period. <u>Book Four</u> deals with the nervous system. The trigeminal, facial, and auditory nerves are not clearly rendered; however, the general surface of the brain and cerebellum is accurately portrayed. <u>Book Five</u> includes the abdominal viscera. The great omentum and intestines are crudely illustrated. <u>Book Six</u> is devoted to the description of the heart and lungs. Finally, <u>Book Seven</u> examines the brain. A series of fine illustrations show the dissection of these structures (Fig. 8.33).

De humani corporis Fabrica is an epoch-marking textbook which provides a complete detailed description of the human body coupled with illustrations of the different parts. He corrected the errors of traditional teaching derived from Galen who used animals for dissection. Vesalius revolutionized the study of anatomy and the practice of surgery by insisting that anatomical knowledge must be derived from dissections and from the study of human structures. For the first time in the history of medicine, a text covering the whole of anatomy was issued. Before Vesalius, other anatomists wrote summaries of their original observations. Even Berengario, author of a text published 22 years earlier, included descriptions of only a few parts of the human body. The remarkably accurate text is coupled with woodcut anatomical illustrations of artistic and technical relevance, in a detailed study of bones, muscles, blood vessels, nerves, abdominal viscera, thoracic organs, and the brain. The work is a blend of science, teaching, and art.

Epitome, issued in the same year, and in a larger format, represented a skillful condensation of all the material to be found in *Fabri*ca. It was designed by Vesalius at the request of students and surgeons, to be used alongside his *Fabri*ca. Two editions were published: one in Latin *Suorum de humani corporis Fabrica Librorum Epitome* (The Epitome of Their Books on the Structure of the Human Body) [36] and another in German, *Von des menschen Cörpers Anatomey ein kurzer aber vast nützer Auszug* (On the Anatomy of the Human Body, a short summary but directed to a vast audience) [37]. The spectacular plates include seven standing figures showing the muscular system in different layers, the human skeleton, and the vascular and nervous networks. They are followed by two additional full-page woodcuts of a naked man and woman (Adam and Eve), to emphasize surface anatomy, and drawn according to the Canon of Proportion. They are considered among the most beautiful illustrations prepared for an anatomical atlas (Fig. 8.34).

Fabrica was reissued 12 years later, in 1555, by the same press in an enlarged edition. At least 25 editions, printed between 1543 and 1782, are known [2].

Fig. 8.29 Dissection scene. Title page of *De humani corporis Fabrica* (The Structure of the Human Body), representing Andreas Vesalius, who is lecturing to a large audience of students, physicians, nobles, university professors, and church authorities, while performing a cadaveric dissection. (From: Vesalius A. *De humani corporis Fabrica libri septem*. Basel, Joannes Oporinus, 1543)

Fig. 8.30 Portrait of Andreas Vesalius (1514–1564), aged 28, at work dissecting an arm and a hand. (From: Vesalius A. *De humani corporis Fabrica libri septem*. Basel, Joannes Oporinus, 1543)

Fig. 8.31 Lateral view of the skeleton of the human body. The skeleon reproduces Hamlet who holds Yorick's skull as he speaks beside his tomb. On the side is the motto *Vivitur ingenio, caetera mortis erunt* (Genius continues to live, the rest is mortal). (From: Vesalius A. *De humani corporis Fabrica libri septem*. Basel, Joannes Oporinus, 1543. Book 1)

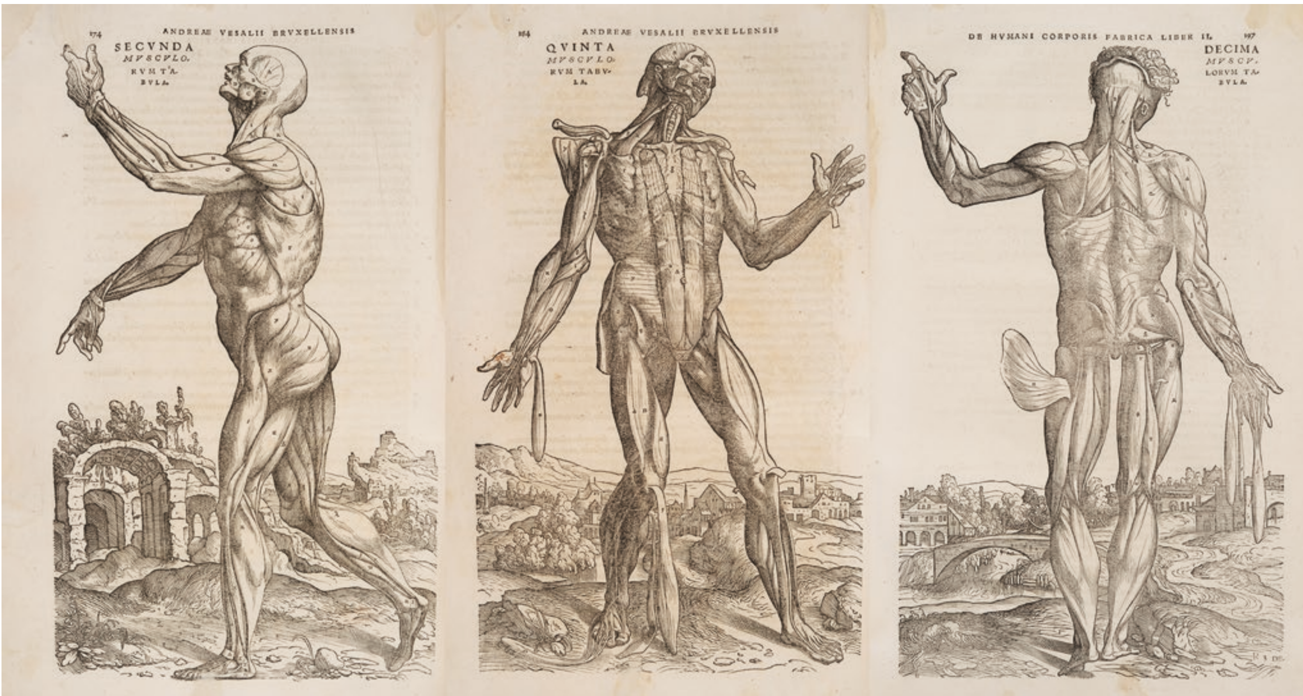


Fig. 8.32 The muscles of the human body. *Left*: Profile view of the superficial layer of the anterior muscles; *center*: second layer of the anterior muscles; *right*: the second layer of the posterior muscles. (From: Vesalius A. *De humani corporis Fabrica libri septem*. Basel, Joannes Oporinus, 1543. Book 2)

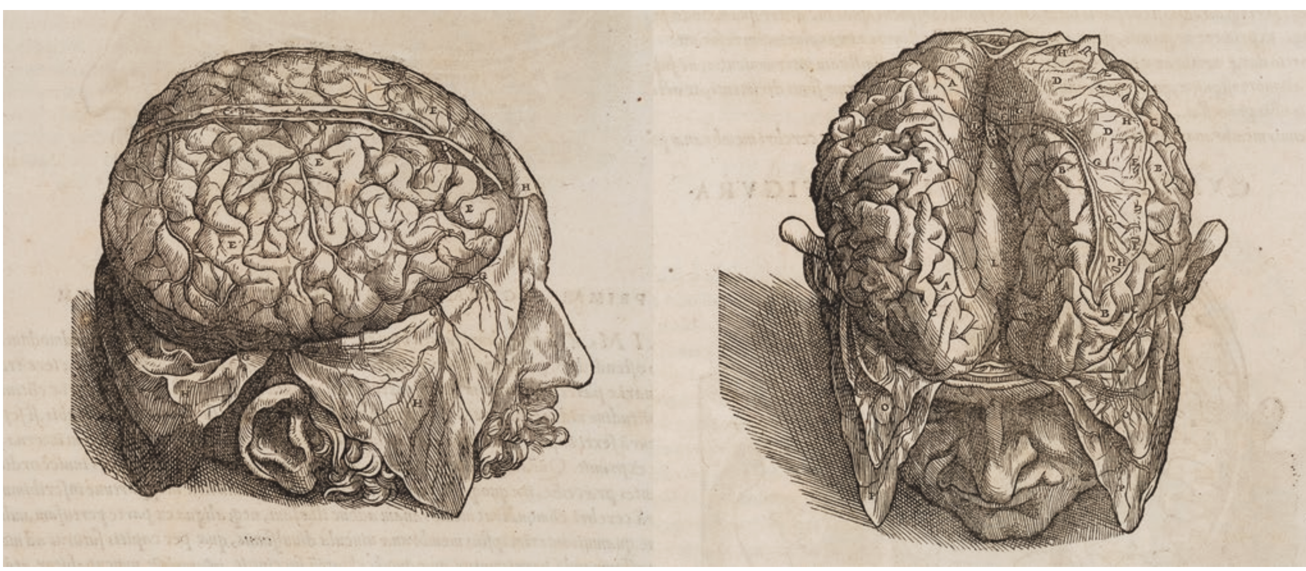


Fig. 8.33 Dissection of the brain. *Left*: lateral view of the dissection of the brain. The falx is exposed, and the dura is reflected; *right*: the brain from above. The cerebral hemispheres are divided. The pia and dura are reflected. Brain convolutions are exposed. (From: Vesalius A. *De humani corporis Fabrica libri septem*. Basel, Joannes Oporinus, 1543. Book 7)

Fig. 8.34 Male and female nudes. The naked figures of Adam and Eve were designed to accompany the explanation of the terminology used for indicating surface anatomy. Drawn following the Canon of Proportion, they are considered among the most beautiful illustrations prepared for an anatomical atlas. (From: Vesalius A. *Von des menschen Cörpers Anatomey*. Basel, Joannes Oporinus, 1543)

8.4.4.2 Thomas Geminus: Vesalius' Illustrations Plagiarized

In 1540, King Henry VIII, supporting true doctors against malpractice and charlatans, sanctioned the English Barber Surgeons Company. With the aim of improving surgery and knowledge of the human body, he authorized the supply of four corpses per year to the newly established company. At this point, the need for a textbook on anatomy was mandatory. **Thomas Geminus**, the pseudonym of Thomas Lambert (or Lambrit) (ca.1510–1562), a copper engraver, astrolabe maker, publisher and printer, filled in this gap immediately. He fortuitously came across Vesalius' woodcuts. Without permission, he redrew the plates, and completely rearranged them. In 1545, he provided the company with an anatomical textbook which plagiarized Vesalius' illustrations, and published *Compendiosa totius Anatomie Delineatio* (Compendium of the Whole Anatomy), first issued in Latin [38]. Being a copperplate engraver, Geminus decided to choose this technique instead of woodcuts. Copper engraving, in fact, permitted a sharpness of details not possible to achieve with a woodcut. As he was not much interested in aesthetic form, he eliminated the beautiful landscapes from the plates. The result was not particularly attractive—nothing to compare with the finesse of the original illustrations. Vesalius himself sadly wrote: *In England* (...) *the illustrations of my Epitome have been copied so poorly and without any artistic skill*.

It seems that King Henry VIII, to whom the first edition of the work was dedicated, pushed Geminus to translate Vesalius' text and illustrations to make it available to English surgeons. In the first edition, in Latin, Thomas Geminus gave full credit to Vesalius, but in the English translation this acknowledgement disappeared.

The plates, 40 in total, comprise: the title-page with the portrait of Queen Elizabeth I, to whom the English translation was dedicated, surrounded by allegorical figures; 1 folding woodcut illustration of Adam and Eve seated with superimposed flaps showing the inner organs (Fig. 8.35); 3 skeletal figures, 16 of different layers of the muscular system (Fig. 8.36); 5 of the arteries and veins; 4 of the nervous system; 6 of the internal organs; 4 of the brain; and 1 each of the eye, adnexa, and surgical instruments. The text was a modified version of *Epitome.*

Compendiosa is the first example of the many instances of plagiarism of Vesalius' *Fabrica* and *Epitome*.

The work had great success, and played an important role in the spread of anatomical knowledge in England, considered a sort of guideline for performing cadaveric dissection in the Barber-Surgeons' Hall. Moreover, Geminus had the great merit of introducing copper engraving into England, and *Compendiosa* was the first large-scale example of the use of this new technique.

Little is known about Geminus' life. He was probably born in Liège (Belgium) about 1510, from where he moved to England in 1540. Having printed the first edition of *Compendiosa* in 1545, Geminus took care of the English translation in 1553 and 1559, done by **Nicholas Udall** [39]. In 1555, he started to practice as a surgeon. However, on examining his position, the College of Physicians discovered that he had no license for performing surgery, and penalized him. He died in 1562, aged 52.

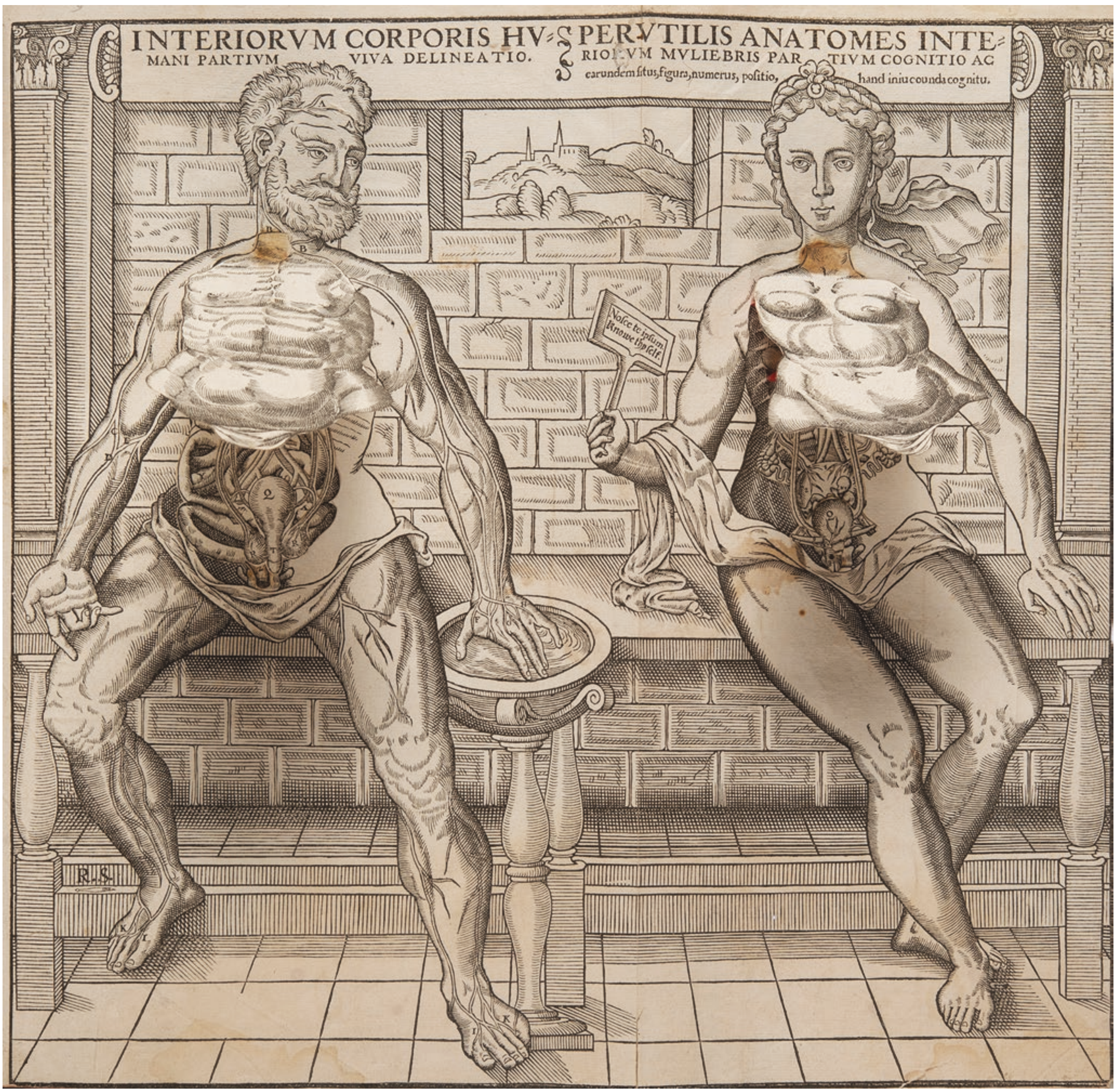


Fig. 8.35 The naked figures of Adam and Eve, seated, with superimposed flaps to show the inner abdominal organs. (From: Geminus T. *Compendiosa totius Anatomie Delineatio*. London, Blackfriars, 1559)

Fig. 8.36 Engraved plate illustrating the second layer of the anterior muscles. Observe the striking difference in the same plate by Vesalius (Fig. 8.32 *center*). (From: Geminus T. *Compendiosa totius Anatomie Delineatio*. London, within the Blackfriars, 1559)

8.5 The Anatomical School of Padua in the Sixteenth and Seventeenth Centuries

Initiated by Andreas Vesalius, the Anatomical School of Padua was probably the most important in Europe in the sixteenth century and in the first two decades of the seventeenth century. During this period, **Realdo Colombo, Gabriele Falloppio, Hieronymus Fabricius ab Aquapendente, Giulio Casserio, Adrianus Spigelius,** and **Johannes Vesling** taught anatomy in Padua. With Johannes Vesling, the tradition of the anatomical school of Padua came to an end.

8.5.1 Realdo Colombo

When Vesalius left Padua in 1543 to take care of the publication of the *Fabrica*, **Realdo Colombo** (ca.1510–1559), his disciple, replaced him temporarily. Colombo, the son of an apothecary, was born in Cremona (northern Italy). In 1538, he enrolled in Padua University, where he became the assistant to Andreas Vesalius. In 1544, he graduated in medicine, and in the same year he was appointed Professor of Anatomy and Surgery at Padua University. He remained in Padua for 2 years before moving to Pisa for teaching purposes at the invitation of Cosimo I de' Medici. He was in close contact with Michelangelo and established a good relationship with him [12]. In 1548, he moved to Rome where he taught at La Sapienza and kept this position until his death in 1559, aged 59. He gained favor at the papal court and performed autopsies on a number of leading ecclesiastics. In 1550, he was appointed surgeon to Pope Giulio III.

Colombo continued his collaboration with Michelangelo for the publication of an illustrated textbook on anatomy to rival the famous *Fabri*ca. In 1558, the publication of *De re anatomica* (On Anatomy) was started and dedicated to Pope Paul IV. Regrettably, just as publication was being completed, he died as did the Pope. Colombo's two sons retrieved the few copies that had been issued and printed the book with an updated dedication to the new Pope, Pius IV [40].

Numerous improvements in anatomy were made in *De re anatomica*, and some of Vesalius' errors were criticized. For this reason, his relationship with Vesalius, initially good, deteriorated rapidly.

As a result of his own dissections, Colombo discovered pulmonary circulation. Contrary to the current belief, he demonstrated that venous blood traveled between the two sections of the heart through the lung. In Book Seven, page 177, and Book Eleven, page 223, he explains that: "between the ventricles there is a dividing wall (…) Almost everyone believes that the blood passes from the right ventricle into the left across this wall (…) But they are completely wrong. For the blood is conducted to the lungs by the pulmonary artery, where it is diluted and together with air is led from the left ventricle by the pulmonary veins" [11].

Whether Colombo was the first anatomist to demonstrate that the blood passes from the lung into the pulmonary vein is unclear. The Spanish theologian and physician **Miguel Serveto** (1511–1553) had already denied the permeability of the septum in 1553. The first description of pulmonary circulation appeared in **Juan Valverde de Hamusco's** textbook on anatomy published in 1556, 3 years before *De re anatomi*ca. However, Valverde, one of Colombo's students, attended his lectures in 1544 in Padua, where he learned about pulmonary circulation directly from him. He probably stole this important discovery and published it without acknowledging the source.

In addition to pulmonary circulation, Colombo noticed that the active phase of the heart was in systole (*contraction*), not in diastole (*dilatation*) as previously believed. These observations were later confirmed by Harvey in *De motu cordis* (1628), who gave credit to Colombo for this finding.

The book has no images, apart from a beautiful woodcut title page attributed to **Paolo Veronese** (1528–1588), which shows a dissection scene where Realdo Colombo is sectioning a cadaver in front of numerous students and physicians (Fig. 8.37).

Fig. 8.37 Dissection scene. Woodcut title page of *De re Anatomica* (On Anatomy), representing Realdo Colombo, who is lecturing to a large audience of students, physicians, nobles, university professors, and church authorities, while performing the dissection of a cadaver, with the abdomen opened. (From: Colombo R. *De re anatomica*. Venezia, Nicola Bevilacqua, 1559)

8.5.2 Gabriele Falloppio

The tradition of the Paduan School of Anatomy continued with **Gabriele Falloppio** (1523–1562), a disciple of Andreas Vesalius, who succeeded Realdo Colombo at his death in 1559. A summary of his biography and contributions is reported in Sect. 3.1.3.4. Due to his premature death, aged 39, all his works but one were posthumously published by his co-workers. Only *Observationes Anatomicae* (Anatomical Observations) was issued during his lifetime, in 1561, without illustrations [41]. A great dissector and acute observer, he discovered and described the sphenoidal sinus, the chorda tympani, the semicircular canals, and the aqueduct, which, along with the tubes, eponymously bears his name. He introduced the term hard and soft palate and velum palatini. He also studied the course of the cerebral vessels, the ovaries, and the round ligament. He is considered the most outstanding Italian anatomist of the sixteenth century.

8.5.3 Hieronymus Fabricius ab Aquapendente

At Falloppio's death in 1562, the Chair of Anatomy in Padua was given to **Hieronymus Fabricius ab Aquapendente** (ca.1533–1619), one of the most prominent anatomists and surgeons of the sixteenth and the beginning of the seventeenth centuries. Fabricius maintained the Chair of Anatomy and Surgery at Padua University for almost 40 years until his retirement in 1608, when he was replaced by his disciple **Giulio Casserio** (1552–1616). In Sect. 4.1.5.1, we have reported Fabricius' life and achievements in the field of surgery. During his long life, Fabricius contributed significantly to the progress of anatomy with important anatomical, embryological, and physiological works, posthumously collected in *Opera Omnia Anatomica & Physiologica* (Complete Works on Anatomy and Physiology) [42]. He built an anatomical theater at his own expense, inaugurated in 1594, for teaching purposes and public dissections (*see* Fig. 4.18). The theater still exists in Palazzo Bo in Padua. Thanks to him and to the great anatomical tradition, Padua became one of the most celebrated international centers for medicine in Europe thanks to the high quality of his teaching. Fabricius had numerous students coming from various countries to attend his lectures. Among them were **William Harvey** (1578–1656) from England, **Adrian van der Spieghel** (1578–1625) from Belgium, **Caspar Bahuin** (1560–1624) from Switzerland, **Peter Paaw** (1564–1617) from The Netherlands, **Caspar Bartholin** (1585–1629) from Denmark, and **Olaus Worm** (1588–1654) from Denmark. All of them became famous, to varying degrees, in their own country.

Fabricius' writings on embryology, *De formato Foetu* (On the Formed Foetus) and *De formatione Ovi et Pulli* (On the Development of the Eggs and Chickens) first published in 1600 and 1621, respectively, and profusely illustrated with copper engraved plates, are unique studies of the highest scientific value on the early stages of the formation and development of the fetus (Fig. 8.38). They are the first works of this kind [2]. He published on the structure of the esophagus, stomach, and intestines; on the structure of the eye; on respiration; on locomotion; and on the voice and hearing apparatus, *De Locutione et eius Instrumentis* (On Speech and Its Organs), first issued in 1601 [43] (Fig. 8.39). In 1603, he published a seminal account *De Venarum Ostiolis* (On the Valves of the Veins), probably his best work, in which he gave the first clear description of the semilunar valves that prevent retrograde blood flow within the veins [44] (Fig. 8.40). These discoveries provided **William Harvey**, a student of his, with the basis for his theory of blood circulation.

At Fabricius' retirement as Chair of Anatomy and Surgery, the continuation of the leadership in anatomy in Padua was represented by two of Fabricius' disciples: **Giulio Casserio** and **Adrian van der Spieghel.**

Fig. 8.38 Engraved plate showing the opened uterus containing the foetus and placenta. To the right the fetus before delivery. (From: Fabricius ab Aquapendente H. *De formato Foetu*. Table III. In: *Opera Anatomica*. Padova, Antonio Meglietto, 1625)

Fig. 8.39 Engraved plate showing the organs of voice production: larynx, pharynx, soft palate, and tongue. (From: Fabricius ab Aquapendente H. *De Locutione et eius Instrumentis*. Padova, L. Pasquati, 1603)

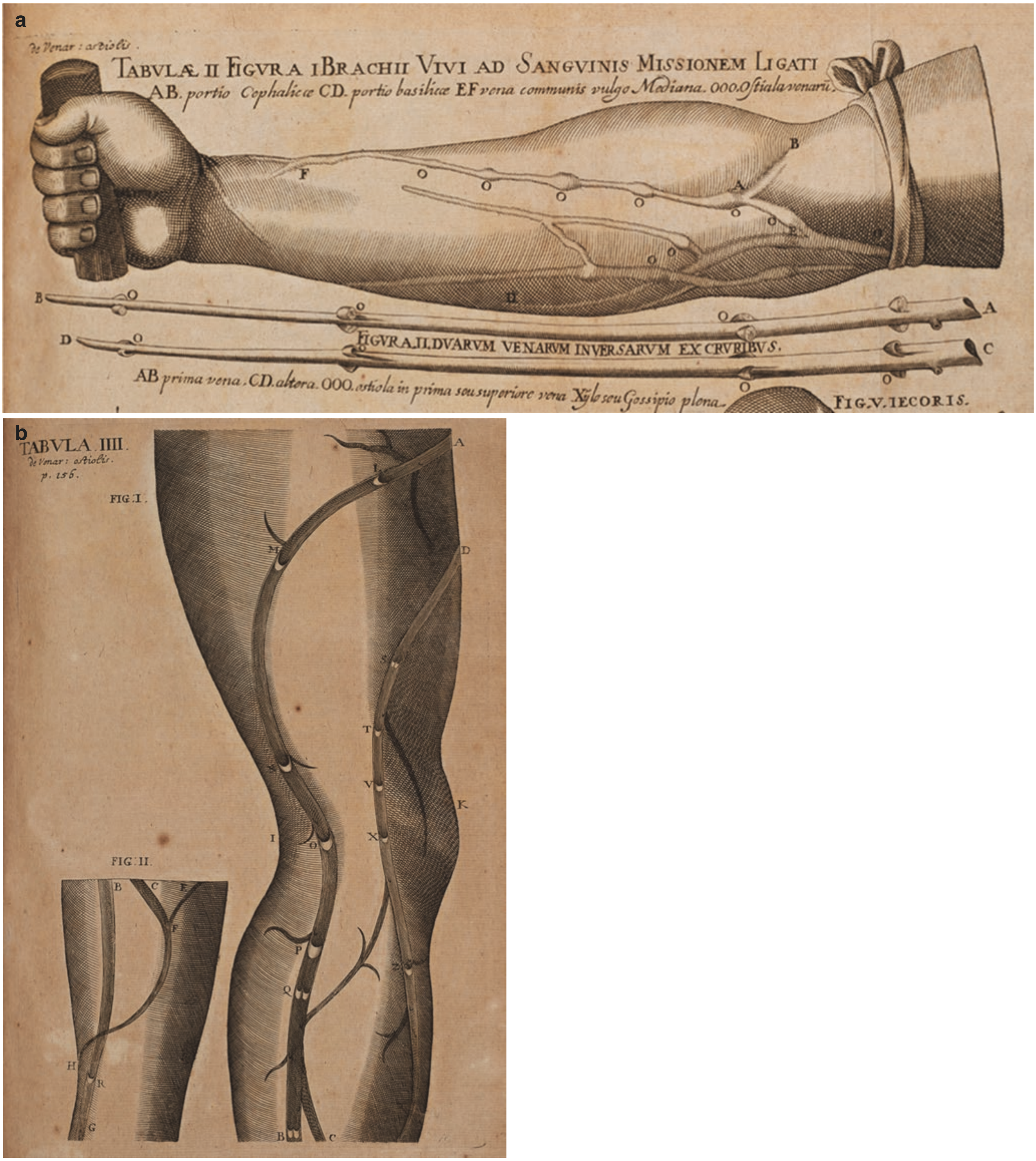


Fig. 8.40 Engraved plates demonstrating the presence of vein valves which allow blood to flow uni-directionally. (**a**) the veins of the arm with the valves (*ostiola*); (**b**) the opened saphenous vein in the leg with the valves (*ostiola*). (From: Fabricius ab Aquapendente H. *De venarum ostiolis*. Table II and IV. In: *Opera Omnia Anatomica & Physiologica*. Leipzig, Johann Friederic Gleditsch, 1687)

8.5.4 Giulio Casserio

Originally from Piacenza (northern Italy), **Giulio Casserio** (ca.1552–1616) (*see* Fig. 4.21) succeeded Fabricius in 1604 as Professor of Anatomy at the University of Padua [2]. As we have seen in Sect. 4.1.5.2, in 1601, he published *De Vocis Auditusque Organis* (On the Organ of the Voice and Hearing), where he illustrated the vocal and auditory apparatus of man and animals and provided the first image of a tracheostomy [45] (*see* Fig. 4.22). He issued two other important anatomical works: in 1609, *Pentaestheseion* (Five Books on Estesiology) on the five sense organs, with 33 beautifully engraved anatomical illustrations; and *Tabulae Anatomicae* (Anatomic Plates), posthumously published in 1627, following a turbulent story [46]. Casserio worked on the publication of an anatomical atlas with large folio engraved plates for about 16 years. Unfortunately, he died in 1616 before the work was completed.

8.5.5 Adrian Van der Spieghel

Casserio was replaced as the Chair of Anatomy by **Adrian van der Spieghel**, better known as **Adrianus Spigelius** (1578–1625), from Brussels and from the same school of Fabricius. Even Spigelius planned to write an anatomical textbook, *De humani Corporis Fabrica* (On the Structure of the Human Body). Regrettably, he died in 1625, when only the manuscript without illustrations was finished. In his will, he entrusted **Daniel Rindfleisch**, better known as **Bucretius**, (ca.1600–1631), a German physician from Breslau in Silesia (current day Poland), to issue his anatomy text. Bucretius obtained the beautiful engraved copperplates from the heirs of Casserio, prepared by **Odoardo Fialetti** (1573–ca.1637), a disciple of Tintoretto, for his unpublished *Tabulae Anatomicae* to illustrate Spigelius' work. Of the 78 plates received, he used 77, as one was spoiled, and 20 more were added by Bucretius himself. Each image, combining scientific accuracy with artistic perfection, was accompanied by explanatory text [46]. Commenting on the plates, Choulant-Frank said: "they mark a new epoch in the history of anatomical illustration (…) and have become the models for anatomical representation in engraving, just as Vesalius' images had been for anatomic woodcuts" [12]. *Tabulae anatomicae* represents a masterpiece of anatomical imagery (Fig. 8.41).

The historian **Charles Singer** emphasized that with the death of Spigelius, the golden age of the Anatomical School of Padua, initiated by Andreas Vesalius and continued by Fallopius, Fabricius, and Casserio, came to an end [2]. However, in our opinion, the name of another great anatomist, **Johannes Vesling**, should be added.

Fig. 8.41 Engraved plates from Giulio Casserio (ca.1552–1616) *Tabulae Anatomicae*. *Left*: the superficial layer of the anterior muscles; *right*: the superficial musculature of the dorsum. A beautiful landscape in the background. (From: Casserio G. *Tabulae Anatomicae*. Venezia, Evangelista Deuchino, 1627)

8.5.6 Johannes Vesling

Johannes Vesling (1598–1649), a native of Minden in Westphalia (Germany), studied in Leiden and later in Bologna. In 1628, he went to Egypt where he lived for 5 years before returning to Italy, and was appointed Professor of Anatomy and Surgery first in Venice and then in 1632 in Padua. The German **Johannes Wirsung** (1589–1643), the discoverer of the pancreatic duct, was his prosector. Among his students, mention should be made of **Thomas Bartholinus** (1616–1680). **Vesling's** contribution to the study of blood circulation, based on Harvey's investigations, his description of the lymphatics, and his studies of embryology are of the utmost scientific importance. In 1638, Vesling became Director of the Botanical gardens, a position previously held by **Prospero Alpino** (1553–1616) and dedicated himself to their renovation, ceasing lecturing on surgery. He died in Padua in August of 1649, after a trip to Crete, and was buried in the cloister of the Church of St. Antonio [12, 28].

During the period when he was in Padua, Vesling issued *Syntagma Anatomicum* (A Collection of Anatomy), one of the most popular anatomical textbooks of the period and considered the standard manual for more than 50 years in universities all over Europe. *Syntagma Anatomicum* was first published in 1641 without illustrations and reissued in 1647 with engraved plates [47]. It went through many editions and was translated into German, Dutch, and English.

The frontispiece depicts a dissection scene in the anatomical theater built in 1594 in Padua by Fabricius. It shows Johannes Vesling, in the position of Professor of Anatomy, dissecting a human corpse by candlelight in front of students occupying the tiers and wearing hats (Fig. 4.18). The frontispiece and plates were engraved by **Giovanni Giorgi**. Figures are mostly original, very technical, sometimes even diagrammatic. They represent the organs of the human body, without adding any background to them, a style commonly used in the anatomical illustration of the period. *Syntagma Anatomicum* contains numerous new discoveries. The chyliferous circulation was reported here for the first time. Seventeen years before **Thomas Willis** (1621–1675), he described the anastomotic vascular circle existing at the base of the brain between the anterior cerebral artery, the internal carotid, the posterior communicating, and the posterior cerebral. However, priority of the discovery of the vascular cerebral circle belongs to **Gabriele Falloppio** in 1561 [41].

8.6 Anatomy in Rome in the Sixteenth Century

In Rome, the tradition of anatomy was established by **Bartolomeo Eustachio**, probably the most outstanding sixteenth-century anatomist outside Padua, and by his disciple **Juan Valverde de Hamusco**.

8.6.1 Bartolomeo Eustachio

A native of San Severino Marche in the Vatican State, **Bartolomeo Eustachio** (ca.1510–1574) studied medicine at the University of Rome. In 1539, at the completion of his studies, he was appointed Physician at the court of the Duke of Urbino. In 1549, when Giulio Feltre della Rovere, the Duke's brother, was nominated Cardinal by Pope Paolo III, Eustachio followed him to Rome. He obtained the Chair of Anatomy at Sapienza University and was given permission to dissect cadavers.

In 1564, he published *Opuscula Anatomica* (Anatomical Essays) [48], the only work issued during his lifetime, a collection of different anatomical tracts: *De renum structura* (On the Structure of the Kidney), *De Auditu organis* (On the Hearing Apparatus), *De vena quae Azygos Graecis dicitur* (On the Vein Named Azygos by the Greeks), and *Libellus de Dentibus* (Booklet on Teeth), together with two earlier defenses of Galen *Ossium Examen* and *De motu capitis* (On Bone Examination) and (On Head Movements).

Opuscula Anatomica is regarded as a very innovative essay for the important anatomical discoveries it contained. The tract on kidneys, the first work specifically devoted to this topic, includes a description of the suprarenal glands, and is illustrated by eight copper engraved plates. Seven of them pertain mainly to the kidneys, whereas the last one, Plate 8, to the heart and to the veins in the arm. The azygos vein and the stapedial muscle are shown in Plates 4 and 7, respectively (Fig. 8.42). The tract on the hearing apparatus illustrates the cochlea, tensor tympani, stapedial muscle, and the auditory tube (*tuba auditiva*), eponymously named Eustachian. In the tract on the azygos vein, Eustachio provides a description of the thoracic duct and the valve of the right ventricle, demonstrating a clear knowledge of the heart's structure.

The *Libellus De Dentibus*, bound separately at the completion of *Opuscula Anatomica*, has a different title and date: 1563 instead of 1564. It plays a key role in the history of medicine, being the first report of teeth, their structure, the enamel and the dentin, the two dentitions, and tooth sensitivity. It is rightly considered the beginning of dentistry.

Eustachio was among the first anatomists to use copper engravings for illustration, more accurate and precise than woodcuts. He introduced the ruler to the plate borders to facilitate the reader's locating the different structures and measuring their size, without printing any letters on the figures.

He planned a comprehensive anatomical work, *De dissensionibus ac contoversiis anatomicis* (Anatomical Disputes and Controversies), which never appeared. Of the 54 plates prepared for the projected book, only 8 were used for *Opuscula*. The other 47, already engraved in 1552 by **Giulio de' Musi**, were entrusted by Eustachio personally to his co-worker **Matteo Pini**, along with explanatory text, with the specific task of publishing them. For various reasons, the publication never took place, and after Eustachio's death in 1574, the plates, bequeathed to Pini, and kept in a separate closet, were soon forgotten. They were rediscovered almost 150 years later in Urbino by one of Pini's descendants, the priest **Andrea De Rossi**, and purchased for 600 scudi by Pope Clement XI. Presented to **Giovanni Maria Lancisi** (1665–1720), physician to the Pope, the plates were first published in Rome in 1714 [49] and reissued numerous times. Differing from those of Vesalius, these plates didn't indulge in amazing landscapes and architectural motifs. They were less beautiful. However, they were scientifically very precise and contained the numerous discoveries of Eustachius (Fig. 8.43). Had these plates been published earlier, Eustachio would have ranked among the most outstanding sixteenth-century anatomists. According to Singer [2], Eustachio, along with Vesalius, *must be considered one of the founders of modern anatomy.*

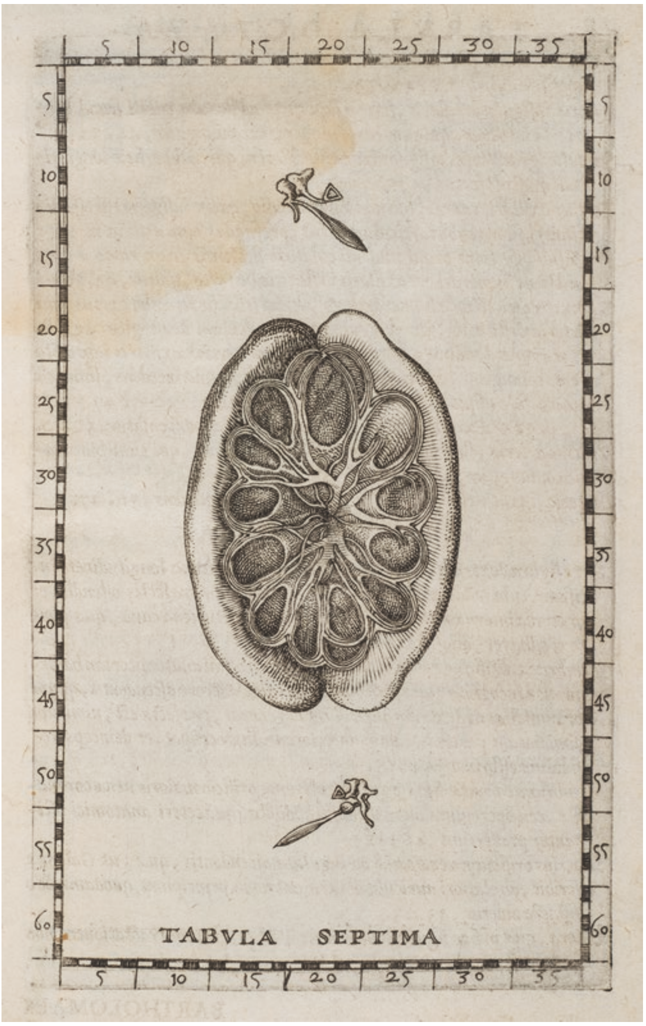


Fig. 8.42 Engraved plate from Bartolomeo Eustachio (ca.1510–1574) *Opuscula Anatomica* showing the section of the kidney of a dog and the ear ossicles with the tensor tympany muscle in man and dog. (From: Eustachio B. *Opuscula Anatomica*. Venezia, Vincenzo Luchino, 1564)

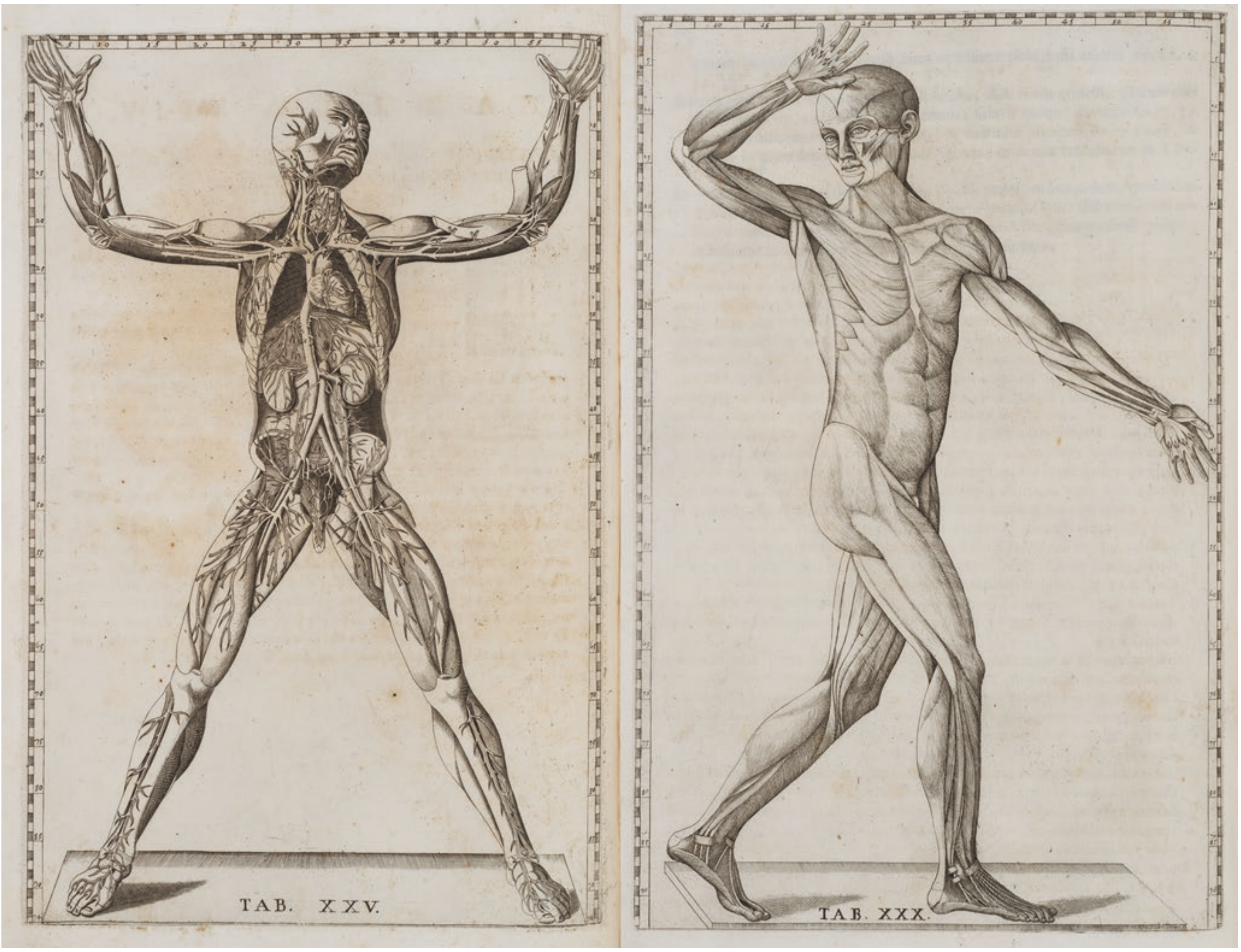


Fig. 8.43 Engraved plates from Bartolomeo Eustachio *Tabulae Anatomicae*. *Left*: the vascular system in an opened cadaver showing its relationship to the internal organs and to the muscles; *right*: the first layer of the anterior muscles in a skinned man (*écorché*). (From: Eustachio B. *Tabulae Anatomicae*. Edited by J. M. Lancisi. Roma, Francesco Gonzaga, 1714)

8.6.2 Juan Valverde de Hamusco

In 1544, **Juan Valverde de Hamusco** (ca.1525–1587) studied medicine in Padua under Realdo Colombo, successor to Vesalius, and, when he moved to Rome, under Bartolomeo Eustachio. He was the personal physician to Cardinal Juan Alvarez de Toledo, the son of the Duke of Alba, to whom his book was dedicated. In 1555, Valverde worked at Santo Spirito Hospital in Rome [12, 28].

In 1556, he published a textbook on anatomy first in Spanish, *Historia de la Composición del Cuerpo Humano* (History of the Structure of the Human Body) [50], then translated into Italian in 1560 as *Anatomia del Corpo Humano* (Anatomy of the Human Body) [51], and later into Latin and Dutch. Of the 42 plates in the work, only 4 were original. The rest were plagiarized from Vesalius, who bitterly commented on Valverde, accusing him of having performed very few dissections himself. The illustrations were drawn by the Spanish painter and sculptor **Gaspar Becerra** (1520–1570), and engraved by a disciple of Michelangelo, **Nicholas Beatrizet** (ca.1507–1570), whose monogram NB appears in some images. The book was a great success. It was easier to read and to consult than *Fabrica*, with copper plates, much more clear and detailed than Vesalius' woodcuts, and last but not least, less expensive. Of particular relevance was the rich architectural composition of the title page (Fig. 8.44) with dissected cadavers wearing suits of armor and the standing figure of a skinned muscle man (*écorché*), holding his skin in the right hand, and the knife, used for dissection, in the left, illustrating the superficial musculature of the body (Fig. 8.45). A similar dramatic image was painted in the Sistine Chapel by Michelangelo.

Fig. 8.44 Engraved architectural title page of Valverde's *Anatomia*. On the sides two skeletons hold the shield with the book's title. (From: *Anatomia del Corpo Humano*. Roma, Antonio Salamanca, 1560)

Fig. 8.45 The superficial musculature of the entire body in a skinned man (*écorché*). The dramatic standing figure holds his skin in the right hand, and the knife, used for skin dissection, in the left hand. (From: Valverde J. *Anatomia del Corpo Humano*. Roma, Antonio Salamanca, 1560)

8.7 Anatomy in the Seventeenth and Eighteenth Centuries

In the sixteenth century and in the first three decades of the seventeenth century, medical students eager to take advantage of top level scientific education went predominantly to Padua University. As a result of their training in Padua, when they returned home, they successfully practiced medicine and taught anatomy in their native countries, often achieving leading positions.

8.7.1 Switzerland

8.7.1.1 Caspar Bauhin

Returning to Basel (Switzerland) from Padua, where he spent a year and a half with Fabricius, **Caspar Bauhin** (1560–1624) was named Chair of Anatomy and Botany in 1588. The following year, he built an anatomical theater for dissections. In 1605, he published a chunky textbook, *Teatrum Anatomicum* (Anatomical Theater), mainly addressed to medical students, with engraved plates, not original, but reproduced in smaller size, from Vesalius, Valverde, Eustachio, Casserio, Estienne, and others [52].

8.7.1.2 Albrecht von Haller

Albrecht von Haller (1708–1777) had a very versatile mind and was one of the most learned personalities of all time. He was a scientist, physiologist, anatomist, botanist, poet, writer, and an avid book collector. He was born in Bern in 1708 and studied medicine in Tübingen and in Leiden under **Hermann Boerhaave** (1668–1738) and **Bernhard S. Albinus** (1697–1770). In 1727, aged 18, he graduated in medicine and beginning in 1734, gave demonstrations in anatomy at the theater, built for this purpose in Bern, at his own request. In 1736, he was appointed Professor of Anatomy and Surgery at the newly established University of Göttingen (Germany). An excellent anatomist, he personally dissected more than 400 cadavers, employing injection techniques to study the vascular network of the human body. Between 1743 and 1756, he issued *Icones Anatomicae* (Anatomical Illustrations), a series of 47 large folio plates, collected into fascicles in 8 parts, with engraved illustrations by **J. Paul Kaltenhofer** (died 1777), mainly focused on the system of arteries of the whole body. Moreover, he illustrated the diaphragm, the spinal cord, the skull base, the omentum, and the heart [53]. *Icones Anatomicae* remained the standard text on the vascular system until well into the middle of the nineteenth century [12].

While in Göttingen, he dedicated himself to developing the physiology of the nervous system. In 1743, he published *Primae lineae Physiologiae* (First Lines of Physiology) which was followed by an eight-volume work, *Elementa physiologiae corporis humani* (Elements of Human Physiology), issued from 1757 to 1766 [54]. In 1753, he resigned from his university position in Göttingen and returned to Bern, where he worked as a municipal administrator. He continued to write on a variety of subjects, philosophical and literary matters included, leaving aside his studies of normal anatomy for the lack of cadavers. He published on embryology, describing normal and abnormal development of the fetus. He investigated congenital malformations and issued the first systematic classification based on etiology, which appeared in <u>Volume Three</u> of *Opera Minora* (Minor Works) (1762–1768). He was an extremely prolific writer, publishing more than 600 scientific works.

Von Haller assembled an important library which at his death was acquired by the Austrian government by order of Emperor Joseph II, son of Empress Maria Theresa. The whole library was brought from Bern to Milan via the Gothard pass. It is now housed in Milan at the Braidense Public Library. Von Haller married three times and had 8 children. He died in Bern in 1777, aged 69 [28].

8.7.2 Denmark and Sweden

8.7.2.1 Caspar Bartholin

Caspar Bartholin (1585–1629) trained in Padua between 1608 and 1610 under Fabricius and Casserio. Upon his return to Copenhagen, he was appointed Professor of Medicine in 1613 and later Professor of Theology. In 1611, he published *Institutiones Anatomicae* (Anatomical Institutions). Despite the book having no illustrations, it had great success and went through several editions. It was posthumously reissued by his son Thomas in 1641 and 1645, with illustrations derived from Vesalius, Casserio, and Vesling and became the standard text for years [55].

8.7.2.2 Thomas Bartholin

Thomas Bartholin (1616–1680), the second of Caspar's six sons, studied theology at the University of Copenhagen. In 1637, he visited various European universities, namely, Paris, Leiden, Basel, Montpellier, and Padua, before deciding to study medicine. In Padua, he was the student of **Johannes Vesling** (1598–1649), who in the meantime had been appointed Professor of Anatomy at that university. From there, Bartholin continued to Rome and Naples where he met **Marco Aurelio Severino** (1580–1656) and established a long-lasting friendship with him. Before returning to Copenhagen, he went to Basel where, in 1645, he received the degree of Doctor of Medicine from Caspar Bauhin. In Copenhagen, he was nominated Professor of Philosophy in

1646 and 3 years later Professor of Anatomy at the Medical Faculty. His most famous student was **Niels Stensen** (1638–1686).

Bartholin pursued his anatomical studies intensively, dedicating himself to the investigation of lymphatic circulation, and the relationships between chyliferous and blood vessels. He was the first to describe the correct route of lymph into the blood stream. Bartholin's greatest contribution to anatomy was the demonstration that lymphatic circulation is a completely separate system.

Thomas Bartholin was considered the greatest anatomist of his time not only for his teaching, but also for his publications. His lectures were attended by Danish and foreign students and sometimes even by King Fredrik III himself. A very prolific writer, his most important publication was *Institutiones Anatomicae*, first printed in 1641 and then in 1645, as a revision of his father's textbook. A completely new edition appeared in 1651, with illustrations derived from Casserio and Vesling [56] (Fig. 8.46). In 1663, he retired from all academic duties and died in 1680, aged 64.

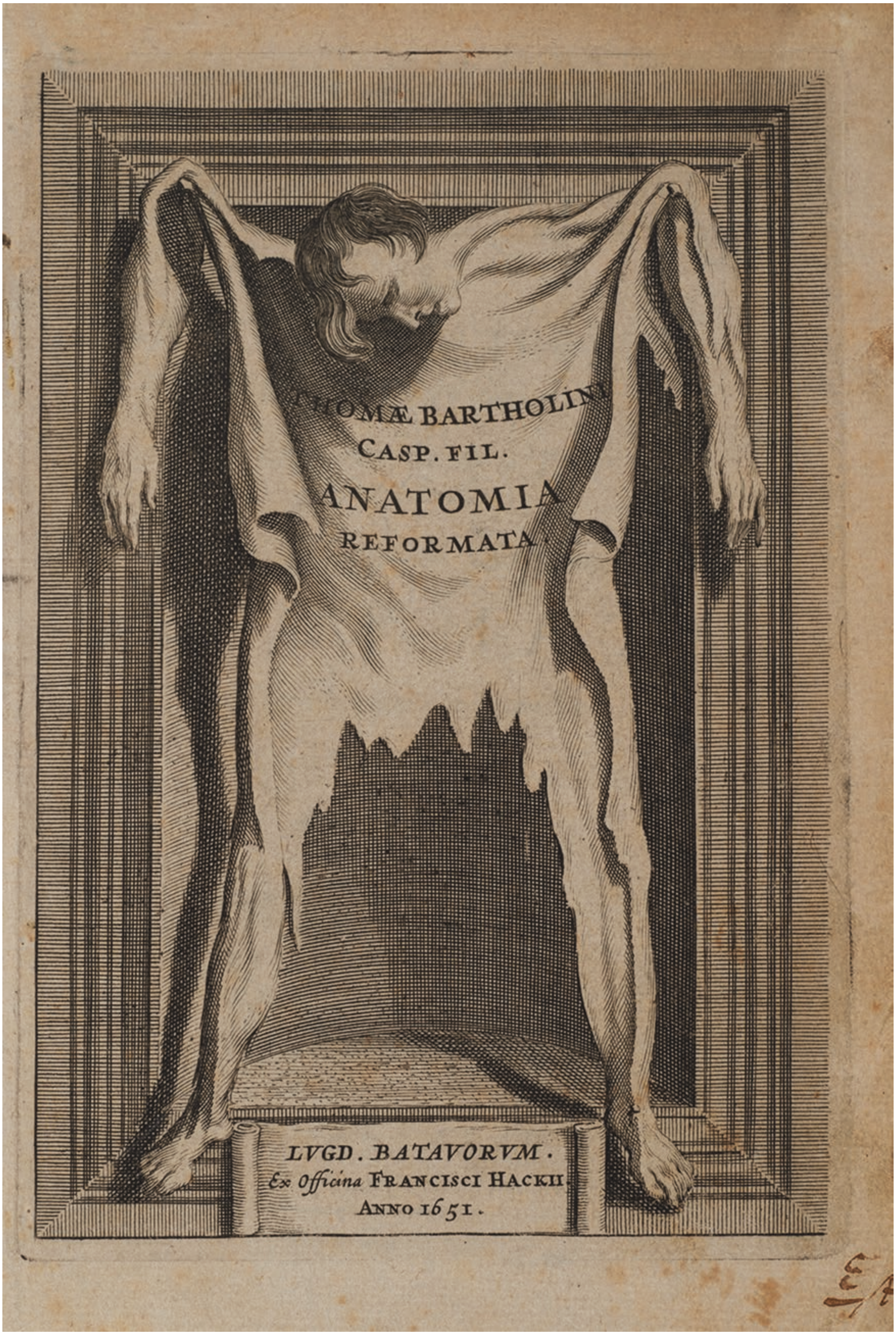


Fig. 8.46 The dramatic title page of Thomas Bartholin's (1616–1680) *Anatomia,* representing the skin of the human body. (From: Bartholin T. *Anatomia reformata*. Leiden, Franc. Hack, 1651)

8.7.2.3 Olof Rudbeck

Shortly after the publication of Pecquet's [57] and Bartholin's [58] findings in 1653, the Swedish physician **Olof Rudbeck** (1639–1702), Professor of Medicine at Uppsala University, did similar research on the human lymphatic system and claimed priority of the discovery. An endless dispute followed. Regrettably, Rudbeck delayed the publication of his research after Bartholin [59].

All the discoveries related to the lymphatic system, from Aselli to Pequet, Bartholin, Rudbeck, and Ruysch, were summarized and incorporated with their related plates in *Bibliotheca Anatomica* (Anatomic Library), a two-volume encyclopedia of the most significant anatomical contributions of the seventeenth century, edited by two Swiss medical writers, **Daniel Le Clerc** (1652–1728) and **Jean-Jacques Manget** (1652–1742) in 1685 [60]. Incidentally, Manget edited a similar encyclopedic work devoted to surgery (*Bibliotheca Chirurgica*) in 1721 (see Sect. 3.3.5.2).

8.7.3 The Netherlands

The torch of medical education was passed from Padua to The Netherlands. Increasing trade with the New World added political importance and wealth to the country and interest in science grew rapidly.

8.7.3.1 Leiden

Leiden University, established in 1575, soon became the center of medical training, and its fame spread around the world. Flourishing book commerce disseminated scientific knowledge in Latin, Dutch, German, French, and other languages. During the seventeenth and eighteenth centuries, numerous printing houses opened in Leiden (in Latin: *Lugduni Batavorum*), and a considerable number of scientific texts with fine engraved illustrations drawn by highly skilled artists were produced, as large in-folio atlases of human anatomy, rarely surpassed in terms of accuracy and detail. The golden age of Dutch anatomy developed through a series of unquestionably prominent anatomists including **Pieter Paaw**, **Frederik Ruysch**, **Theodor Kerckring**, **Govard Bidloo**, and **Bernard S. Albinus**.

Pieter Paaw

Pieter Paaw (1564–1617) was born in Amsterdam and studied medicine in Leiden. After graduating in 1587, he started to teach anatomy. To improve his knowledge, he travelled to Padua where he became a student of Fabrizio d'Aquapendente. Upon his return to Leiden, he was appointed Professor of Anatomy and Botany. He built an anatomical theater in Leiden and brilliantly taught anatomy and botany. He died in 1617, aged 53.

In 1615, he wrote *Primitiae Anatomicae. De humani corporis Ossibus* (First Fruits of Anatomy. On the Bones of the Human Body) devoted to osteology with four large, finely executed engraved anatomical folding plates, two showing skulls, and two with full skeletons, one of them a fetal skeleton [61]. The figures in the text illustrate the anatomy of the human body with particular reference to the head. The splendid frontispiece shows Paaw dissecting in the Leiden anatomical theater, surrounded by students, physicians, and Dutch burghers (Fig. 8.47).

Fig. 8.47 Engraved illustration by J. de Gheyn showing Pieter Paaw (1564–1617) teaching and dissecting in the Leiden anatomical theater, built at his own request, surrounded by students, physicians, and Dutch burghers. (From: Paaw P. *De humani corporis Ossibus.* Leiden, J. van Colster, 1615)

Thomas Theodor Kerckring

Born in Amsterdam, **Thomas Theodor Kerckring** (1640–1693) studied medicine in Leiden. After graduation, he moved to Amsterdam where he worked in cooperation with Frederik Ruysch. In 1678, he left Amsterdam and established a practice in Hamburg. In this city, thanks to his former affiliation with Ruysch, he created an incredible collection of anatomical preparations and curiosities, like fetal skeletons arranged in peculiar positions. This *cabinet* was the object of great admiration by visitors. Kerckring died in Hamburg in 1693, aged 53 [28].

In 1670, he published *Spicilegium anatomicum* (Anatomical Gleaning) divided into two parts [62]. In Part One, he reported 100 rare anatomical and pathological observations such as polydactyly, the hepatic portal vein, and the *valvulae conniventes* of the small intestine, which eponymously bear his name. Part Two, *Osteogeniam Foetuum* (Foetal Osteogenesis), with a separate title page, was devoted to the osteogenesis of the embryo.

The following year, he issued *Anthropogeniae Ichnographia* (Ichonography of Embryology) a supplement of *Osteogenia Foetuum*, where he described the first stages of an embryo's ossification from 1 month of gestation onwards, a continuation of the author's studies of fetal osteology [63]. Kerckring affirms that he was able to visualize the extremities, ears, nose, and mouth of a 15-day-old fetus.

Govard Bidloo

Also born in Amsterdam, **Govard Bidloo** (1649–1713) studied medicine in France and in 1670 became a student of the anatomist Frederik Ruysch in Amsterdam. About 1676, he began his apprenticeship in surgery. He then studied medicine at the University of Franeker, from where he graduated in 1682. Soon afterwards Bidloo began a relationship with the Belgian painter and engraver **Gérard de Lairesse** (1640–1711) and in 1688 was appointed Professor of Anatomy at The Hague. In 1694, he became Professor of Anatomy at Leiden University and maintained this position until his death in 1713 [12]. In 1701, he was appointed Royal Physician to William III of Orange, King of England.

In the history of anatomical illustration, Bidloo's *Anatomia humani Corporis* (Anatomy of the Human Body) certainly holds a key position [64]. It is one of the finest examples of anatomical atlases ever printed reflecting the Baroque style. The 105 full-page engraved plates, drawn after nature, illustrate the different parts and organs of the human body: head and neck, thorax, dorsum (Fig. 8.48 *left*), and genital organs and extremities (Fig. 8.48 *right*) as they appear on dissection. To improve realism and even sensuality, objects of everyday life, such as books, jars, cords to suspend the corpse (Fig. 8.49), pins to maintain skin flaps open, dissection knives, and even a fly (Plate 52) were often associated with the image of the cadaver in a macabre though dramatic combination.

Abraham Bloeteling (1640–1690), the engraver of the author's portrait, was probably also the engraver of the plates of Bidloo' work.

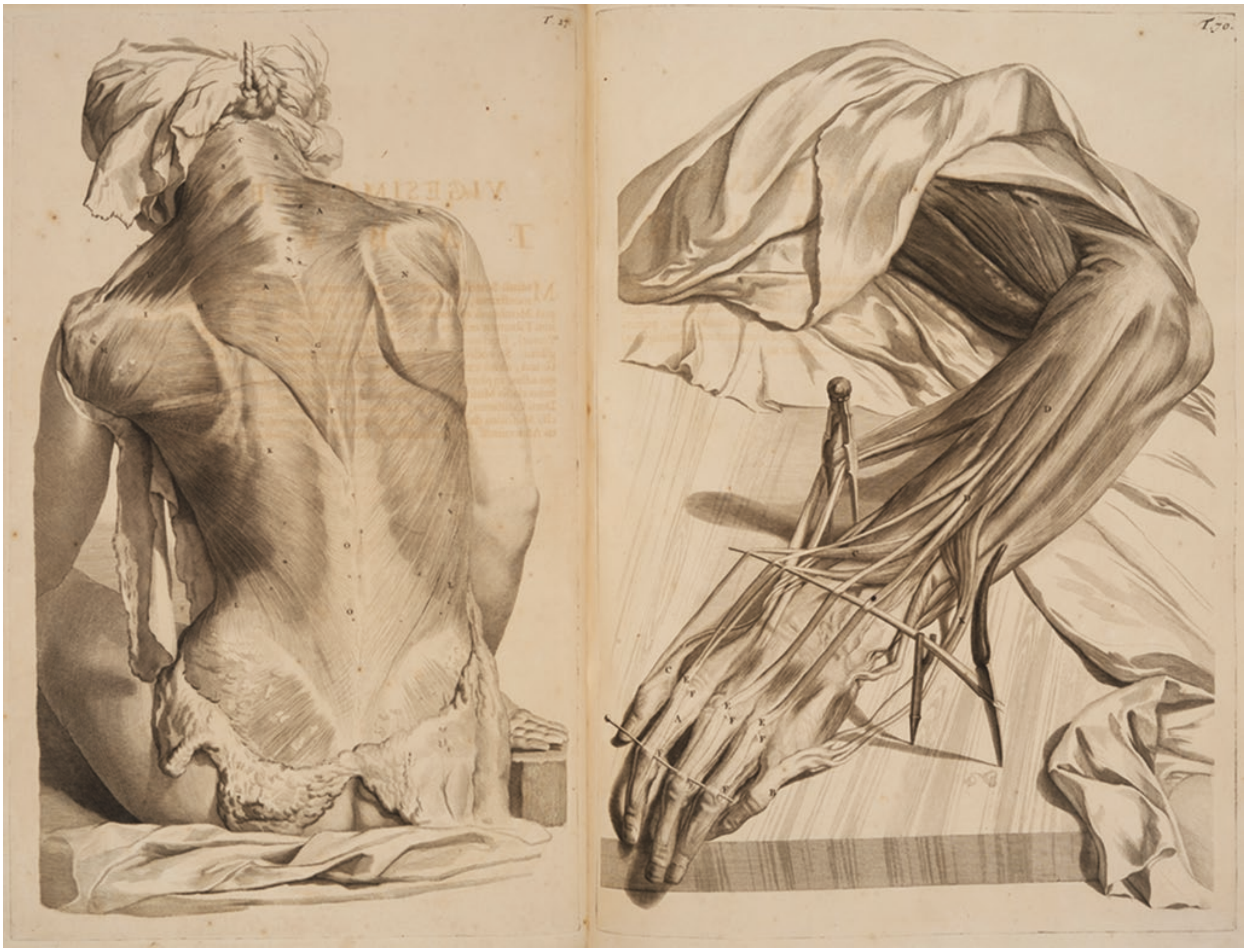


Fig. 8.48 Full page engraved plates by Govard Bidloo (1649–1713). *Left*: the first layer of the muscles of the dorsum; *right*: the muscles of the dorsum of the forearm and the dissected tendons of the dorsum of the hand. (From: Bidloo G. *Anatomia humani Corporis*. Amsterdam, Widow of J. van Someren, et al., 1685)

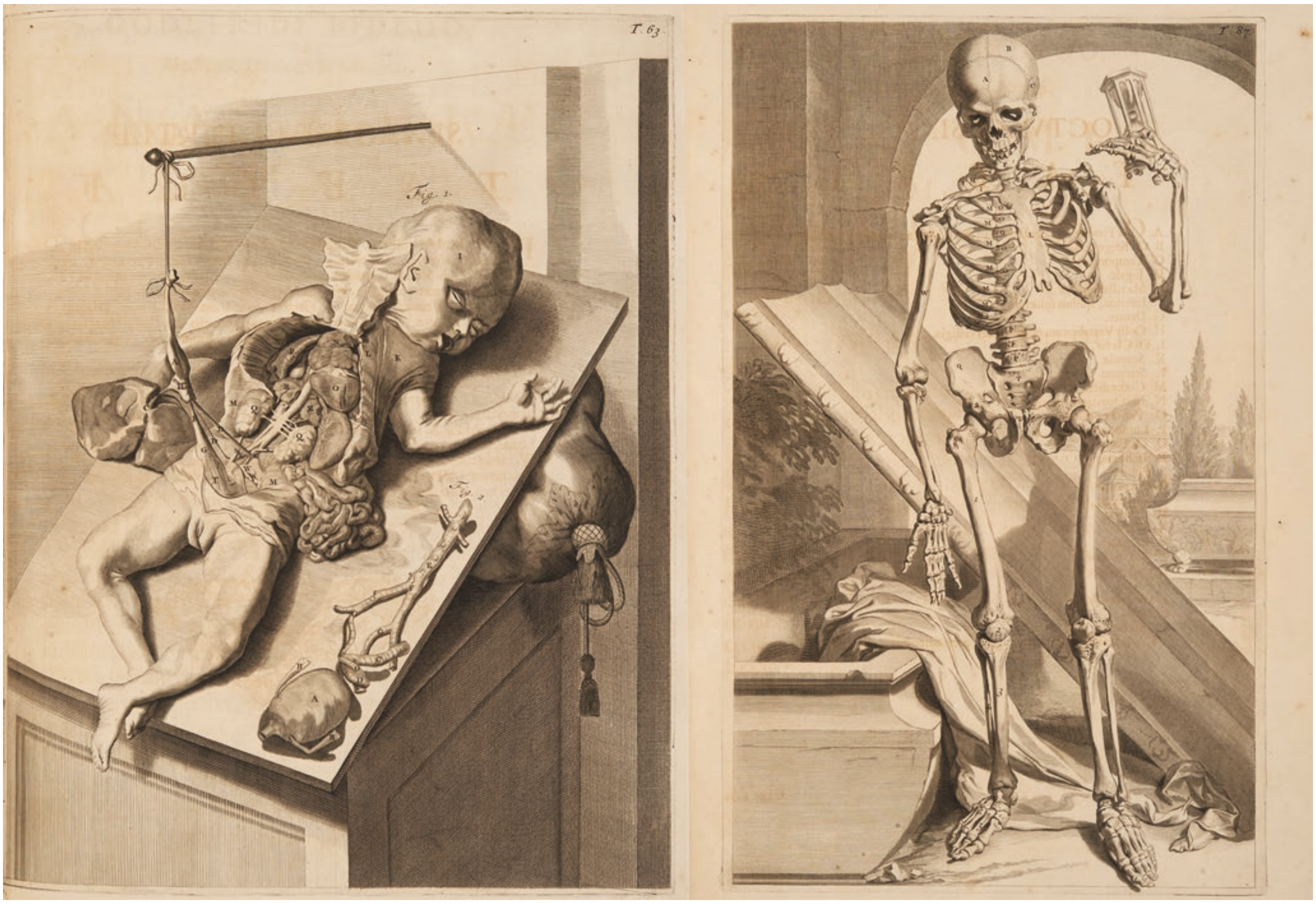


Fig. 8.49 Full page engraved plates by Govard Bidloo. *Left*: Dissection of a newborn; *right*: front view of a skeleton emerging from the tomb, holding an hourglass in its left hand. (From: Bidloo G. *Anatomia humani Corporis*. Amsterdam, Widow of J. van Someren, et al., 1685)

Bernhard Siegfried Albinus

Bernhard Siegfried Albinus (1697–1770) was born in Frankfurt a/O and entered the University of Leiden at the age of 12. He studied in Leiden under **Govard Bidloo** and **Hermann Boerhaave** and in Paris under **Guichard Joseph Duverney** and **Jacques Bénigne Winslow**, before graduating in 1719. With this strong anatomical basis, in 1721, aged 24, he was named Chair of Anatomy and Surgery at Leiden and dedicated his entire life to the study of anatomy, publishing numerous books and editing texts of previous authors, such as Vesalius, Eustachius, and Harvey [12]. In 1745, Albinus was appointed Professor of the Practice of Medicine. His brother, **Frederick Bernhard Albinus** (1715–1778) succeeded him as the Chair of Anatomy. During his life, he assembled an important scientific library and, like **Frederik Ruysch**, he created a *Wunderkammer Museum* (Cabinet of Curiosities). He died in Leiden in 1770, aged 73.

His most important publication was *Tabulae sceleti et musculorum corporis humani* (Plates of the Skeleton and Muscles of the Human Body), issued in 1747, illustrated by 40 full-size engraved plates, 3 of them representing the skeleton (Fig. 8.50 *left*), and 9 completely finished musclemen (Fig. 8.50 *right*), all accompanied by an outline-plate. They are provided with ornamental backgrounds to give the illusion of movement and produce a three-dimensional effect. The most famous illustration in the atlas shows a muscleman, seen from in front, almost completely dissected, standing in front of an enormous rhinoceros that arrived at the Amsterdam Zoo in 1741 (Fig. 8.51). The 16 following plates depict specific muscles and parts of muscles, without outlines. They show the insertion and action of the different muscles of the human body [28, 65]. Albinus personally supervised drawings with great care and accuracy, ensuring that every detail was maintained and proportions respected, to achieve a perfect result. Engravings were made by **Jan Wandelaar** (1690–1759), not freehand, but from careful measurements and brought down to scale. Albinus and Wandelaar devised a new technique of placing nets with square webbing at specified intervals between the artist and the anatomical specimen and copying the images using the grid patterns. Wandelaar was a student of **Gérard de Lairesse**, the artist who prepared the plates for Bidloo. He worked almost exclusively for Albinus from 1721 until his death in 1759, living in a part of Albinus' house [12]. In 1749, the plates were published in English, but the quality of the engraving was much lower.

Some of the plates included in this atlas are among the most beautiful and accurate ever printed. They constitute the zenith of anatomical illustration, and Albinus is regarded as one of the greatest anatomic illustrators of his time. *Tabulae ossium humanorum* (Plates of Human Bones), issued in 1753, represents a continuation of *Tabulae sceleti* [66].

Fig. 8.50 Full page engraved plates by Bernhard S. Albinus (1697–1770). *Right*: Profile view of a skeleton; *left*: muscleman seen from the front, showing the second layer thoracic mucles. (From: Albinus BS. *Tabulae sceleti et musculorum corporis humani*. Leiden, J.& H. Verbeek, 1747)

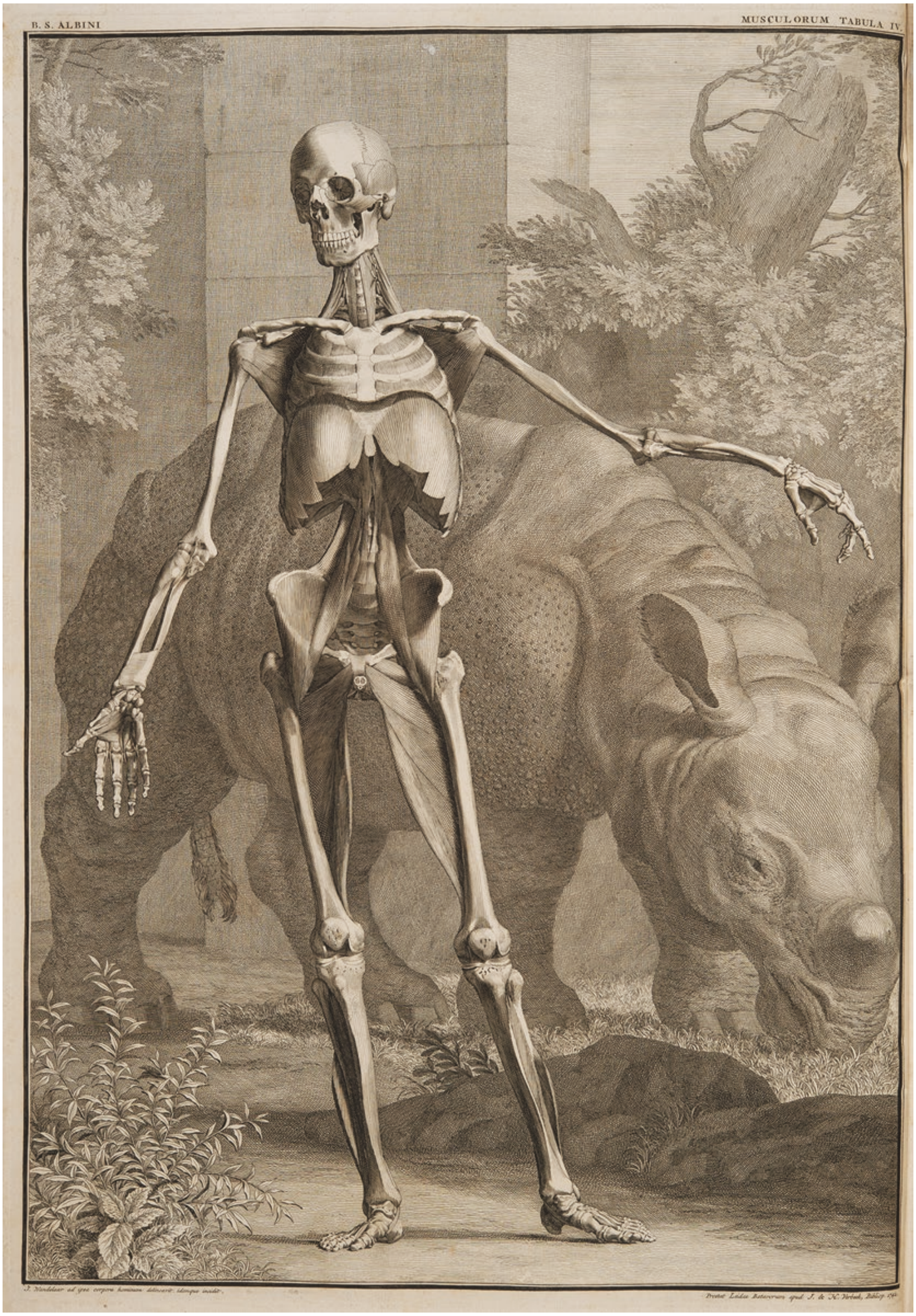


Fig. 8.51 The most famous illustration of Albinus' atlas. A muscleman almost completely dissected, stands in front of an enormous rhinoceros that arrived at the Amsterdam Zoo in 1741. (From: Albinus BS. *Tabulae sceleti et musculorum corporis humani*. Leiden, J.& H. Verbeek, 1747)

8.7.3.2 Amsterdam

Frederik Ruysch

Frederik Ruysch (1638–1731) was born in The Hague, studied medicine in Leiden from where he graduated in 1664, and was appointed Professor of Anatomy in Leiden and Amsterdam. He is best remembered for devising a special technique of injecting cadavers to preserve and study them easily. He gave the first description of bronchial blood vessels, vascular plexuses of the heart, and the valves of the lymphatic system. Ruysch demonstrated for the first time the distribution of blood vessels in almost every tissue of the body, and that the fetus is nourished through the umbilical cord. Besides his skill in anatomy, he was a talented obstetrician and botanist. He died in Amsterdam, aged 93 [12].

Ruysch enjoyed preparing elaborate three-dimensional, fantastic *cabinets* (preparations), constructed with human parts, using a secret method of injection for preserving the anatomical specimens: a mixture of talc, white wax, and cinnabar for the vessels, and a blend of wine, corn, pepper, and alcohol for embalming the creatures. During the first decade of the eighteenth century, Ruysch's Anatomical Museum constituted one of the major attractions for visitors to the city of Amsterdam. The unique collection of approximately 1300 specimens was displayed in his home. Czar Peter the Great (1672–1725), who visited the exhibition, was so fascinated with the preparations that in 1717 he bought the entire collection for an astronomical amount of money, equivalent to the price of a palace. He brought the material to St. Petersburg, where he arranged a *Wunderkammer Museum* (Cabinet of Curiosities). Regrettably, most of the dry preparations deteriorated over the years. Only those preserved in jars survived. Some of them are still visible in St. Petersburg, others in Leiden [28].

Between 1701 and 1716, Ruysch published *Thesaurus Anatomicus, primus-decimus; Thesaurus Animalium primus* (Anatomical Treasure, First-Tenth; Animal Treasure First) a two-volume textbook that was extremely important in the history of anatomical illustration because it showed a great deal of Ruysch's collection, and its bizarre arrangement, that has now almost completely disappeared except for the catalogue of the museum [67]. The text is in Latin and Dutch, in parallel columns. The numerous engravings were mostly by **Cornelis Huijbert** (*fl.* eighteenth century). A unique example of baroque anatomical illustration, Figure 1 from *Thesaurus Anatomicus primus* shows a *cabinet* of stones harvested from gall bladders and piled up to simulate a hill. Three baby skeletons stand in different positions among trees made from arteries or veins: one of them holds a sickle, symbolizing death; another uses the omentum as a handkerchief (Fig. 8.52). Five skeletons are hidden among the trees made from arteries and parts of intestines of various sizes and lengths (Fig. 8.53).

Fig. 8.52 Folding engraved illustration of Frederik Ruysch's (1638–1731) anatomical *cabinet*. Stones harvested from gall-bladders are piled up to simulate a hill. Three baby skeletons stand in different positions among trees made from arteries or veins: one of them holds a sickle, symbolising death; another uses the omentum as a handkerchief. (From: Ruysch F. *Thesaurus Anatomicus primus*. Amsterdam, Joannes Wolters, 1701)

Fig. 8.53 Folding engraved illustration of a Ruysch's anatomical *cabinet*. Bladder stones are piled up to simulate a hill. Five skeletons of various sizes are hidden among the trees, made from arteries and guts. (From: Ruysch F. *Thesaurus Anatomicus tertius*. Amsterdam, Joannes Wolters, 1703)

8.7.4 Italy

The Paduan school of anatomy ended about 1650. As Singer noted: “physiology rather than pure anatomy began to attract the best minds” [2]. Abandoning the comparative tradition that characterized Paduan anatomy from Vesalius to Casserius, was, according to him, one of the factors responsible for this transition. From that date onward, anatomical investigations became more accurate and precise, gaining major interest for the surgeon.

The seventeenth and eighteenth centuries are regarded as the age of specialized anatomic research with a series of discoveries and investigations, most of them with a physiologic background.

However, in the eighteenth century, Italian leadership in medical sciences, which had lasted for almost a millennium, gradually faded. A few cities emerged in the field of surgery and anatomy: Bologna, Venice, the Grand Duchy of Tuscany, and Pavia.

8.7.4.1 Rome

In the seventeenth century, the tradition of anatomy in Rome continued with **Pietro Berrettini da Cortona** who issued an unsurpassed series of anatomical plates, witness of a very accurate dissection and with **Bernardino Genga**, renowned for having issued the first textbook of anatomy for surgeons. Curiously, Berrettini’s engraved plates were printed 120 years after the author’s death, something similar to what occurred to Eustachio’s plates (see Sect. 8.6.1).

Pietro Berrettini

Pietro Berrettini (ca.1596–1669), painter and architect, was born in Cortona (near Arezzo, Tuscany). He is better known as **Pietro da Cortona**. At about 16, he moved to Rome where he became the *protégé* of Cardinal Francesco Barberini, nephew of Pope Urban VIII. In Rome, he was credited with designing numerous important architectural works including churches and palaces, but also frescoes on ceilings, such as the vault of the *salone* of Palazzo Barberini, and in various churches. He also worked in Florence creating the frescoes of some rooms of the Palazzo Pitti, commissioned by Grand Duke Ferdinand II dei Medici. He painted numerous canvases and competed with his rivals **Gian Lorenzo Bernini** and **Francesco Borromini** for architectural projects**.** He died in Rome in 1669, aged 72.

In about 1618, when he was not yet 20 years old, Berrettini directly assisted in dissections performed by the surgeon **Nicolas Larchée** (1602–1665) at the Santo Spirito Hospital in Rome. As a result, he prepared the *Tabulae Anatomicae* (Anatomic Tables) which, for unknown reasons, remained unpublished for more than 120 years [68]. The work was eventually acquired by **Gaetano Petrioli** (*fl.* eighteenth century), surgeon to Victor Amadeus II, King of Sardinia and published in 1741—that is, 72 years after Berrettini’s death. The plates were finally bought by the English ambassador to the Kingdom of Naples, Sir William Hamilton, who presented them to **William Hunter** (1718–1783), a Scottish anatomist, physician, and avid book collector, in 1772. They are now in the Hunterian collection at Glasgow University [69].

Tabulae Anatomicae is one of the most spectacular anatomical atlases ever printed. The figures, masterpieces of Baroque style, drawn after life, present dissected human bodies, all males, except the last one which is a female, in dramatic, peculiar positions, with beautiful landscapes in the background, and surrounded by architectural vaults, columns, arches, and basements. Many of them hold either an oval or a rectangular medallion, possibly a mirror. Inside, anatomical images are shown. Further accessory anatomical details were added to fill in the blank spaces present within the plates, presumably by Petrioli, who wrote the commentary on the *Tabulae*. They were of poor value and were removed in the second edition of 1788.

The first 14 plates show seated or kneeling corpses from the front (Fig. 8.54). As the dissection progresses, the different layers of muscles with nerves, vessels, and internal organs are represented. Plates 15 to 19 show the same type of anatomical dissection from the back. Plate 20, as well as plates 21 to 26, according to Choulant [12], were apparently not by Berrettini’s hand, but copied from Vesalius, Valverde, Vesling, and others, whereas the last plate, number 27, showing the reproductive female organs, seems to be an original Berrettini work (Fig. 8.55). As a common denominator of the plates, particular emphasis was placed on the course of the nerves, but also on the muscles and blood vessels. According to William Hunter, the plates were intended for neurologists, in addition to surgeons. Plate one is signed *Petr. Berret. Corton. delin*. Plates one and four bear the monogram LC, probably **Luca Ciamberlano** (1580–ca.1640), a painter and engraver from Urbino.

Fig. 8.54 Engraved plate of a kneeling dissected cadaver, emphasizing the course of the nerves: the inferior alveolar nerve, the sympathetic trunk within the thorax, and the hypoglossal and lingual nerves visible in the rectangular medallion where the mandible has been removed. (From: Berrettini P. *Tabulae Anatomicae*. Roma, Antonio de' Rossi, 1741)

Fig. 8.55 Engraved plate showing the reproductive female organs. (From: Berrettini P. *Tabulae Anatomicae*. Roma, Antonio de' Rossi, 1741)

Bernardino Genga

Bernardino Genga (1620–1690) was born in Mondolfo in the Duchy of Urbino and moved to Rome, where he practiced surgery at the Santo Spirito Hospital. An excellent anatomist, he was appointed Professor of Anatomy and Surgery and taught anatomy to artists at the French Academy in Rome. In 1672, he published *Anatomia Chirurgica* (Surgical Anatomy), without illustrations, the first textbook entirely devoted to surgical anatomy ever printed, where he emphasized the importance of anatomy for the surgeon [70]. The book went through numerous editions and remained in use for more than 50 years.

A beautiful anatomical atlas with 40 full-page engraved plates, *Anatomia per uso e intelligenza del Disegno* (Anatomy for the Use and Understanding of Drawing), dealing with osteology and myology after Genga's personal dissections, and preceded by an allegory of death, was posthumously issued a year after his death [71] (Fig. 8.56). The atlas was directed to painters and sculptors. At the end of the work, some of the famous statues from antiquity, considered anatomically interesting, were reproduced. **François Andriot** (died 1704) was most likely the engraver, while **Charles Errand** (1606–1689), court painter to Louis XIV, was the artist who drew the anatomical dissections. **Giovanni Maria Lancisi** (1665–1720), physician to the Pope, provided the commentary and the index.

Fig. 8.56 Two skeletons unveil a rounded bowl containing exhumed cadavers. The Angel of Death observes the scene. (From: Genga B. *Anatomia per uso e intelligenza del Disegno*. Roma, Domenico de' Rossi, 1691)

8.7.4.2 Milan

The only important anatomist of Milan's Duchy was **Gaspare Aselli**, renowned in the history of medical illustration for having issued the first textbook with color-printed anatomical plates.

Gaspare Aselli

An example of the new trend, favoring physiology rather than pure anatomy, came from **Gaspare Aselli** (1581–1625). A native of Cremona in the Duchy of Milan, Aselli studied medicine at Pavia University. He was a student of **Giovanni Battista Carcano Leone** (1563–1606) (see Sect. 3.1.3.6) and practiced medicine and surgery in Milan, becoming head surgeon of the Spanish army from 1612 to 1620. In 1624, he was appointed Professor of Anatomy and Surgery at Pavia University. He died the following year in Milan, aged 44.

In July of 1622, in Milan, during the dissection of a dog that had just been fed a fatty diet, Aselli demonstrated the presence of the lacteal vessels of the small intestine. From the section of one of these vessels, a milky fluid emerged. Aselli identified it with the chyliferous circulation, known from ancient times by the Alexandrian physicians **Herophilus** and **Erasistratus** and by the Roman **Galen**, but overlooked by the later anatomists. Although he understood perfectly the nature and role of chyliferous vessels, he failed to recognize their flow into the thoracic duct, and mistakenly believed that they conveyed into the liver. A few years later, the French physiologist **Jean Pecquet** (1622–1674) identified the thoracic duct and published his findings in *Experimenta nova anatomica…* (1651) [57].

Aselli described his discovery of the lacteal vessels in animals in *De lactibus, sive lacteis venis* (On Lacteals, or Lacteal Vessels), an essay posthumously issued in 1627 with funds provided by his friends and co-workers, Tadino and Settala, who had been present at the demonstration [72].

Apart from the value of the scientific research, the publication is of utmost importance in the history of anatomical illustration because it includes the first plates printed in color (black, dark and light red) in the medical literature. These were *chiaroscuro* (or light-dark) woodcut prints, with a black background with two different types of red washes superimposed. Among the red washes are highlights of white, corresponding to the original paper, and black outlines (Fig. 8.57). To obtain this effect, four blocks, inked with different colors, were necessary. The final result gives the impression of a three-dimensional illustration [12]. This sophisticated technique was developed by **Ugo da Carpi** (ca.1480–1532), a well-known engraver. The plates, showing the lacteals in animals, have been attributed to the Milanese **Cesare Bassano** (1584–1648) and to his associate **Domenico Falcini** (ca.1575–1632). The book was reprinted numerous times. Subsequent editions had no colored plates, but black and white copperplate images and were reduced in size.

Fig. 8.57 The liver with the lacteal vessel (N). The first colored illustration in the medical literature. (From: Aselli G. *De lactibus, sive lacteis venis*. Milano, Giovanni Battista Bidelli, 1627)

8.7.4.3 Bologna

The resurrection of the anatomical school of Bologna was mainly accomplished by **Antonio Maria Valsalva** and **Ercole Lelli**.

Antonio Maria Valsalva

An anatomist and surgeon, **Antonio Maria Valsalva** (1666–1723) was born in Imola (a suburb of Bologna) and studied medicine in Bologna having **Marcello Malpighi** (1628–1694), the founder of microscopic anatomy, as a teacher. Once graduated, he practiced at the Ospedale degli Incurabili (Hospital of the Incurables) for 25 years. In 1705, he was appointed a lecturer and demonstrator in anatomy at the University of Bologna, a post he held for the rest of his life. Valsalva was an extremely skilled anatomist and pathologist, a fine physician, and an excellent surgeon. He died in 1723, aged 57, as a result of a stroke. Among his disciples the most famous was **Giovanni Battista Morgagni** (1682–1719), regarded as the founder of modern pathologic anatomy, who posthumously assembled and published the anatomical works of his teacher in 1740 and prepared his biography.

Valsalva's most famous work was *De Aure humana Tractatus* (A Treatise on the Human Ear) first printed in Bologna in 1704 [73]. To produce it, Valsalva was engaged for almost 16 years, performing more than 1000 cadaveric dissections. This remarkable book, which became the standard text on the subject for over a century, contained the anatomical, physiological, and pathological observations of the hearing apparatus. It is divided into two parts. In Part One, Valsalva showed the anatomy of the ear with great accuracy, describing even the smallest muscle and nerve, the tympanic antrum, the tube that connects the pharynx to the middle ear permitting communication between the cavity and the externum, and coined the term Eustachian tube to identify this structure. Finally, he subdivided the ear into three parts: internal, middle, and external (Fig. 8.58). In Part Two, more physiologically oriented, he indicated the functions of the different formations which compose the ear, described the most common diseases, and suggested an original method of inflating the middle ear (*Valsalva's maneuver*), still practiced today.

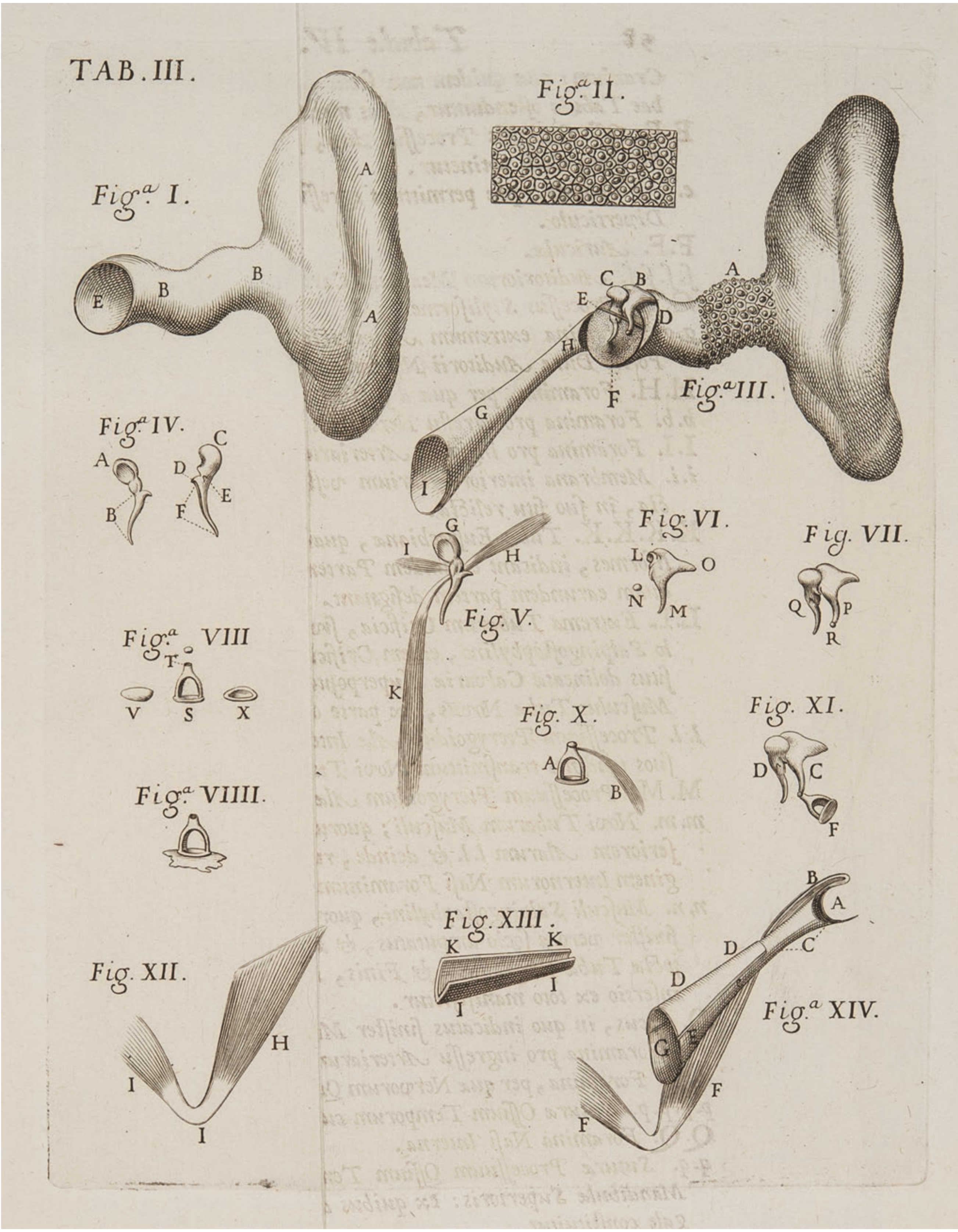


Fig. 8.58 Engraved plate showing the middle ear's ossicles and related muscles, the Eustachian tube, the chorda tympani. (From: Valsalva A. *De Aure humana Tractatus*. Venezia, F. Pitteri, 1740)

Ercole Lelli

Born in Bologna, **Ercole Lelli** (1702–1766) dedicated himself to the art of painting and sculpture of human anatomy in particular [12]. For this, he attended the dissection halls of the different city hospitals. In 1733, he replaced the damaged wood sculptures of the Archiginnasio (the Anatomical Theater) with two splendid *écorché*, musclemen carved in lime wood to illustrate the superficial muscular layer of the male human body. Considered masterpieces, they reproduced myology very accurately and were used as a guide to surgery for students of anatomy. They were placed on either side of the lecturer's chair in the Archiginnasio and were so admired by local citizens that the Bolognese **Cardinal Prospero Lambertini** (1675–1758), the future Pope Benedict XIV, commissioned a series of anatomical sculptures and wax models for the Anatomical Institute.

In 1746, Lelli was appointed Director and Chair of Anatomical Painting and taught artistic anatomy to the students. In the last few years of his life, he dedicated himself to the preparation of a textbook on anatomy in cooperation with the engraver **Carlo Pisarri**. At his death, in 1766, only five plates, complete with their explanatory text, were prepared. They were published at the expense of the Academy of Sciences, under the title *Anatomia Esterna del corpo umano* (External Anatomy of the Human Body) [74].

After Lelli's death, Bologna's anatomical school fell on hard times, and Lelli's statues were moved from the Archiginnasio to the Academy of Fine Arts.

It is probable that, under these circumstances, the eighteenth-century engraver **Antonio Cattani** (*fl.* 1780) from Piacenza (northern Italy) decided to reproduce them with life-size copper engravings, for educational purposes (Fig. 8.59).

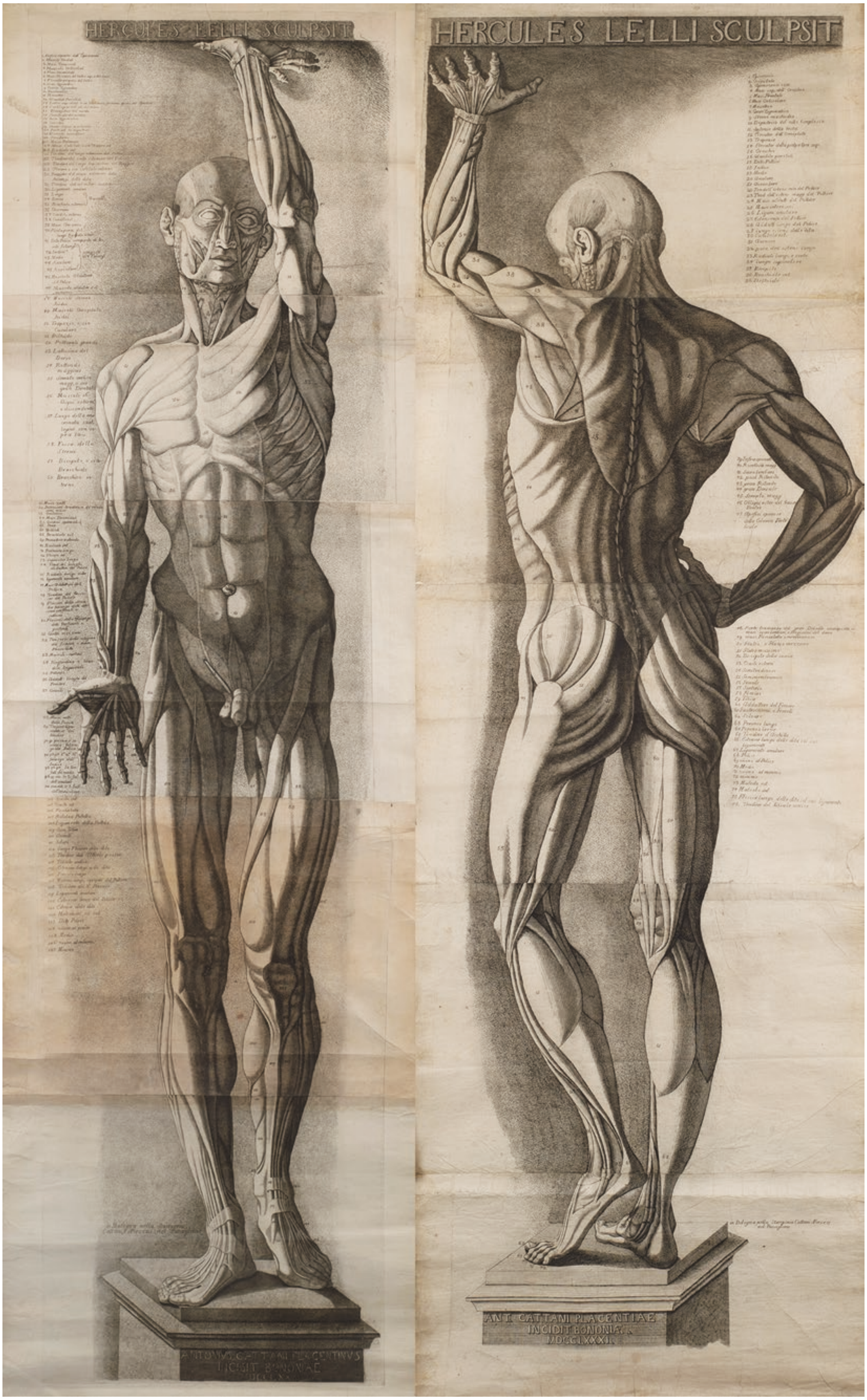


Fig. 8.59 Life size engraved reproduction of the *écorchés* statues by Ercole Lelli (1702–1766). *Left*: front view; *right*: back view. (From: Cattani A. Bologna, Cattani e Nerozzi, 1780–1781)

Anna Morandi

The art of anatomical wax models, established by Lelli, was continued after his death by **Anna Morandi** (1714–1774), anatomist and sculptor, and her husband **Giovanni Manzolini** (1700–1755) [12, 75]. They created a school of wax modelers and produced an extraordinary, impressive, and unique series of hundreds of anatomical preparations, now housed and displayed in the Istituto delle Scienze, Palazzo Poggi, and in the Anatomical Institute of Bologna. They were used for teaching purposes, as a guide to surgery, and for students of anatomy.

8.7.4.4 Venice

Giovanni Domenico Santorini

A native of Venice, **Giovanni Domenico Santorini** (1682–1737) was the son of a pharmacist. He studied medicine in Bologna, Padua, and Pisa, from where he graduated in 1701, and practiced in Venice under the guidance of Francesco Delfino, a Venetian physician. Santorini was a very talented anatomist, and from 1703 to 1728, he served as Professor of Anatomy in Venice. During his numerous dissections, he made important anatomical discoveries. His name is eponymously remembered for the arytenoid cartilages, the risorius muscle, the plexus venosus pudendi, the accessory duct of the pancreas, and the orifice of the accessory duct into the duodenum.

His most important work, *Observationes Anatomicae* (Anatomical Observations), was published in 1724 and dedicated to Peter the Great, Emperor of Russia (1672–1725) [76]. Three engraved plates, representing the mimic muscles, the pelvic region, the genital organs, the inner ear, and the larynx were added to the text. A tireless anatomist and researcher, Santorini, planned an enlarged edition of *Observationes Anatomicae*. Regrettably, he died in Venice in 1737, before completing the project. Fortunately, the plates for the upcoming book had already been prepared. Drawn with a light and delicate crayon effect by **Giovanni Battista Piazzetta** (1682–1754), a renowned artist, and engraved by **Florentia Marcella**, a woman who worked under Santorini's personal supervision, belong to the finest anatomical illustrations of the eighteenth century. The unfinished text and plates were completed by **Michael Girardi** (1731–1787), Professor of Anatomy in Parma, who added four plates. The textbook, titled *Septemdecim Tabulae* (Seventeen Plates), was posthumously issued in 1775, 39 years after Santorini's death, and published by the celebrated Bodoni Press, the only significant medical book issued by that publisher [77]. **Giambattista Bodoni** (1740–1813) was printer to the Duke of Parma and creator of the *modern* style typeface. Plates illustrate the mimic muscles (Fig. 8.60), smell and hearing apparatus, the palate, pharynx, and larynx, the breast, the heart, the diaphragm with the thoracic duct, the stomach, the pancreas, the intestines, the bladder, the perineum, and the genitals.

Fig. 8.60 The mimic muscles. (From: Santorini GD. *Septemdecim Tabulae*. Parma, Regia Typographia, 1775)

8.7.4.5 Grand Duchy of Tuscany

The Wax Modelers of the Grand Duchy of Tuscany

In the Grand Duchy of Tuscany, the study of anatomy during the eighteenth century was strongly fostered by **Pietro Leopoldo Habsburg-Lorena** (1747–1792), Grand Duke of Tuscany, a great patron of the sciences. Having seen the anatomical wax models of Bologna, Pietro decided to create something similar in Tuscany. He appointed **Felice Fontana** (1730–1805), an anatomist and physiologist from Pisa to organize a science museum in Florence, named *La Specola*, the first of its kind in the world, where, besides scientific instruments, the wax models prepared for the study of anatomy could be housed.

The most famous wax modelers and anatomists of the period were entrusted with the project. Among them were **Clemente Susini** (1754–1814) who studied sculpture at the Royal Gallery of Florence and **Paolo Mascagni** (1755–1815), Professor of Anatomy in Florence. From the documentation preserved in the archives of the museum, it appears that at least 200 cadavers were necessary to produce an anatomical wax model or a statue [78]. At that time, no means to preserve cadavers was available. Before his death in 1814, Susini prepared more than 2000 models. Some of them were made for *La Specola* museum, but 1192 were sold to the Josephinum in Vienna, or to other universities such as Cagliari (Sardinia), Bologna, Budapest, and Paris.

Wax models are a true masterpiece of anatomical imagery, very useful for teaching purposes. Every single detail is accurately reproduced. The tradition of wax models ended in 1893 with the death of the last wax modeler, **Egisto Tortori** (1829–1893).

Giovanni Alfonso Borelli

It is difficult to assign Borelli to a specific Italian region. In fact, he was born in Naples, trained in Rome, worked in Pisa, founded the Academy of Cimento in Florence (both in the Grand Duchy of Tuscany), became Chair of Mathematics in Messina (Sicily) in 1635, and was finally exiled in Rome, where he died. However, due to his involvement in physiological research in Pisa, we regard Borelli as part of the Grand Duchy of Tuscany.

The new way of considering anatomy under a different light attracted scientists from disciplines other than the pure medical field to investigate the physiology of the human body. This is the case of the Neapolitan **Giovanni Alfonso Borelli** (1608–1679), a mathematician, physicist, astronomer, and physiologist. Borelli graduated in mathematics from La Sapienza University in Rome and remained in that city until 1656 when he was named Professor of Mathematics in Pisa by a decree of Grand Duke Ferdinand II. With a group of Galileo Galilei's disciples, he was a founding member of the *Accademia del Cimento*, a scientific association whose Motto was *Provando e riprovando* (Trying and trying again), established in Florence with the aim of performing experiments in every field of science (see Sect. 4.1.1).

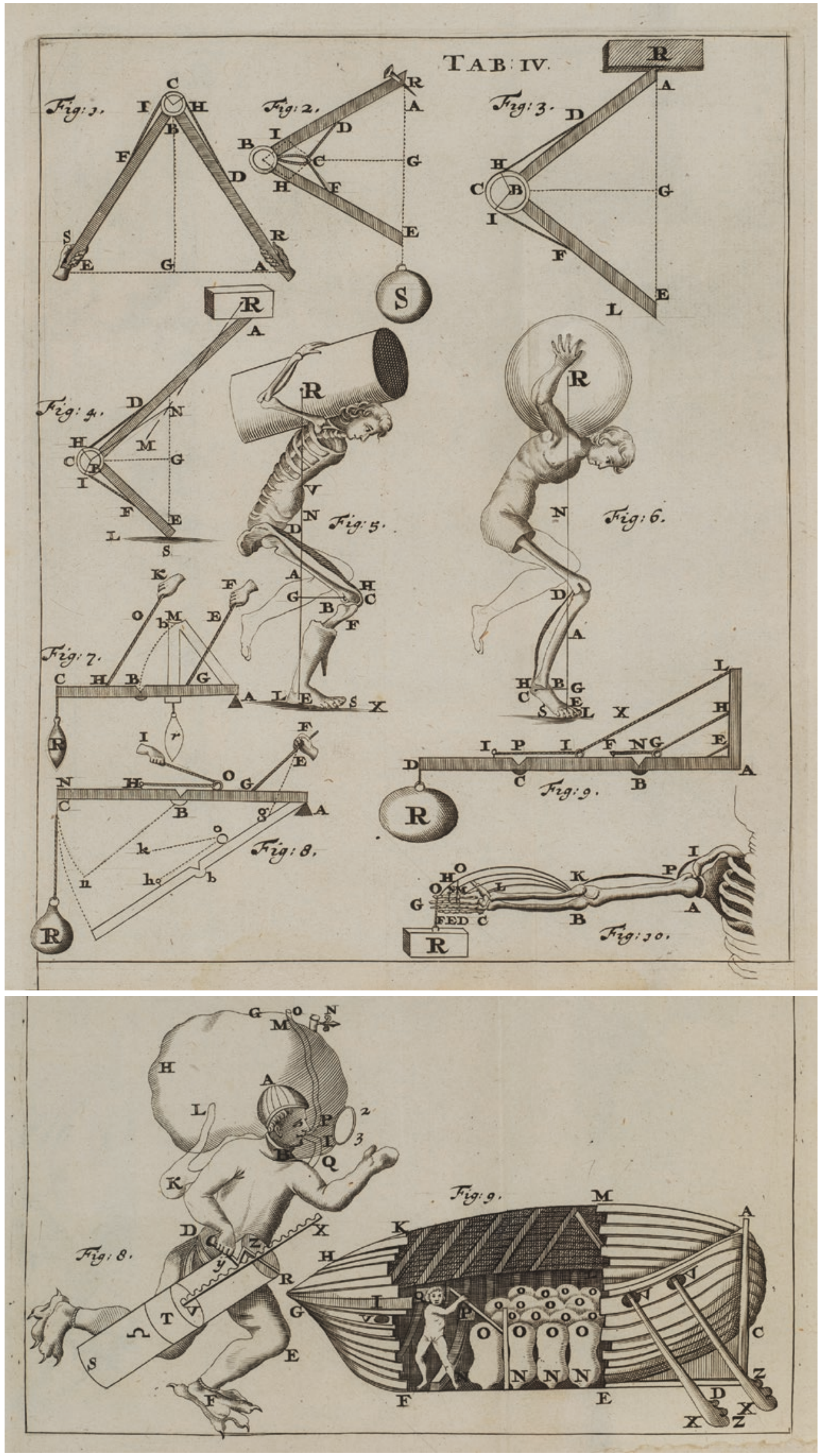
While in Pisa, he met **Marcello Malpighi** (1628–1694), a well-known anatomist. From his association with Malpighi, Borelli developed a particular interest in anatomy, starting investigations in the science of animal movement, or biomechanics, and pursued this research for the rest of his life. In 1668, Borelli returned to the University of Messina, but for political reasons he had to leave this city in 1674, moving instead to Rome, where he lived exiled in poverty. To survive, he taught mathematics at the school of the convent where he stayed. He made the acquaintance of Queen Christina of Sweden (1626–1689) who financed the printing expenses of *De Motu Animalium.* He died in December 1679, aged 71, probably of pneumonia, without the pleasure of seeing the publication of his book, which was posthumously issued in 1680.

Along with **René Descartes** (1596–1650), Borelli was one of the founders of the Iatrophysical School, which tried to explain physiological phenomena in mechanical terms. Borrowing the title from Aristotle's treatise *De Motibus Animalium*, Borelli wrote *De Motu Animalium* (On the Movement of Animals) [79]. He applied laws of mathematics and physics to animal motion and to the flight of birds. Essentially, he considered the human body a machine functioning according to the laws of physics. He studied muscular movements in particular, calculating the motor forces of muscles and considered bones as levers powered by muscular motion. He identified the center of gravity at rest and during forward movement of the body and described the first self-contained underwater breathing apparatus, the forerunner of the submarine (Fig. 8.61). Volume One of his work is devoted to the study of external motion activated by the interaction of muscle and bone, on the basis of mechanical principles, that is, muscular motor forces. Volume Two deals with internal motion, in particular the movements of muscles, blood circulation, respiration, and nervous activity. He first explained heartbeat as the result of muscular contraction under nervous stimulation.

For all these discoveries, Borelli is regarded as the founder of the physiology of muscular movement on a mechanical basis, thus the father of modern biomechanics.

The *American Society of Biomechanics* established the Borelli Award as its highest honor for research in this field.

Fig. 8.61 The study of muscular movement. *Upper*: the mechanics of muscular contraction at rest and during weight bearing. The identification of the center of gravity at rest and during forward movement; *lower*: a self-contained underwater breathing apparatus, the forerunner of the submarine. (From: Borelli GA. *De Motu Animalium*. Leiden, D. à Gaesbeck, C. Boutesteyyn, et al., 1685)



Paolo Mascagni

Paolo Mascagni (1755–1815) ranks among the most illustrious anatomists of all time, well known for having discovered the great majority of lymphatic vessels and for having published the most spectacular atlas on this topic, a masterpiece of anatomical illustration [12, 80].

Mascagni was born to a wealthy family in 1755 in Pomarance, in the surroundings of Pisa (Tuscany). He graduated in 1778 in medicine and philosophy from Siena Medical School. The following year he was appointed a Lecturer in Anatomy at Siena University by the Grand Duke of Tuscany, Pietro Leopoldo of Lorena, and dedicated himself to the study of the lymphatic vessels. To demonstrate the pattern of distribution of the entire lymphatic network, to its thinnest branches, he conceived an injection technique using mercury, cannulating the lymphatic vessels successively, employing fine tubular needles, bent at right angle—extremely tedious, tiring, and complicated work that had never been done before. In this way, he was able to trace not only the course of the lymphatics in the limbs, lower trunk, lungs, head, and neck, but also the pathways between superficial and deep lymphatic circulation with their intercommunication. For the first time, he demonstrated the phenomenon of diapedesis, which typically accompanies inflammation, the direct connections between lymph and serous vessels, the absence of communication between arteries and veins, and, most important, that lymph always passes through one lymphatic station on its way centrally. He identified, described, and named almost all of the lymphatic glands and discovered about 50% of the lymphatic vessels now known. His studies constituted the basis for future research.

In 1784, he participated in the Paris Academy of Sciences award by submitting the following essay: *Prodrome d'un ouvrage sur le système des vaisseaux lymphatiques* (Prodrome on an Essay on the Lymphatic Vessels), accompanied by four plates by **Ciro Santi**. Due to his poor command of the French language, the work did not receive a prize, but only special mention for the innovative research.

Three years later, in 1787, he issued *Vasorum lymphaticorum corporis humani historia et ichnographia* (On the History and Iconography of the Lymphatic Vessels of the Human Body), the first comprehensive work on this subject, that made him well known internationally [81] (Fig. 8.62). Dedicated to his patron Pietro Leopoldo of Lorena, Grand Duke of Tuscany, *Vasorum lymphaticorum* (…) is accompanied by 27 in-folio, engraved plates, drawn by **Ciro Santi**, a celebrated artist who left his home town of Bologna to establish himself in Siena in order to personally assist with the cadaveric dissections performed by Mascagni, and to prepare the images precisely. Illustrations depict the lymphatic vessels in some of the finest detail before the advent of radiography or photography. The work is divided into two parts: Part One revises the history of the lymphatic vessels, while Part Two shows the distribution of the vessels into different organs and apparatuses. Plates 1 to 3 explain the anatomy of the lymphatic vessels. Plates 4 to 11 demonstrate the superficial and deep circulation of the lower limbs. Plates 12 to 18 show the lymphatics of the genital area, abdomen, and its contents. Plates 19 to 21 show the thorax and its contents. Plate 22 shows the upper limb, Plate 23 the torso and the neck, Plate 24 the superficial circulation of the thorax, head, and neck (Fig. 8.63 *left*), and finally Plates 25 to 27 the deep lymphatic circulation of the upper limb, axilla (Fig. 8.63 *right*), head, neck, heart, breast, brain, and tongue.

Pietro Leopoldo of Lorena, so proud of Mascagni's great achievement, doubled his salary.

The political turmoil that upset the Grand Duchy of Tuscany, with the French occupation in 1799–1800, considerably affected Mascagni's career. Arrested and imprisoned for 7 months, he had to stop his scientific activity.

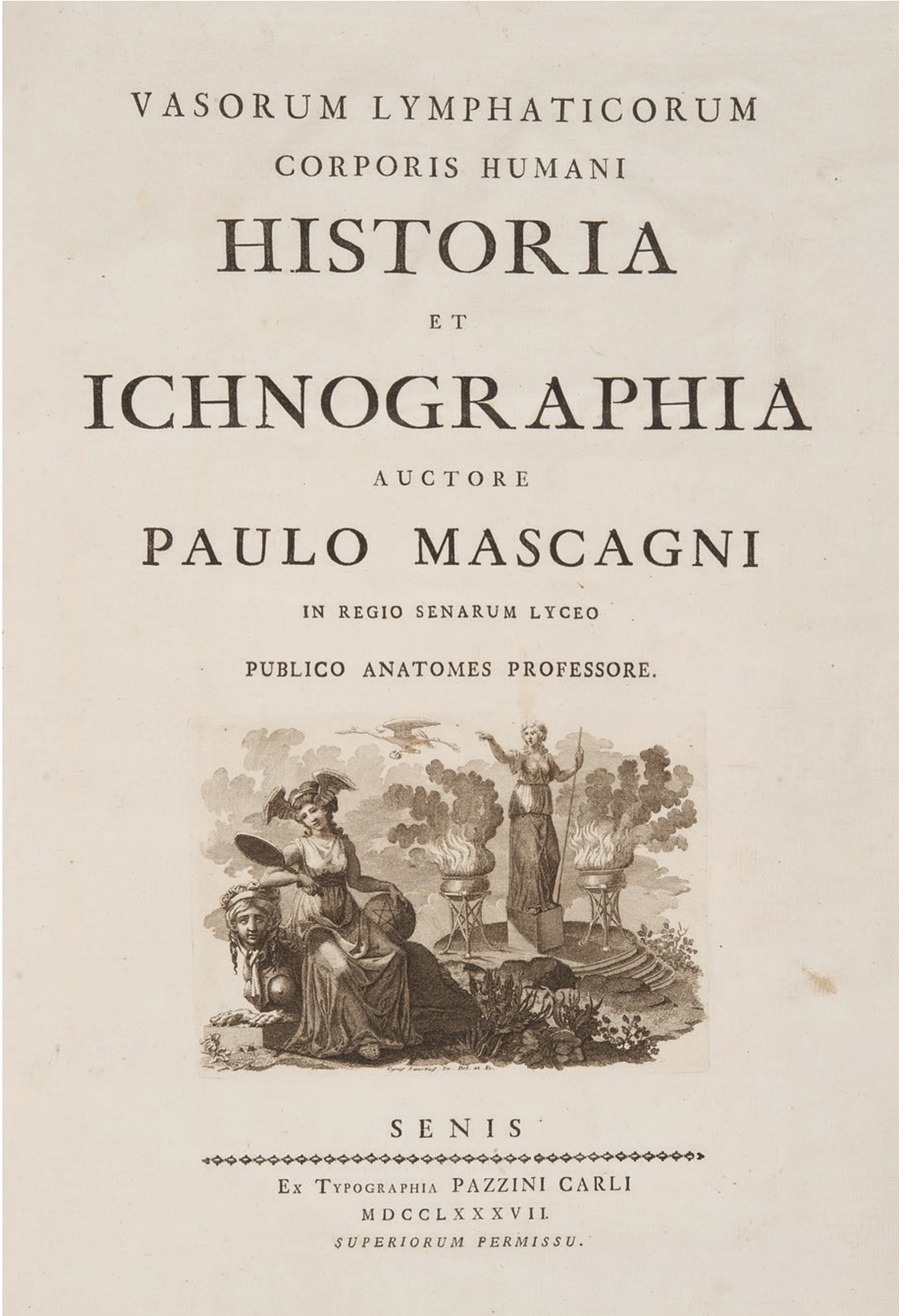
Freed from prison by a decree of Ludovico first, King of Etruria, who succeeded Pietro Leopoldo, Mascagni was appointed a Professor of Anatomy at the University of Pisa in 1801, with the additional charge of lecturing twice a week at the Hospital of Santa Maria Nuova in Florence. In 1803, he was nominated as full Professor at the University of Florence where he participated in the project, coordinated by **Felice Fontana** and **Clemente Susini** (*see above*), to prepare wax models of all the parts and organs of the human body.

In 1815, Mascagni, aged 60, died suddenly of pernicious fever during a stay at his home in Castelletto, near Siena. The family inherited not only plates, drawings, sketches, and records, but also debts. To prepare the very large copperplates, drawn by remarkable artists, and to have them finely engraved, the costs were exceedingly high and Mascagni had to mortgage his estate.

The three unfinished Mascagni works were posthumously published. *Anatomia per uso degli studiosi di pittura e scultura* (Anatomy for Students of Painting and Sculpture) appeared in Florence in 1816, subsidized by Mascagni's brother and grandson [82]. The large folio atlas had 15 finely hand colored illustrations, drawn by **Antonio Serantoni** (1780–1837), an artist whom Mascagni had trained and worked with for 14 years (Fig. 8.64). *Prodromo della grande anatomia* (Prodrome of the Great Anatomy), was issued in 1819 and edited by **Francesco Antommarchi** (1780–1838) [83].

The third work, certainly the most spectacular, in which Mascagni was involved daily for more than 15 years, until his death, was the *Anatomia Universa* (Universal Anatomy), published between 1822 and 1832 [84]. Very complex from a typographical stand point due to its large size, *Anatomia Universa* included 44 elephant folio hand-colored engraved plates representing the different layers of the human body. **Antonio Serantoni** was the artist of the plates. Text and illustrations were unbound, but stored in a specially designed wooden cabinet. Francesco Antommarchi, formerly Mascagni's prosector, pirated the plates and published them in Paris under his own name between 1823 and 1826, without mentioning Mascagni, something similar to what occurred between Cowper and Bidloo (see Sect. 8.7.7.4).

Nowadays, Mascagni is also remembered for a pathway which eponymously bears his name that indicates the direct lymphatic route to the supraclavear lymphnodes, bypassing the axilla.



VASORUM LYMPHATICORUM
CORPORIS HUMANI
HISTORIA
ET
ICHNOGRAPHIA
AUCTORE
PAULO MASCAGNI
IN REGIO SENARUM LYCEO
PUBLICO ANATOMES PROFESSORE.

SENIS
Ex Typographia PAZZINI CARLI
MDCCLXXXVII.
SUPERIORUM PERMISSU.

Fig. 8.62 Title page from Paolo Mascagni's (1755–1815) *Vasorum lymphaticorum*. (From: Mascagni P. *Vasorum lymphaticorum corporis humani historia et ichnographia*. Siena, Pazzini Carli, 1787)

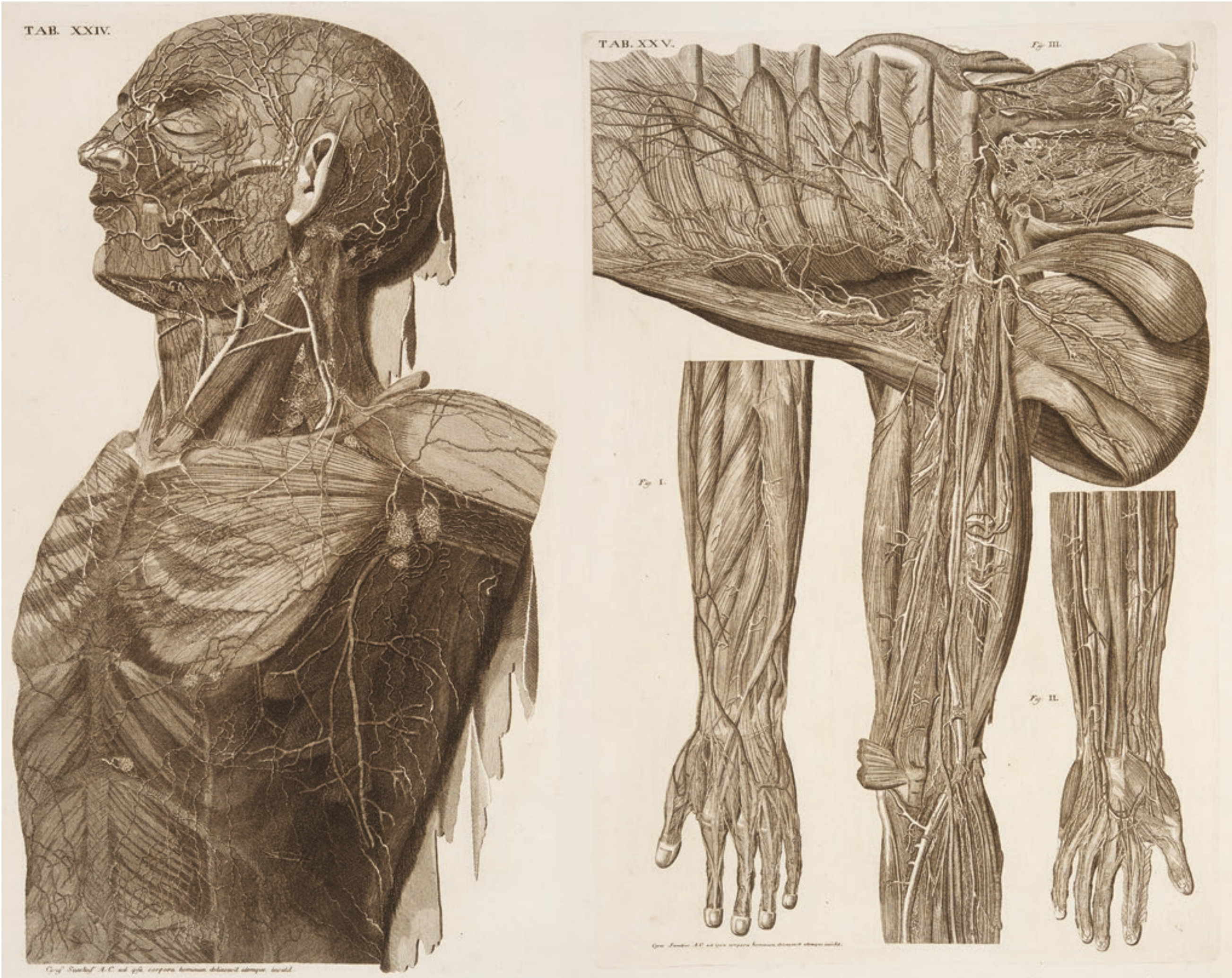


Fig. 8.63 Engraved life-size illustration of the lymphatic vessels: *Left*: thorax and head and neck; *right*: upper limb and axilla. (From: Mascagni P. *Vasorum lymphaticorum corporis humani historia et ichnographia*. Siena, Pazzini Carli, 1787)

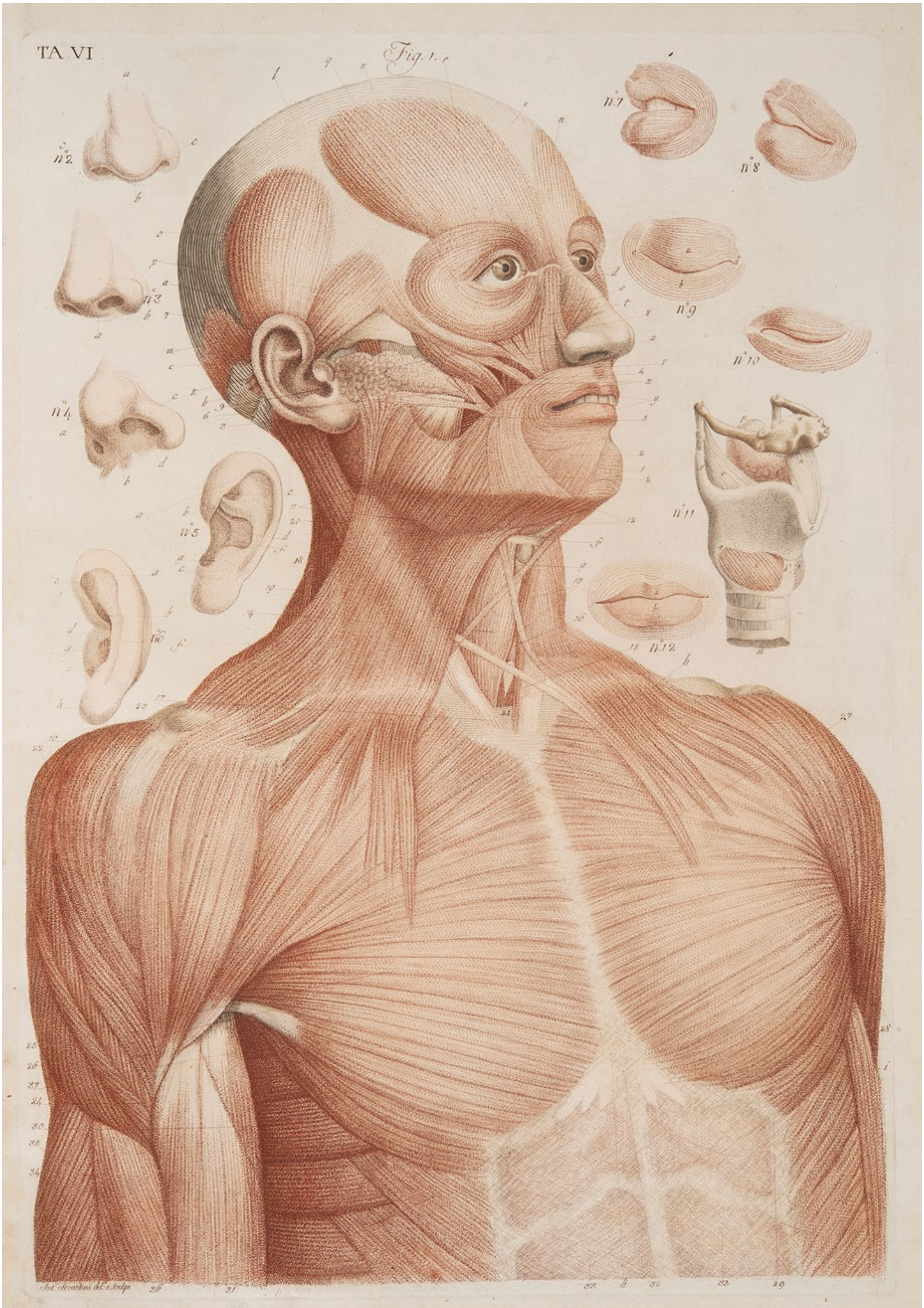


Fig. 8.64 Hand colored engraved illustration of the thorax and head and neck. (From: Mascagni P. *Anatomia per uso degli studiosi di pittura e scultura*. Firenze, Marenigh, 1816)

8.7.4.6 Pavia

In the eighteenth century, Pavia, as well as the whole of Lombardy, was dominated by the Austro-Hungarian Empire—and Maria Theresa (1717–1780), the Holy Roman Empress. She undertook a series of positive reforms for Milan's Duchy and for Pavia in particular, favoring the growth of the university, creating the library, expanding the hospital, and improving the botanical gardens.

Antonio Scarpa

As we have seen in Sect. 5.2.3.2, **Antonio Scarpa** (1752–1832) was a Professor of Anatomy and Surgery in Pavia which had at that time the leading university in northern Italy. We have emphasized the unique qualities of Scarpa, an unsurpassed anatomist, especially in the study of nerves, the brilliance of his lectures which brought him the fame of a great teacher, combined with a deplorable character [28]. He was a remarkable artist and medical illustrator and made the drawings of his works personally. **Faustino Anderloni** (1766–1847) became the official engraver of plates for Scarpa's numerous publications.

He wrote numerous important anatomical works [12] including *Anatomicae disquisitiones de Auditu et de Olfacto* (Anatomical Disquisitions on Hearing and Smell) (1789) [85] and *Tabulae Neurologicae* (Neurological Tables) (1794) [86] regarded as his best work, where Scarpa illustrated the proper delineation of the glossopharyngeus, vagus, hypoglossal nerves, and of the nerves of the heart (Fig. 8.65). He gave the first demonstration of cardiac innervation, showing how nerves are directly connected to cardiac muscular fibers. In *Sull'ernie. Memorie anatomo-chirurgiche* (On hernias. Anatomo-surgical memories) (1809) [87], Scarpa described the fascia and the triangle of the thigh, which eponymously bear his name (Fig. 5.44).

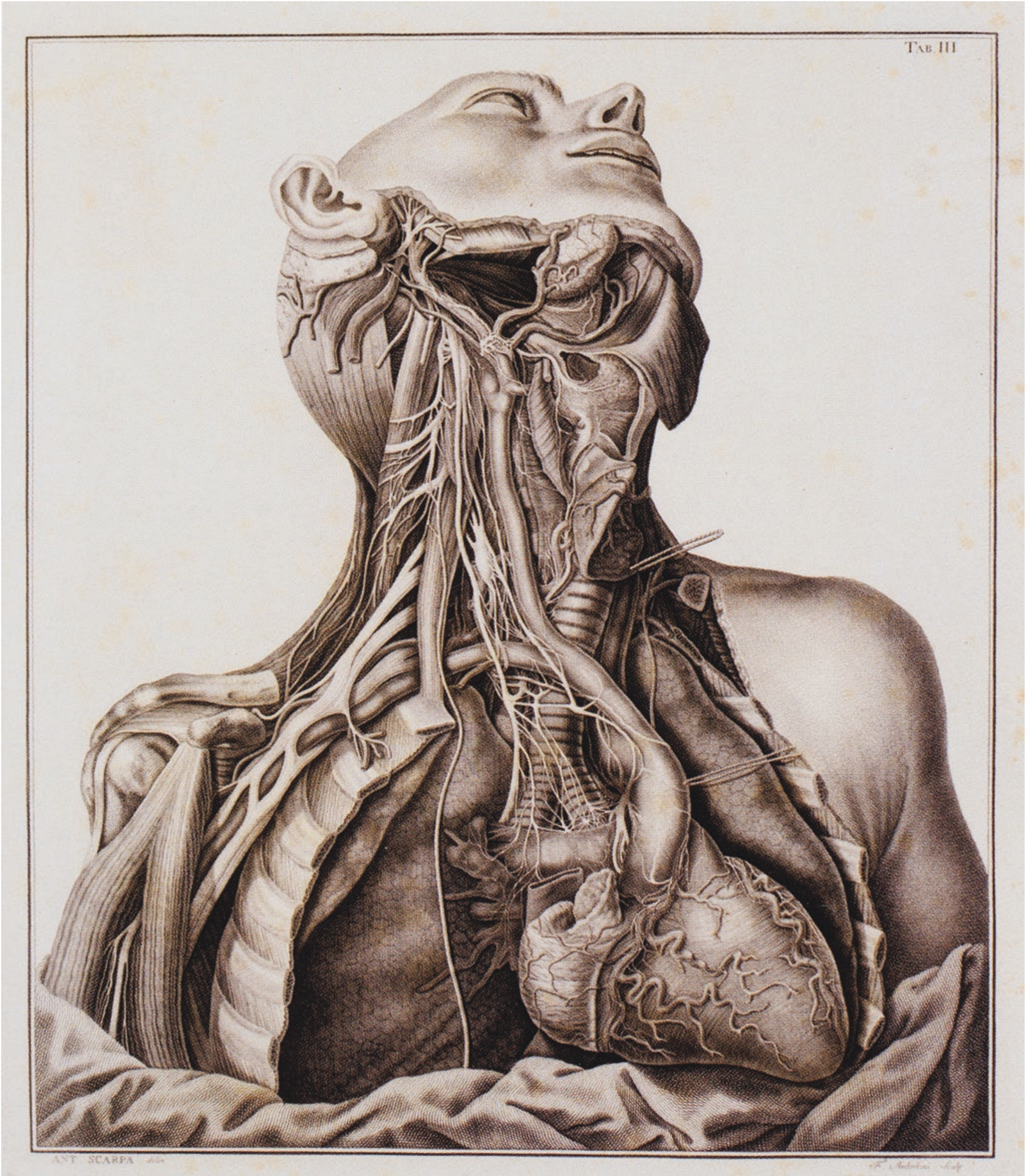


Fig. 8.65 Dissection of the nerves of the heart. The facial nerve, the glossopharyngeus, and the brachial plexus are well illustrated. (From: Scarpa A. *Tabulae Neurologicae ad illustrandum historiam anatomicam cardiacorum nervorum…* Pavia, B. Comino, 1794)

8.7.5 Germany

In the seventeenth and eighteenth centuries, one of the most remarkable centers for medicine was the University of Göttingen, where anatomical investigation was accurately performed, thanks to **Albrecht von Haller** and his student **Johann Gottfried Zinn**. Von Haller dedicated himself to the study of the arteries of the human body, whereas Zinn did research in ophthalmology. Regrettably, Zinn died very young, aged 32. Göttingen was also the University where **Samuel Thomas von Sömmerring** studied and graduated in medicine. His formal anatomical education derived partly from his mentor in anatomy at Göttingen, Prof. **Heinrich August Wrisberg**, and partly from **Bernhard S. Albinus**, whom he met during one of his travels and who influenced considerably his scientific accuracy. As Albinus worked closely with Jan Wandelaar to produce unsurpassed anatomical illustrations, Sömmerring also trained Christian Köck, a talented artist, who made anatomical drawings exclusively for him.

8.7.5.1 Johann Remmelin

In about the same period when Pietro Berrettini prepared his outstanding, accurate plates in Rome (ca.1618), **Johann Remmelin** (1583–1632) in Germany summarized crude anatomy in three engraved illustrations, providing scientific education and learning more for the layman than for artists or physicians.

Remmelin was a physician and mathematician. Born in Ulm, he studied philosophy in Tübingen and medicine in Basel. He became City Physician in Ulm and Augsburg and was the author and translator of numerous works. He died in Augsburg in 1632, aged 49.

In 1619, he published *Catoptrum Microcosmicum* (Greek κάτὸπτρον, mirror of the small world **-***microscosmos*. The *microcosmos* represents the human being, as opposed to *macrocosmos*, or the great world of the Divine). It is one of the most peculiar anatomical atlases of the seventeenth century, with dozens of highly detailed, superimposed anatomical engravings. The title page and plates constitute a blend of anatomy, religion, misticism, and alchemical symbolism [88].

The use of superimposed flaps to demonstrate the anatomy of internal organs was introduced in the middle of the sixteenth century. The illustration of Adam and Eve showing the contents of their thoracic and abdominal cavities, as appeared in Geminus' *Compendiosa totius Anatomiae delineatio* (1545), and two woodcuts depicting the anatomy of the eye and brain layer by layer in Bartisch's *Augendienst* (1583), are some examples. The technique of superimposed flaps is rather complicated. Eight plates were necessary to print the images, before the flaps were cut out and pasted together.

However, Remmelin first conceived the idea of publishing a synoptic atlas of the internal structures and organs of the human body in three plates (*Visiones*), using the multiple flaps technique to illustrate anatomy in the Vesalian tradition, from outside to inside. <u>Plate One</u> depicts a male and a female body. Man and woman are surrounded by the anatomical images of the ear, eye, oral cavity, heart, abdomen of a pregnant woman, and numerous allegories. The genital areas are covered by a drape, which hides the image of a devil. The whole scene is supervised by the eye of the Divinity, an angel (*heaven*), and underneath it a devil (*hell*). <u>Plate Two</u> illustrates the internal organs of a man, with his leg resting on a skull, with movable flaps allowing the progressive vision of the brain's anatomy. A drape hides genital organs: by lifting it, a banana leaf appears which covers the penis. <u>Plate Three</u> shows the woman's anatomy. Lifting the movable flaps, the internal organs of the thoracic cavity, the abdomen, and the stomach appear. The genitalia are hidden by a drape. Below it, a cloud covers the *labia majora.* At the bottom of the page, the skull base with a snake coming out of the *foramen magnum* is shown. It symbolizes both the spinal cord and the fall of man (Fig. 8.66).

The illustrations were issued without text and without the author's permission in 1613. In 1619, the first authorized edition was printed—also the first to contain text, Remellin's name on the title page, and his portrait on the verso. The work went through numerous editions and was often plagiarized. *Nosce te ipsum*, by **Christopher Hellwig** (1663–1721), published in Frankfurt in 1720, is an example.

The plates were designed by Remmelin himself and engraved by **Lucas Kilian** (1579–1637), a well**-** known German engraver from Augsburg. **Stephan Michelspacher** (*fl.* early seventeenth century), a Tyrolean physician and printmaker, created the alchemical images.

However, in the second half of the eighteenth century, things changed considerably. Typically, anatomists concentrated their investigations only on one region, with the aim of offering the reader the most precise and accurate details of particular structures. The great majority of anatomical illustrations were restricted to a specific area of the body, such as the face and neck, breast, abdomen, or to a particular system, such as the vascular, nervous, or lymphatic systems. This is the case of **Johann Gottfried Zinn** and **Samuel Thomas von Sömmerring**.

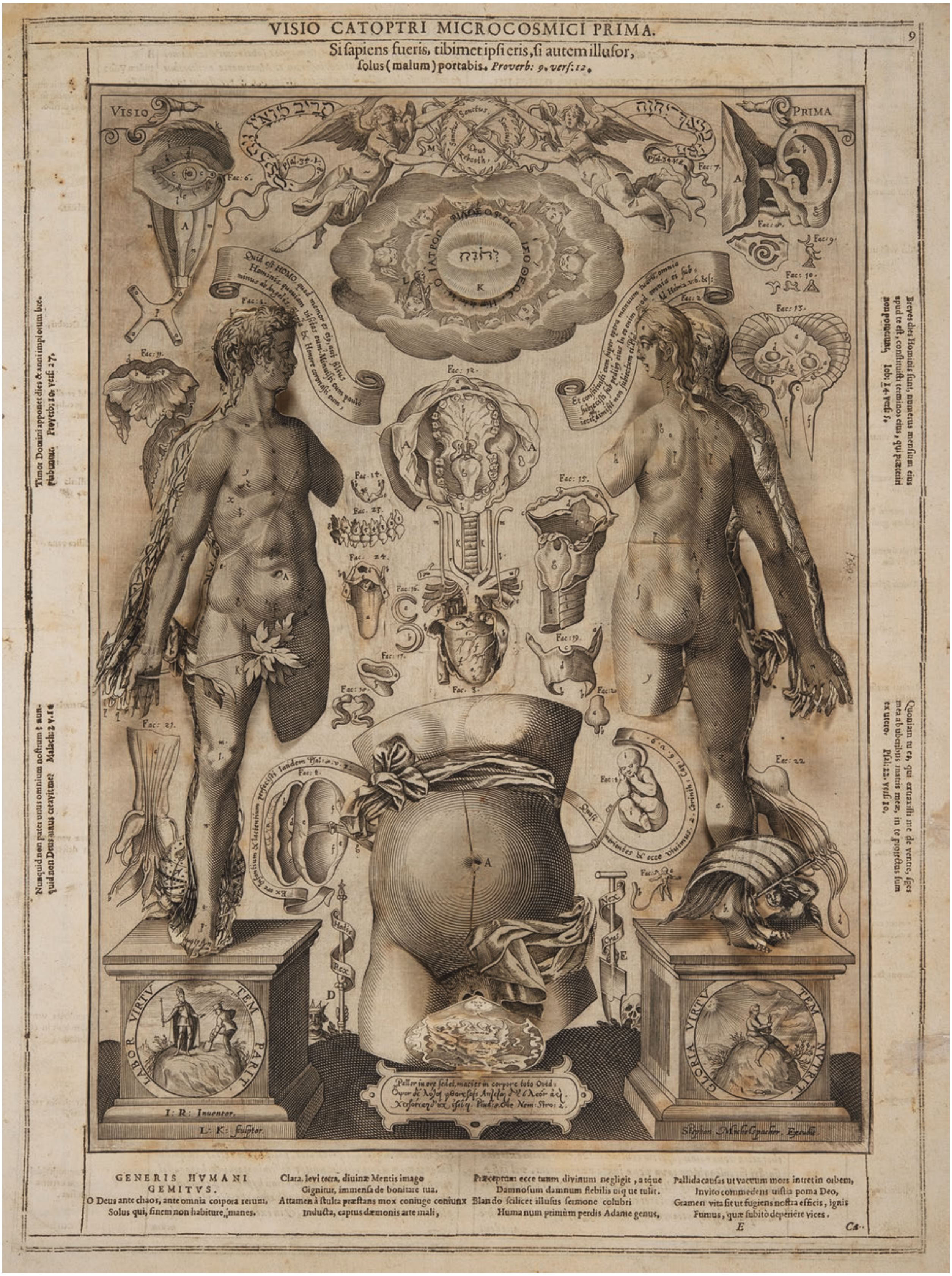


Fig. 8.66 Engraved plate of the female anatomy. Lifting the movable flaps, the internal organs of the thoracic cavity, the abdomen, and the stomach appear. The genitalia are hidden by a drape. Below it a cloud covers the labia majora. At the bottom of the page, the skull base with a snake coming out of the foramen magnum is shown.(From: Remmelin J. *Catoptrum Microcosmicum*. Augsburg, David Franck, 1619)

8.7.5.2 Johann Gottfried Zinn

Johann Gottfried Zinn (1727–1759), born in Ansbach, Bavaria, studied medicine at Göttingen University, from where he graduated in 1749. He was a student of **Albrecht von Haller** learning anatomy from him and performing dissections. In 1753, he was appointed Professor of Medicine and Director of the botanical gardens in Göttingen and made substantial contributions to anatomy. In 1755, he published *Descriptio Anatomica Oculi Humani* (Anatomical Description of the Human Eye), an epoch-marking work in the field of ophthalmology, where he provided the first detailed and comprehensive account on the human eye [89].

The engraved folding plates show the anatomy of the bulbus, the corpus ciliare, the extrinsic musculature and the contents of the orbital cavity, the zonule, and the ligament, origin of the extrinsic ocular muscles, eponymously named *Anulus tendineus* (Circle of Zinn) (Fig. 8.67). He died very young of phthisis at Göttingen, aged 32.

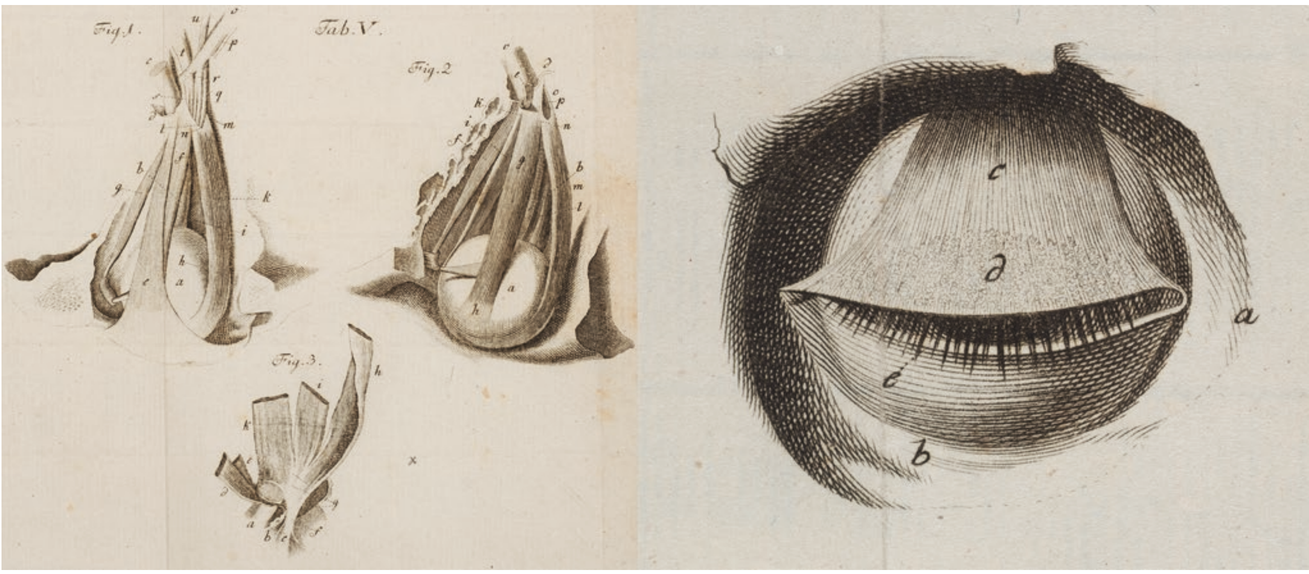


Fig. 8.67 The ligament, origin of the extrinsic ocular muscles, named *Anulus tendineus*. *Left*: Figure 1 shows the extrinsic musculature with the levator muscle (*e*); Figure 2 shows the circle of Zinn (*k*); Figure 3 illustrates the common tendon (*f*); *right*: the levator muscle and its aponeurosis (*c*). (From: Zinn JG. *Descriptio Anatomica Oculi Humani*. Göttingen, Abram Vandenhoeck, 1755)

8.7.5.3 Samuel Thomas von Sömmerring

Born in Thorn (Prussia), **Samuel Thomas von Sömmerring** (1755–1830) studied medicine in Göttingen, becoming a student of **Heinrich August Wrisberg** (1739–1808), a well-known anatomist. He graduated in 1778 and dedicated himself to anatomy. In 1779, he was appointed Professor of Anatomy at the Caroline College in Kassel. In 1784, he moved to Mainz as Professor of Medicine and remained there until 1797. From 1805 to 1820, he lived in Munich as a member of the Bavarian Academy of Science. Finally, in 1820 he established himself in Frankfurt where he practiced medicine until his death in 1830, aged 75 [12, 28]. He was a prolific writer and published important works on embryology, taste, and the anatomy of the eye and ear.

The historian Choulant-Frank compared Sömmerring with Albinus for his continuous research, commenting: "(...) of the true and beautiful in the form of every part of the human body and combined a perfect sense for artistic representation with the most exact perfection of detail" [12]. He always tried to reproduce the different organs as if they were in a living body, not in a cadaver. He had trained **Christian Köck** (died 1818), a particularly talented illustrator, who made the anatomical figures exclusively for him, as Jan Wandelaar did for Albinus. He lived in the house with Sömmerring and drew the most amazing images with the greatest accuracy.

From 1801 to 1809, Sömmerring issued a complete series of monographs on the human sense organs: vision, hearing, olfactory, taste, and voice. *Abbildungen des menschlichen Augen* (Illustrations of the Human Eye) [90], issued in 1801, was according to Choulant-Frank [12] the most perfect example of Sömmerring's production, and, along with Zinn's monograph [89], it constituted the foundation of anatomical studies on the structure of the human eye and periorbital region, both scientifically and artistically (Fig. 8.68).

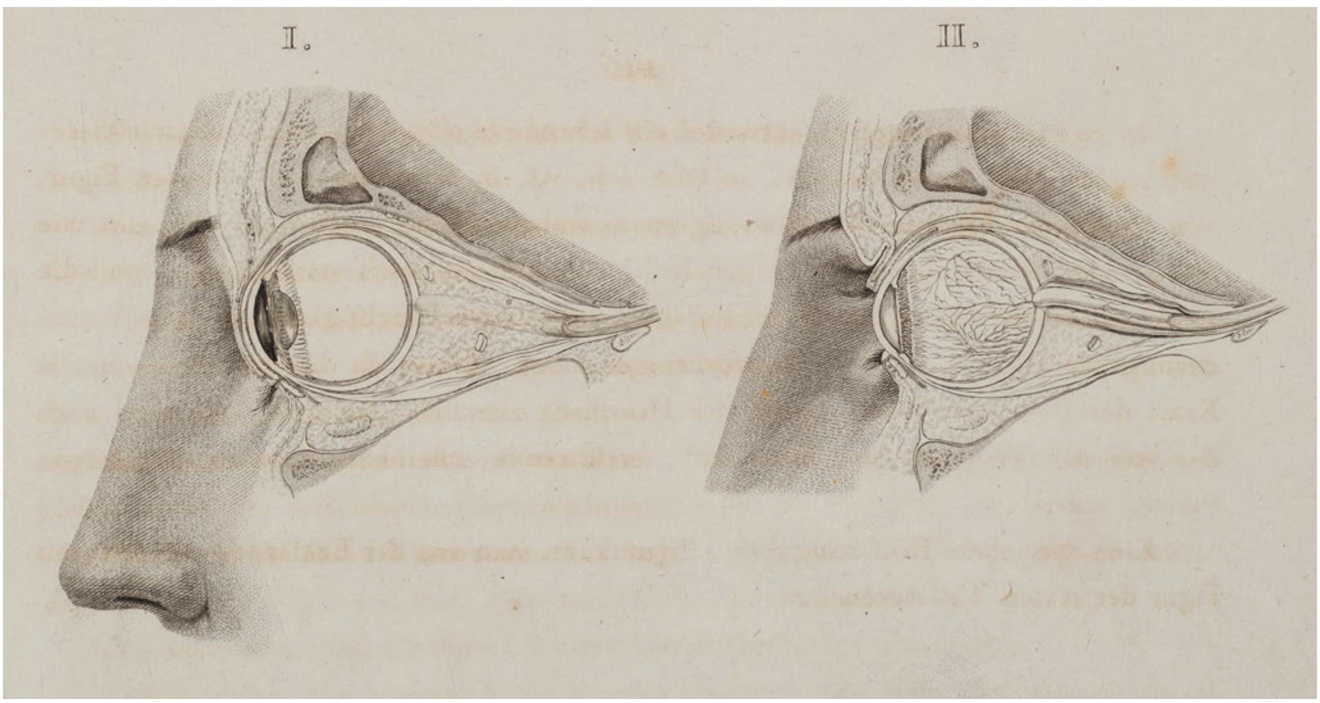


Fig. 8.68 Sagittal section through the orbit showing the eyeball and the orbital contents. *Left*: eyelid closed; *right*: eyelid opened. (From: Sömmerring ST von. *Abbildungen des menschlichen Augen*. Frankfurt, Varrentrapp u. Wenner, 1801)

8.7.6 France

In the seventeenth and eighteenth centuries, the study of anatomy in France knew a particularly favorable moment. Dissections were practiced in the newly built anatomical amphitheater of St. Côme, in Paris, authorized by King Louis XV. Anatomical tradition continued in the nineteenth century with important achievements, as we shall see.

8.7.6.1 René Descartes

One of the cleverest minds of the seventeenth century was **René Descartes** (1596–1650), better known as **Renatus Cartesius**, a philosopher, mathematician, and scientist. He was born at La Haye in Turennes (France) on the 31st of March in 1596 and studied at the Jesuit College in La Flèche (France), where he remained until 1612. He began a military career, fighting in the Netherlands, Germany, and Hungary. Back in France, he devoted himself entirely to science and philosophy. From 1623 to 1625, he visited Italy and in 1628 established himself in the Netherlands, where he remained for more than 20 years; thus, his scientific and philosophical works were issued there. In 1649, he was invited by Maria Christina, Queen of Sweden, to visit Stockholm, where he died from a severe case of pneumonia, aged 54.

Descartes applied the foundations of his philosophical and mathematical theories to medicine, anatomy, and physiology. The Latin statement *cogito, ergo sum*, usually translated into English as *I think, therefore I am*, represents the foundation of Descartes' philosophy, clearly expressed in *Discours de la Méthode* (Discourse on the Method), his major work, issued in Leiden in 1637. *We can doubt everything*, he affirmed, *but we cannot doubt our existence, while we doubt*. *The human body is a machine created by God and this machine is directed by a rational soul, center of thinking, located in the pineal gland.*

Descartes' theories produced a sort of Copernican revolution in medicine. From these concepts originated the previously mentioned Iatrophysical School, by which all physiological phenomena were explained using the laws of physics, and René Descartes, along with the Neapolitan **Giovanni Alfonso Borelli**, was one of the founders.

About 1633, he wrote *L'Homme* (Treatise on Man), generally regarded as the first textbook on physiology, which reflects Descartes' mechanicistic views of the human body. Originally conceived as part of a much larger work, *Le monde* (The World) and as an appendix to *Discours de la Méthode*, *L'Homme*, was written in The Netherlands, but remained unpublished when Descartes heard of Galileo's condemnation by the Inquisition. The work was translated into Latin by **Florentius Schuyl** (1619–1669), Professor of Philosophy and Senator of Hertogenbosch (The Netherlands), as *De Homine* and posthumously issued in Leiden in 1662 [91].

De Homine includes several splendid anatomical plates, partly engraved and partly woodcut. One of them, the heart, has movable superimposed flaps, probably designed by Schuyl himself (Fig. 8.69 *left*). The activity of the body can be demonstrated in purely mechanical terms. Sensations are explained in the following way: "The nerves are hollow tubes filled with animal spirits. They contain small fibres which connect the sensory organs to the brain ventricles. The pineal gland placed in the middle of the ventricles and nourished by the arterioles that surround it, plays a crucial role in coordinating sensation, imagination, and movement. It is the center of the soul and regulates every sort of human activity. Perception of an image relayed from the eyes to the pineal gland determines the motor action causing muscles' contraction and relaxation. Physical motions are the result of movements of the pineal gland and of the spirits that continuously flow from the nerves to the gland and vice versa. Whereas perception of pain, or tickling, caused by external objects, depends on the stimulation of sensory organs and gives rise to involuntary movements, or reflexes, that escape from the pineal gland's control. They are originated by direct exchange of animal spirits between hollow tubes within the brain. As an example, reflex stimuli contribute to pull the hand away from fire and to suddenly turn the body to protect itself" (Fig. 8.69 *right*).

Fig. 8.69 *Left*: engraved image of the heart with movable flaps; *right*: the stimulation of sensory organs gives rise to involuntary movements, or reflexes. Reflex stimuli contribute to pull the hand away from the fire. (From: Descartes R. *De Homine*. Leiden, F. Moyard and P. Leffen, 1662)

8.7.6.2 Guichard Joseph Duverney

In 1616, the brotherhood of St. Côme and St. Damien, the first professional association of surgeons that had been established in France by **Jean Pitard** (ca.1248–1327) about 1260 (see Sect. 2.4.1.3), obtained authorization to organize public dissections for its students in the graveyard of the Church of St. Côme. Eventually, in 1694, due to growing participation by students, the brotherhood built the anatomical amphitheater of St. Côme, still existing in rue de la Bûcherie in Paris (*see* Figs. 4.42 and 4.43). **Guichard Joseph Duverney** (1648–1730), Professor of Anatomy, was in charge of the anatomical lectures and dissections with **Pierre Dionis** (1643–1718) and **Jacques Bénigne Winslow** (1643–1718) as part of his team (see Sect. 4.2.2.1 "Pierre Dionis" in Chap. 4).

Duverney was born in Feurs (Loire Department, France) and graduated in 1667 from Avignon. He moved to Paris where he dedicated himself to anatomy, becoming Lecturer of Anatomy in 1674 and later obtaining a professorship at the Royal Gardens. He was a member of the Royal Academy of Sciences. Along with **Claude Perrault** (1613–1688) and **Jean Pecquet** (1622–1674), he drew renewed interest in anatomical studies, at that time almost entirely abandoned. His students included **Pierre Dionis,** the Dane **Jacques-Bénigne Winslow,** and **Jean-Baptiste Sénac** (1693–1770).

Duverney is best remembered for one of the earliest comprehensive text books on otology: *Traité de l'organe de l'ouie, contenant la structure, les usages et les maladies de toutes les parties de l'oreille* (Treatise on the Organ of Hearing, Containing the Structure, Function, and Diseases of All Parts of the Ear), first issued in French in 1683 [92]. His brother, **Jacques François Marie Duverney** (1661–1748), a surgeon, anatomist, and demonstrator at the *Jardin du Roi* (Royal Garden), contributed to the publications of the well-known colored mezzotint anatomical atlases on myology and head anatomy, issued in 1746 and 1748, respectively, by **Jacques Fabien Gautier d'Agoty**.

8.7.6.3 Jacques Bénigne Winslow

Jacques Bénigne Winslow (1669–1760), born in Odense (Denmark), studied medicine in Copenhagen. In 1698, he moved to Paris where he became an assistant to **Guichard Joseph Duverney**. He was elected Lecturer of Anatomy at the *Jardin du Roi* and in 1743, at the age of 74, was appointed a Professor of Anatomy at the University of Paris. He was considered one of the most talented anatomists of the period, and died in 1760, aged 90.

Exposition Anatomique de la Structure du Corps Humain (Anatomical Account on the Structure of the Human Body), first published in 1732, is divided into the following tracts: osteology, myology, arteries, veins, nerves, lower abdomen, chest, and head [93]. The tract on the head includes the famous *Discours sur l'Anatomie du Cerveau* (Account on the Anatomy of the Brain) by **Niels Stensen** (pages 641–658), first issued in 1669 and reprinted in the present work for the third time. Stensen demonstrated that the pineal gland is not the seat of the soul, as was advocated by **René Descartes** (1596–1650) (see Sect. 8.7.6.1).

Scholarly written, *Exposition Anatomique* was very popular among students and teachers. It was the reference text for almost a century following its publication and went through numerous editions and translations. Despite acknowledging in the preface that he planned to add 80 plates to the text, he included only four small engraved figures after Eustachius, but he introduced a new system for referencing them. His name is eponymously associated with the foramen epiploicum, between the greater and lesser sacs of the peritoneum, described on page 542.

8.7.6.4 Color Printing: The Gautier Family and the Mezzotint Technique

The story of colored printing is challenging [94]. The German-born artist, painter, and engraver, **Jacob Christoph Le Blon** (1667–1741), who had studied painting in Rome in the workshop of **Carlo Maratta** (1625–1713), had the idea of using three copperplates, inked differently, one in yellow, the second in blue, and the third in red. To obtain additional colors, he superimposed the copperplates and printed them three times. In 1719, Le Blon established a company in London called the *Picture Office*, to commercialize his method and patent his procedure. The response from the public was modest and the company was bankrupted. In 1735, he moved to Paris, where on the contrary, the mezzotint-colored process flourished rapidly. In 1737, Le Blon obtained a 20-year *privilège du roi*, what is now referred to as a patent, for his invention of the three separate copperplates. He received numerous orders, including a project for a treatise on anatomy. To fulfill these requests, he employed several artists, among them **Jacques Fabien Gautier d'Agoty**, of the Gautier family of engravers. In 1741, once his first print was ready, Le Blon died suddenly and Gautier applied immediately for a 30-year *privilège du roi*, claiming that he had invented the procedure, having added a fourth plate, black, to the three colors used by Le Blon. Despite this, he could not obtain the patent, and was obliged to purchase it from Le Blon's heirs.

Jacques Fabien Gautier d'Agoty

Jacques Fabien Gautier d'Agoty (ca.1717–1786), born in Marseille, was an anatomist, painter, and printmaker [12, 28] who drew, engraved, and printed a series of books in color, and published them, assisted by his five sons, Jean Baptiste, Louis, Edouard, Arnaud Eloi, and Fabien. While the rights for mezzotint prints were shared with others, he had the sole right for anatomical and natural history books. He prepared a varnished version of the images to resemble oil paintings, offered at an additional cost.

In 1745, Jacques Fabien issued a first set of eight images of the face, neck, head, tongue, and larynx, with the title *Essai d'Anatomie en Tableaux imprimés* (An Anatomical Account with Printed Plates), followed a year later by a second group of 12 larger prints, *Suite de l'Essai d'Anatomie en Tableaux imprimés* (Continuation of the Anatomical Account with Printed Plates), showing the muscles of the pharynx, torso, arms, and legs. In 1746, Jacques Fabien assembled the two works of 20 colored plates under the collective title *Myologie complètte* [sic] *en couleur et grandeur naturelle* (Complete Myology in Color and Natural Size) [95]. The plates, printed in large scale, are particularly impressive, showing the dissection of the facial muscles, the floor of the mouth, the oral cavity with jaw excised (Fig. 8.70), and the famous flayed angel, which shows a deep dissection of the female body from the back (Fig. 8.71). Illustrations were intended to dazzle more than to instruct. Gautier made the drawings, using the mezzotint technique; however, the cadaveric dissection and the text was by **Jacques François Marie Duverney** demonstrator in anatomy to Louis XV, King of France, at the *Jardin du Roi* and brother of **Guichard Joseph Duverney** (see above).

Gautier issued two other important anatomical works. In 1748, *Anatomie de la Tête en Tableaux imprimés* (Anatomy of the Head with Printed Plates) with eight mezzotint, varnished, life-size plates [96], to show the intricate network of blood vessels, the brain, face (Fig. 8.72), and neck. It was followed in 1754 by *Anatomie générale des viscères, en situation de grandeur et couleur naturelle avec angéologie et la néurologie, de chaque partie du corps humaine* (General Anatomy of the Viscera in Color and Actual Size, with Angiology and Neurology, of Each Part of the Human Body) with 18 mezzo-tint, varnished, life-size plates [97]. To provide dissections and text for the second work, Gautier chose **Antoine Mertrud** (died 1767), surgeon to the King, and demonstrator in anatomy at the *Jardin du Roi*, due to the death of Duverney in 1748. *Anatomie générale des viscères* includes several spectacular images, as the first two sets and the last set of three plates, respectively, representing a full-length injected female body, the complete body of a man, and an entire skeleton with nerves and arteries. A very emotional illustration shows a dissected newborn child peacefully asleep, close to the genital organs of his mother, with the opened uterus (Fig. 8.73).

Fig. 8.70 J.F. Gautier d'Agoty (ca.1717–1786). Colored mezzotint illustration showing the muscle of the floor of the mouth after the excision of the mandible. (From: Gautier d'Agoty JF, Duverney JFM. *Myologie complètte* [sic] *en couleur et grandeur naturelle*. Paris, Gautier, Quillau père et fils and Lamesle, 1746–1748)

Fig. 8.71 One of the most famous of Gautier's mezzotint-colored illustrations showing the dissection of the second layer of the female body from the back, nicknamed the *flayed angel*. (From: Gautier d'Agoty JF, Duverney JFM. *Myologie complètte* [sic] *en couleur et grandeur naturelle*. Paris, Gautier, Quillau père et fils and Lamesle, 1746–1748)

Fig. 8.72 Dramatic mezzotint-colored illustration showing the dissection of the brain and the nasal cavity with the maxillary sinus. (From: Gautier d'Agoty JF, Duverney JFM. *Anatomie de la Tête en Tableaux imprimés*. Paris, Gautier, Duverney and Quillau, 1748)

Fig. 8.73 Mezzotint-colored illustration of a dissected newborn child, peacefully asleep, close to his mother with an opened uterus. (From: Gautier d'Agoty JF, *Anatomie générale des viscères…* Paris, Gautier and Delaguette, 1754)

Arnauld Éloi Gautier d'Agoty

Born in Paris, **Arnauld Éloi Gautier d'Agoty** (1744–1783), the second son of Jacques Fabien, continued the tradition of the mezzotint technique developed by his father by obtaining the *privilège du roi*, the exclusive right to create colored prints.

In 1773, he issued *Cours complet d'Anatomie peint et gravé en couleurs naturelles* (A Comprehensive Course of Anatomy Drawn and Engraved in Natural Colors) [98]. It was originally planned in five parts: osteology, myology, splanchnology, angiology, and neurology. However, probably due to the premature death of the author, the work remained incomplete and only *Myology* was published [12]. *Cours complet d'Anatomie* has 15 beautiful, unvarnished, colored plates, 13 of them dealing with the muscles of the human body (Fig. 8.74). They are preceded by two plates depicting Venus and Apollo in standing position, representing the eighteenth-century ideal of beauty, drawn by **Jean Girardet** (1709–1778), first painter to King Stanislas of Poland. For dissections and text preparation, he referred to **Nicolas Jadelot** (1738–1793), Professor of Anatomy and Physiology at the University of Nancy.

The series of myological plates is inspired by Albinus, and they show the different muscular layers of the human figure, front and back.

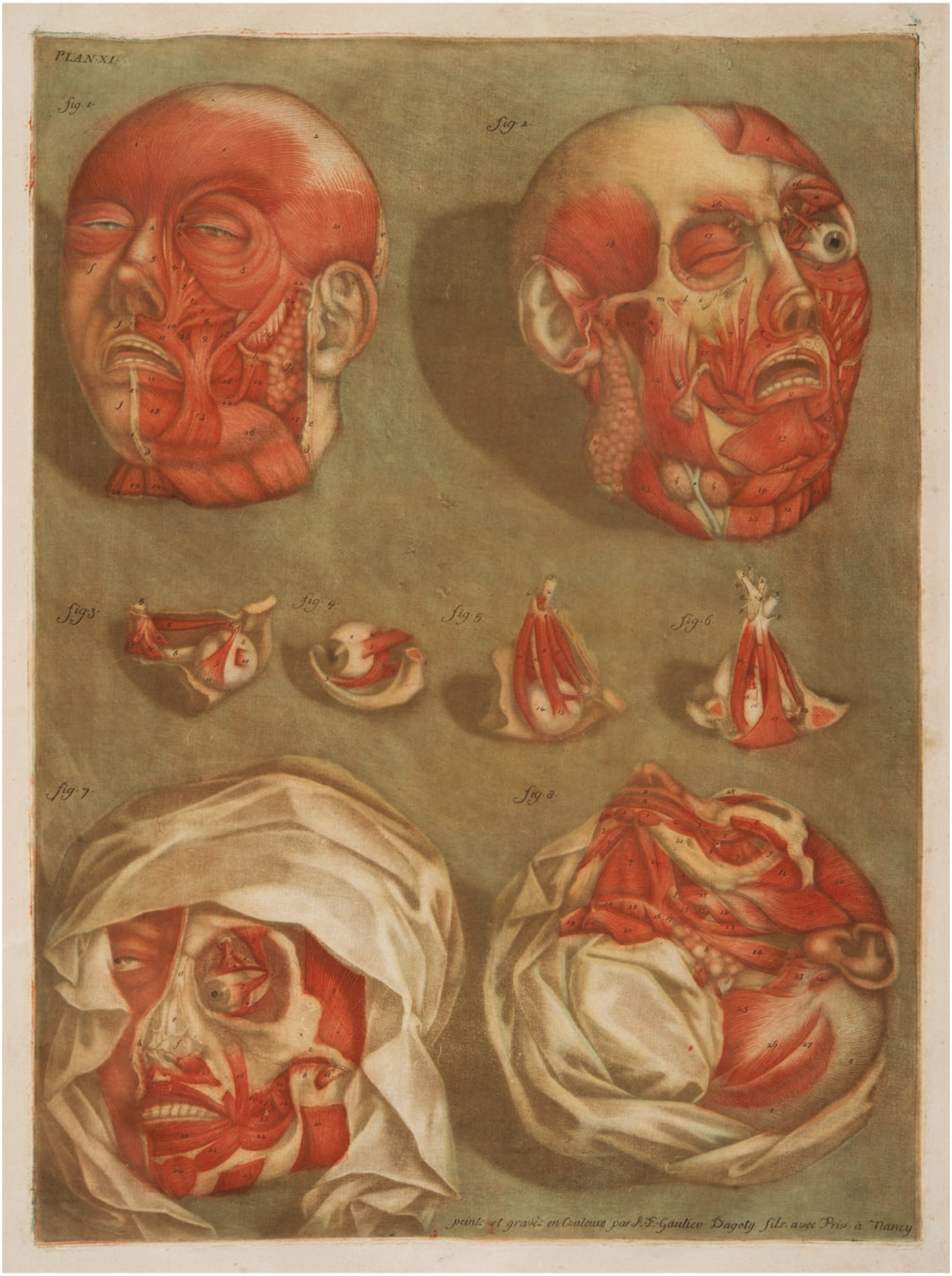


Fig. 8.74 Mezzotint-colored illustration showing the muscles of the face, eye, auricle, floor of the mouth. (From: Gautier d'Agoty AÉ, Jadelot N-J. *Cours complet d'Anatomie*. Nancy, J-B. Leclerc, 1773)

Felix Vicq d'Azyr: Another Form of Color Printing—The Aquatint Method

Almost at the end of the century, **Felix Vicq d'Azyr** (1748–1794) published an atlas in-folio, *Traité d'Anatomie et de Physiologie* (Treatise of Anatomy and Physiology), with 35 splendid colored plates of the brain [99], in line with the trend initiated by the Gautier family of colored anatomical representations. The pictures of the brain, drawn and engraved by **Angélique Briceau Allais** (1767–1827), are probably the finest and most delicate images of that organ published until then. They are of remarkable quality, a unique example of refined intaglio technique, and, thanks to the pale ink used—and to the aquatint method—they look more like watercolor drawings than engravings, in contrast to Gautier's plates, freely depicted with the strong colors of the mezzotint technique, made to resemble oil paintings.

Only Volume One, devoted to neuroanatomy, the result of his own investigations, was published, as Vicq d'Azyr died at the early age of 46 in 1794, before completing a further volume.

The son of a physician, Vicq d'Azyr studied medicine at the University of Paris, from where he graduated in 1774. He showed great interest in comparative anatomy and published numerous scientific works on this subject. As an anatomist, he was a proponent of coronal sections of the brain and made important contributions to the study of the brain. He described the substantia nigra, the mammillo-thalamic tract, the fibers connecting the external granular layer with the external pyramidal layer of the cortex, eponymously named Vicq d'Azyr bundles, and the basal ganglia. He was the permanent Secretary of the *Société Royale de Médecine* and the personal physician to Queen Marie Antoinette [28].

8.7.6.5 Jacques Gamelin

Nouveau recueil d'Ostéologie et de Myologie dessiné d'après nature (New Atlas of Osteology and Myology Designed According to Nature) published in 1779 by **Jacques Gamelin** (1738–1803), is considered among the most beautiful atlases of artistic and plastic anatomy ever printed and shares this supremacy with the *Tabulae Sceleti et Musculorum Corporis Humani* by **Albinus** issued in Leiden in 1747 [65].

Born in Carcassonne (Midi, southern France), Gamelin studied art in Toulouse, Paris, and finally in Rome, where in 1771 he was admitted to the Academy of St. Luca, becoming Professor of Painting and Chief Painter to Pope Clement XIV. In 1774, he returned to Toulouse, where he was appointed Director of the Academy of Fine Arts of Montpellier. In Toulouse, he created a workshop where he organized anatomical dissections with the aim of preparing an atlas on osteology and myology, which eventually appeared in 1779. His art works are housed in various museums throughout France. He died in Carcassonne in 1803, aged 65.

Nouveau recueil d'Ostéologie et de Myologie is divided into two parts: Osteology with 40 etched plates and Myology with 42 [100]. The frontispiece of Part One shows the workshop where Gamelin himself and his co-workers, orientally dressed in the manner of Rembrandt, stand around a table where anatomical corpses are displayed. The frontispiece of Part Two opens with the image of St. Bartholomew skinned.

The atlas includes a number of striking full-page allegorical scenes with skeletons, drawn with unsurpassed accuracy and in unusual positions, such as the skeleton resurrecting from his tomb at the trumpet's blast on the day of the final judgment (Fig. 8.75), or the skeleton kneeling down before a shelf of books, one of which is opened to the page of *Dies Irae* (Fig. 8.76). Aside from these, the work contains a number of intriguing vignettes, fantastic and macabre representations, in the manner of Goya's *caprichos*, which show battle scenes, the unexpected appearance of death during a party, and a quartet of skeletons playing musical instruments (Fig. 8.77 *upper*): a continuous interplay between art and anatomy. Numerous skinned cadavers, arranged in dramatic poses, are included in Part Two, devoted to myology (Figs. 8.77 *lower* and 8.78).

All of the plates were designed by Gamelin himself and 18 of them bear his signature. Most were engraved by his scholars, Lavallée and Martin. The atlas was issued in 2000 copies, but despite the high quality of the illustrations, it had little success and only a few copies were sold causing the author to be bankrupted.

Fig. 8.75 The skeleton resurrecting from his tomb at the trumpet's blast on the day of the final Judgement. (From: Gamelin J. *Nouveau recueil d'Ostéologie et de Myologie dessiné d'après nature.* Toulouse, J.F. Declassan, 1779)

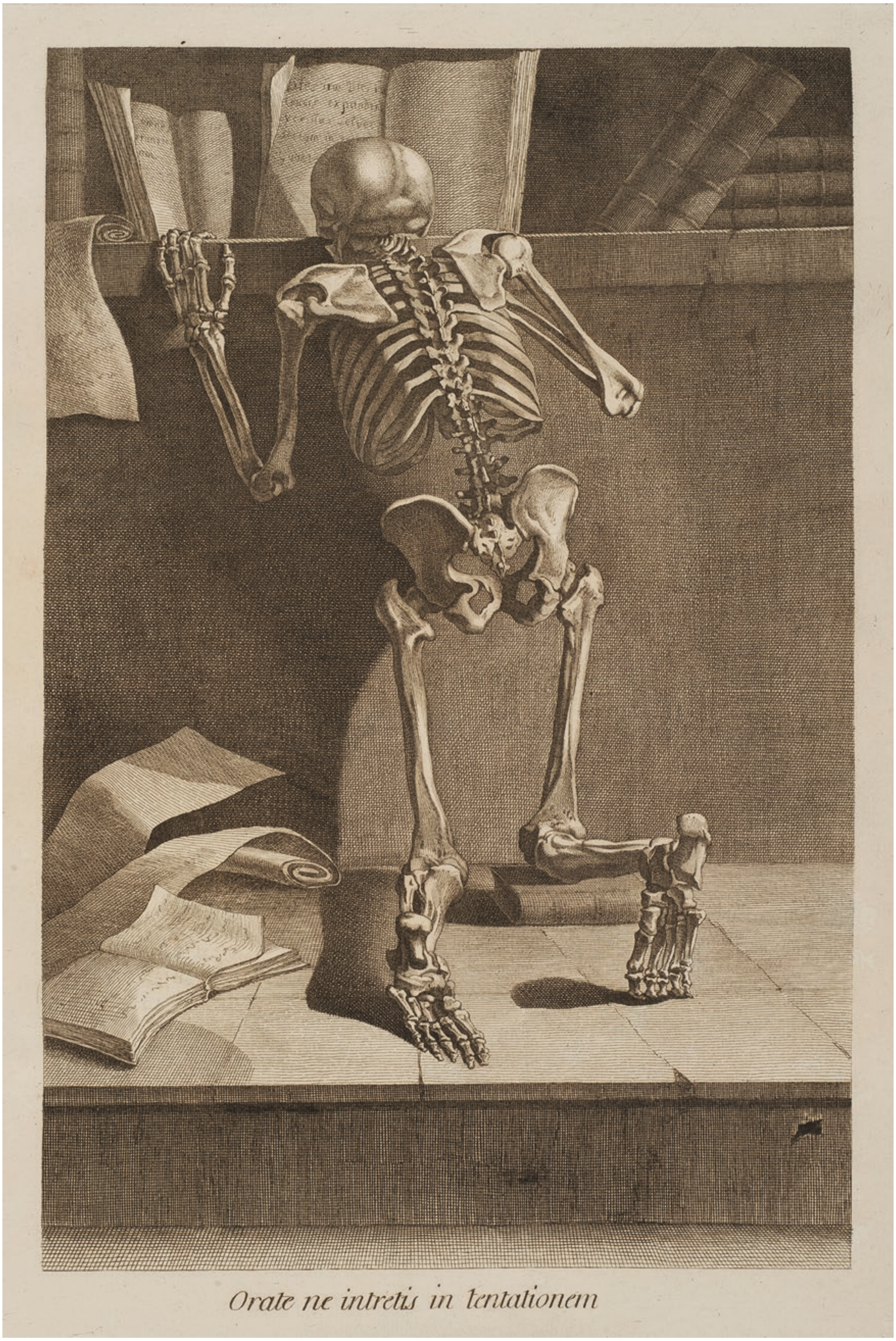


Fig. 8.76 The skeleton kneeling down before a shelf of books, one of which opens on the page of Dies Irae. (From: Gamelin J. *Nouveau recueil d'Ostéologie et de Myologie dessiné d'après nature.* Toulouse, J.F. Declassan, 1779)

Fig. 8.77 *Upper*: a quartet of skeletons playing musical instruments; *lower*: skinned cadavers displayed on a table to emphasize muscular movements. (From: Gamelin J. *Nouveau recueil d'Ostéologie et de Myologie dessiné d'après nature.* Toulouse, J.F. Declassan, 1779)

Fig. 8.78 A skinned cadaver lying on a table. (From: Gamelin J. *Nouveau recueil d'Ostéologie et de Myologie dessiné d'après nature.* Toulouse, J.F. Declassan, 1779)

8.7.7 England

De humani Corporis Fabrica, plagiarized in 1545 by **Thomas Geminus**, exerted a considerable influence on the spread of anatomical knowledge in England. For the first time, illustrations of dissections of the human body were available to physicians and students (see Sect. 8.4.4.2). They were regarded as guidelines for demonstrations in the Barber-Surgeons' Hall. From a technical point of view, Geminus first introduced copper engraving in England, replacing the traditional woodcuts that were used in that period.

The historian **Charles Singer** [2] underlines the general barrenness of the purely Galenic anatomical study in England, before the advent of Harvey. However, when **William Harvey** came back to England after his 5-year experience in Padua, things changed substantially. He gave a new stimulus to the study of anatomy, which was pursued during all of the seventeenth and eighteenth centuries. This new interest culminated in the compulsory requirement for potential surgeons to perform dissections before becoming a Fellow of the College of Surgeons. Since studying anatomy was regarded as a fundamental for a career in surgery, the need for bodies was crucial. To provide cadavers, students ventured into the countryside and robbed village graveyards. The grave robbers were nicknamed *resurrectionists*. On successful days, more than one corpse could be obtained [28]. Numerous private schools of anatomy, with adjacent dissecting rooms, were organized in London and Edinburgh.

In the eighteenth and nineteenth centuries in Edinburgh, anatomy was dominated by the Monro dynasty, **Alexander Monro** *primus* (1697–1767) and his son **Alexander Monro** *secundus* (1732–1817). Hence, it was almost impossible for other physicians to obtain a position in anatomy and surgery at the University of Edinburgh. The brothers **John** and **Charles Bell** experienced this tough situation personally. John had to work in private practice and Charles migrated to London.

8.7.7.1 William Harvey

William Harvey (1578–1657) was born in Folkestone, Kent, in 1578. He studied at Cambridge University, but due to his interest in medicine and science, in 1597, he moved to Padua where he was a student of **Hieronymus Fabricius ab Aquapendente** when Fabricius was at the peak of his fame (see Sect. 8.5.3). In 1602, Harvey returned to England where he began his medical career and applied the comparative method, learned in Padua, to his investigations. He lectured at the Royal College of Physicians and in 1618 was appointed Court Physician and served both James I and Charles I. He died at the age of 79 from a stroke [2].

De Motu cordis et Sanguinis in Animalibus (On the Movement of the Heart and Blood in Animals), one of the most important works in the history of medicine, was first issued in Frankfurt in 1628 on very modest quality paper, with numerous misprints [101]. Why in Frankfurt? Possibly to take advantage of the Frankfurt book fair in the year 1628, where the publication was on display at the price of six shillings and two pfennigs [102]. The second edition, enclosed in **Emilio Parisano's** (1567–1643) *De Microcosmica Subtilitate* (On the Precision of the Microcosmus) and printed in 1635, was incomplete. The whole of Chapter 1, part of the *Proemium* (Preface), Chapter 16 and the illustrations to be printed in the text were all omitted. Another edition, the third in terms of priority, but the second complete version, was reissued in Leiden by **Johann Maire** in 1639 [103]. It incorporates Parisano's refutations, passage by passage, and **James Primerose's** (1580–1659) *Exercitationes et Animadversiones... De Motu Cordis* (Disputations and Refutations… on the Movement of the Heart) (1630), the first printed criticism with violent attacks on Harvey's views on blood circulation, incredibly written by a physician whose candidature for membership in the College of Physicians Harvey had supported a few months earlier.

De Motu cordis comprises an introduction and 17 chapters. The introduction explains some *manifest errors* in the concepts of anatomy of the period concerning arteries, pulmonary circulation, and heart structure. In Chapter 1, Harvey illustrates the rationale for his work, acknowledging **Fracastoro** and his teacher **Hieronymus Fabricius ab Aquapendente**. The text continues with the description of the heart's movements, demonstrating that the heart behaves as a muscular force-pump: the blood expulsion during systole via the arteries, the passive refilling during diastole through the veins, and the filling of arteries during systole. Harvey showed how the blood moves from the right chamber of the heart into the lungs, and from the lungs back to the left side of the heart, then out into the general circulation. The engraved plates, copied directly from Fabricius' *De venarum ostiolis* (On the Valves of the Veins) (1603) [44] (*see* Fig. 8.40a), demonstrated that venous valves allow blood to flow unidirectionally, from the heart through the body via the arteries and returned to the heart via the veins. He also described experimental studies derived from the dissection of molluscs, insects, and cold-blooded animals, in which the slow motion of the heart can easily be observed [2]. Harvey profoundly affected the development of the study of anatomy. Thanks to him, the mechanics of blood movement was finally known. The discovery of blood circulation was one of the most important events in the history of medicine.

8.7.7.2 Nathaniel Highmore

Harvey's revolutionary views were either strongly opposed or accepted with difficulty and great skepticism. The first physician to recognized Harvey's theories, who published an essay on anatomy and on blood circulation, was probably **Nathaniel Highmore** (1613–1685), surgeon and anatomist.

Born in Fordingbridge (Hampshire), Highmore studied medicine at Oxford, from where he graduated in 1643 receiving his medical degree directly from King Charles I, 2 years before he could have obtained it from regular university studies. He established himself at Sherborne (Dorset), where he had a busy practice and where he remained until his death in 1685, aged 72.

Corporis Humani Disquisitio Anatomica (An Anatomical Dissertation of the Human Body), issued in 1651 and dedicated to William Harvey [104], provided the first original anatomical treatise written by an Englishmen, and the first account of blood circulation based on Harvey's theories, published 23 years earlier. Divided into three parts, the work, accompanied by 20 engraved anatomical illustrations, describes the anatomy of the thorax, abdomen, and head. The engraved title page is a tribute to Harvey with an allegory of blood circulation (Fig. 8.79 *left*). The human body is compared to a garden with numerous creeks running through it. The water is pumped from a well. The creeks correspond to the circulatory stream, the water corresponds to the blood, and the pump is the heart. The portrait of Highmore appears on the lower right side, and a scene of a cadaver dissection is depicted on the opposite page. The dissected skin of the human body is held by Galen and Hippocrates, surmounted by the representation of anatomy. The description of the antrum (maxillary sinus) is accompanied by an engraved plate (Fig. 8.79 *right*). Highmore is erroneously credited with the discovery of the antrum, which eponymously bears his name. However, the antrum was well known to older anatomists and first represented by **Leonardo da Vinci** [13–15]. The work was never printed in England nor was it translated into English.

Fig. 8.79 *Left*: the allegory of blood circulation. The human body is compared to a garden with numerous creeks running through it. The water is pumped from a well. The creeks correspond to the circulatory stream, the water to the blood, whereas the pump to the heart; *right*: representation of the maxillary sinus that eponymously bears Highmore's name. (From: Highmore N. *Corporis Humani Disquisitio Anatomica*. The Hague, Samuel Broun, 1651)

8.7.7.3 Thomas Willis

Thomas Willis (1621–1675) is credited for considerable progress in sixteenth-century English anatomy. The son of a farmer, Willis received his medical degree from Oxford in 1646 at the age of 25. He practiced in Oxford, becoming a wealthy and respected physician and was appointed Lecturer in Anatomy [28]. In 1664, he published *Cerebri anatome* (The Anatomy of the Brain), regarded as the most complete and accurate account of brain anatomy and of the nervous system published up until that time. It was the foundation for the anatomy of the central and autonomic nervous system [105]. The work included a description of the full vascular system to all parts of the brain even when the carotid or vertebral arteries were blocked (Fig. 8.80). Indeed, the anastomotic vascular circle at the base of the brain between the anterior communicating artery, the two anterior cerebral, the two internal carotids, the two posterior communicating arteries, and the two posterior cerebral arteries, which nowadays eponymously bear Willis' name, were already described 17 years before in *Syntagma Anatomicum* by **Johannes Vesling** [47], and also by **Gabriele Fallopio** in 1561 [41]. *Cerebri anatome* includes several anatomical findings, such as a clear classification of the cranial nerves, the definition of the course of the cerebral arteries, using stained water, with the identification of the vascular brain circle, the description of the 11th cranial nerve, and the recognition of the sympathetic nervous system. Willis died of pneumonia in 1675, aged 54.

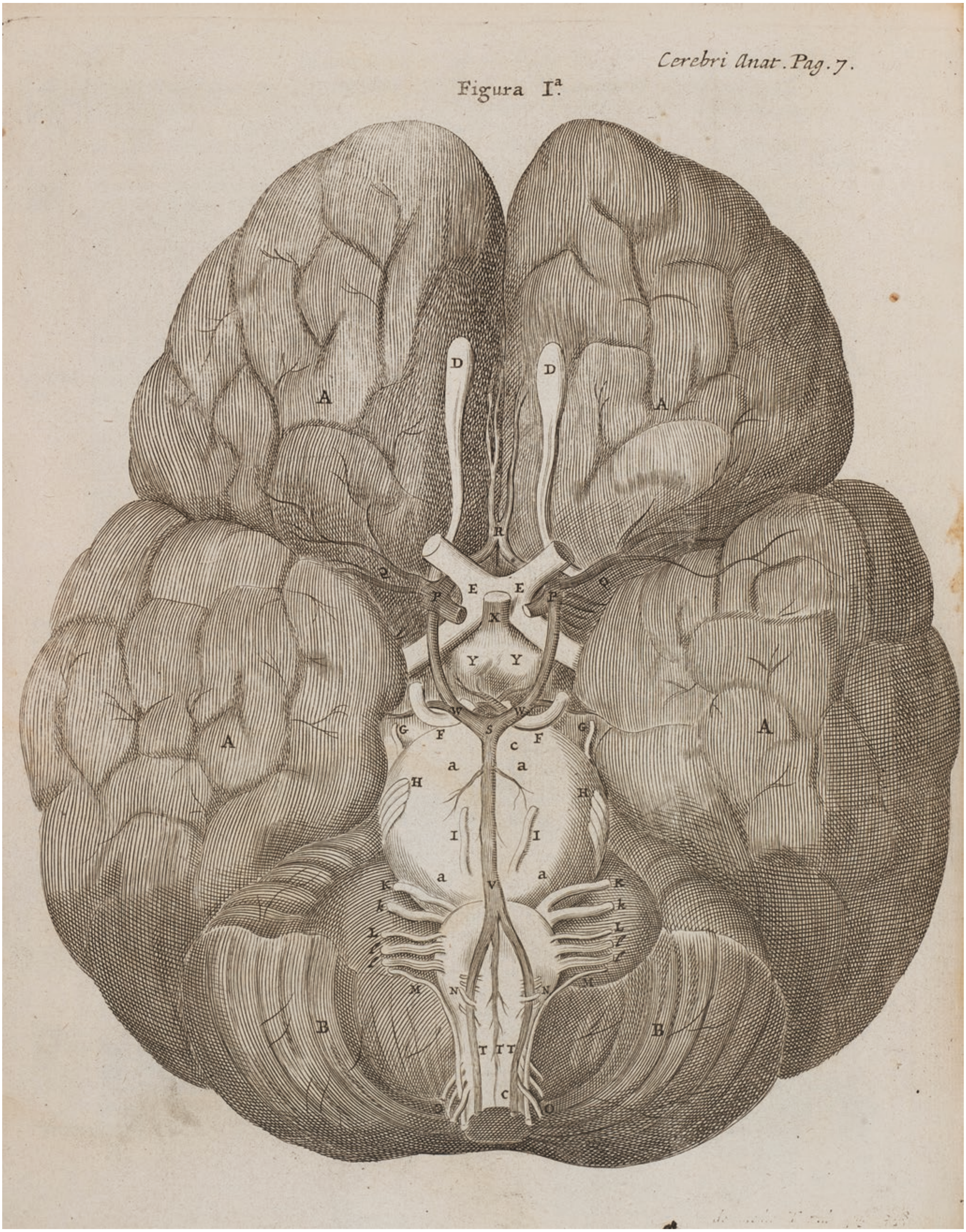


Fig. 8.80 The base of the brain with the olfactory bulbs, optic nerves, and the arterial anastomotic system forming the circle, which eponymously bears Willis' name. (From: *Cerebri Anatome*. In: Willis T. *Opera omnia* (Complete works). Amsterdam, H. Wetstein, 1682)

8.7.7.4 William Cowper

William Cowper (1666–1709) was a London surgeon who devoted much of his time to anatomy. He was admitted to the Barber Surgeons Company in 1691 and elected Fellow of the *Royal Society of London*. He died very young, aged 40, from a cardiac complication [28].

Regrettably, his name is associated with the unpleasant term of plagiarist, despite his contributing to the description of the male bulbo-urethral glands in 1697. His *Anatomia Corporum Humanorum* (Anatomy of Human Bodies) published in 1698 [106], represents one of the most striking examples of piracy in the history of medicine [107].

In 1685, the Dutchman **Govard Bidloo** (1649–1713) issued a fine atlas reflecting the baroque style [64] with 105 superb large folio copper-engraved plates prepared by **Gérard de Lairesse** (1640–1711), a Belgian painter of great repute, who rivaled Rembrandt in popularity in his time (see Sect. 8.7.3.1).

Despite the enormous work involved, and the high-quality detailed illustrations, it was not well received, most likely due to short explanatory text and dramatic images. During his visit to Leiden, Cowper was not only much impressed by the quality of the images, but proposed to Bidloo reissuing the text in English, thereby guaranteeing a wider circulation of the work. When he returned to England, carrying the 105 copper-engraved plates with him, Cowper prepared the English text and added nine plates of his own. The most incredible aspect of the story was that Cowper changed Bidloo's name to his own on the engraved title page (Fig. 8.81) and added his own portrait, removing that of Bidloo.

Having done this, in 1698 he published *Anatomia Corporum Humanorum* in Oxford. Bidloo's name was not even mentioned. Although plagiarism was more easily tolerated at that time, Bidloo strongly attacked Cowper. In 1700, in Leiden, he published a memoir directed to the *Royal Society of London*, of which both Bidloo and Cowper were fellows. *Gulielmus Cowper criminis literarii citatus*… (William Cowper sued for a literary crime…). Cowper published his own defense. The ensuing quarrel lasted for several years. Bidloo did not obtain satisfaction because the Royal Society refused to make any decision against one of its members [12]. Nevertheless, Cowper's atlas was well received and went through four editions.

Despite Cowper being associated with an incredible story of piracy, he should be remembered for *Myotomia Reformata* (Anatomical Treatise on the Muscles of the Human Body) that first appeared in 1694 in an octavo modest edition with only ten plates. Cowper worked until his early death on an enlarged version of *Myotomia Reformata*. The rationale for this publication was to emphasize the importance of the superficial layers of muscles useful not only to surgeons, but also to those interested in art and sculpture.

After Cowper's death, **Richard Mead** (1673–1754) persuaded **James Jurin** (1684–1750) to publish Cowper's text by adding anatomical figures drawn after **Pieter Paul Rubens, Guido Reni,** and **Raphael**.

Henry Pemberton (1694–1771), a physician and mathematician, assisted Mead in preparing the chapter on muscular motion.

The new volume, issued in 1724 [108], was an incredible artistic achievement not only for the quality of the anatomical engraved plates which show all the muscles of the human body, and describe their function in detail (Fig. 8.82), but also for the fine ornaments (head-tail pieces) and for the decorative initials, featuring anatomical details. This idea was clearly inspired by Vesalius' *Fabrica*. Pemberton's chapter on muscular motion (*Introduction* I-LXXVII) represented an independent section. It was illustrated by numerous schemes in text, and aimed at analyzing the muscular action in terms of Newtonian mechanics. A *Syllabus musculorum* (List of Muscles) was added at the end.

Fig. 8.81 Comparison of the title pages of Bidloo's and Cowper's Anatomical Atlas. *Left*: Bidloo's original title page; *right*: the plagiarized copy with the name of Cowper pasted on Bidloo's name. (From: Bidloo G. *Anatomia humani Corporis*. Amsterdam, Widow of J. van Someren, et al., 1685 and Cowper W. *Anatomia Corporum Humanorum*. Oxford, Sam, et al., 1698)

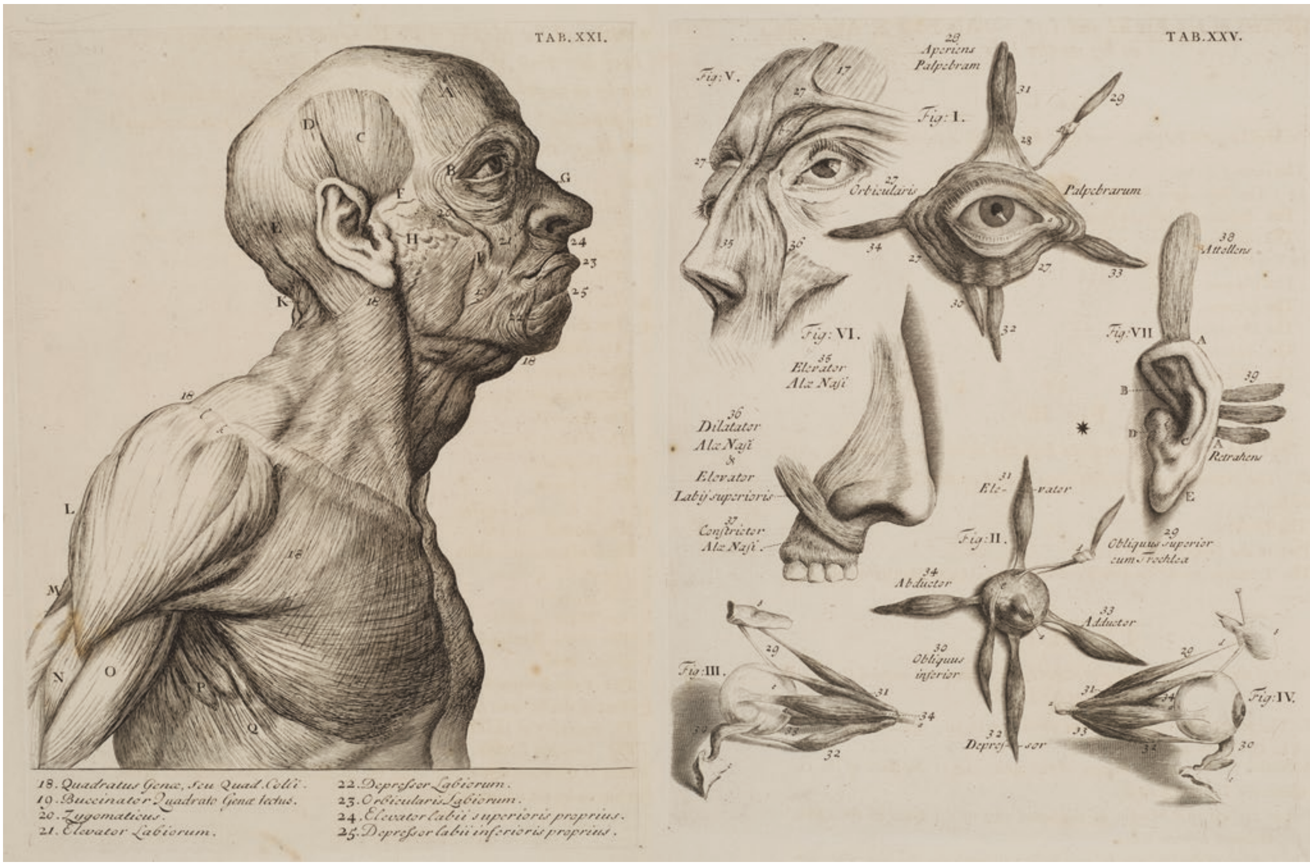


Fig. 8.82 *Left*: the superficial facial muscles with particular emphasis on the platysma; *right*: muscles of the eyelid, eye, nose, auricle. (From: Cowper W. *Myotomia reformata*. London, R. Knaplock et al., 1724)

8.7.7.5 William Cheselden

William Cheselden (1688–1752) (see Sect. 4.2.2.2 "William Cheselden" in Chap. 4) was apprenticed to **James Ferne**, a surgeon at St. Thomas Hospital, London. From Ferne he learned medicine and from William Cowper anatomy. In 1711, he was admitted to the Barber Surgeons Company. From that date onward and for more than 25 years, he became the most considerate teacher of anatomy in the city, giving courses continuously. In 1718, he was appointed physician and surgeon at St. Thomas Hospital in London, and in 1721 he was elected a Fellow of the Royal Society. Apart from being an anatomist of great repute, he was a talented surgeon, particularly keen in removing bladder stones in a very short time and in performing eye surgery. He was appointed Surgeon to the Queen and in 1737, he became Chief Surgeon at the Royal Hospital in Chelsea. Apart from his major anatomical work *Osteographia*, *or the Anatomy of the bones*, Cheselden published *Anatomy of the humane* [sic] *body* in 1713, a modest anatomical book, but a very successful study source for students, that went through several editions. He died in 1752, aged 63.

Osteographia, issued in 1733 at the author's expense [109], is one of the greatest osteological atlases ever produced, and one of the finest of all English anatomical works [12]. Illustrations are after Cheselden's drawings obtained using a *camera obscura*. The innovative use of the *camera obscura* is reproduced in the vignette on the title-page, which shows the author using this device to trace the image of a skeleton hung upside down from a tripod (Fig. 8.83 *left*). Cheselden was the first to employ the *camera obscura* for book illustration and for transforming a tri-dimensional structure into a bi-dimensional image. Full page plates were engraved by the English/Dutch artist **Gérard van der Gucht** (ca.1696–1776) and drawn by the Dutch artist **Jacob Schijnvoet** (1685–1733). They are remarkable for the plasticity expressed by the artist and for the quality of the drawings. Examples are given of a praying skeleton (Fig. 8.83 *right*) and the skeleton of a young boy resting on a horse's skull (Fig. 8.84 *left*). Illustrations of human bones are actual size. The small figures show the skeletons of some animal species in curious and fanciful poses (Fig. 8.84 *right*). The book is enhanced by beautiful engraved initials, vignettes, and osteological motifs.

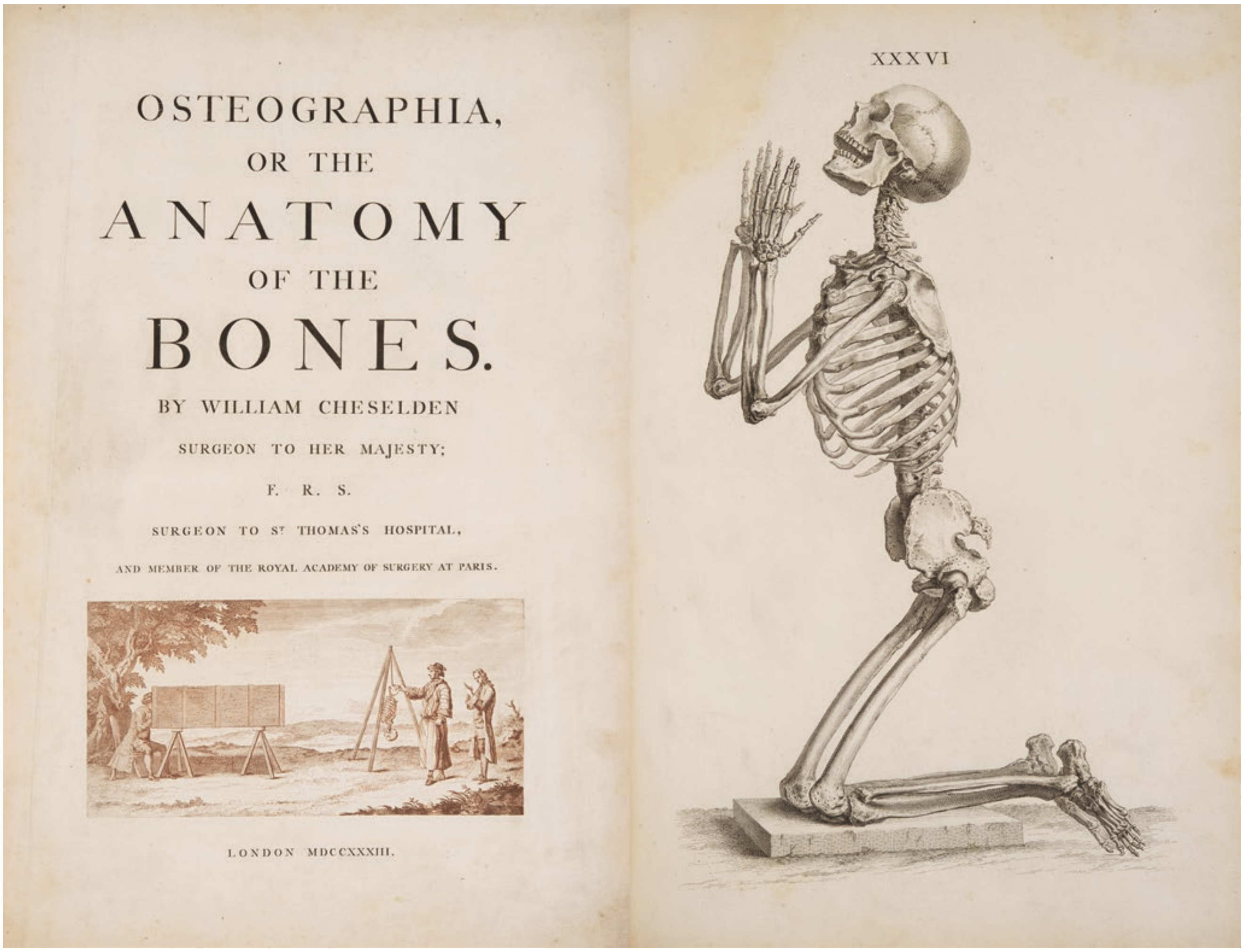


Fig. 8.83 *Left*: title page from William Cheselden (1688–1752) *Osteographia* showing the *camera obscura* and its use in tracing the image of a skeleton; *right*: the praying skeleton. (From: Cheselden W. *Osteographia,* London, (William Bowyer for the Author), 1733)

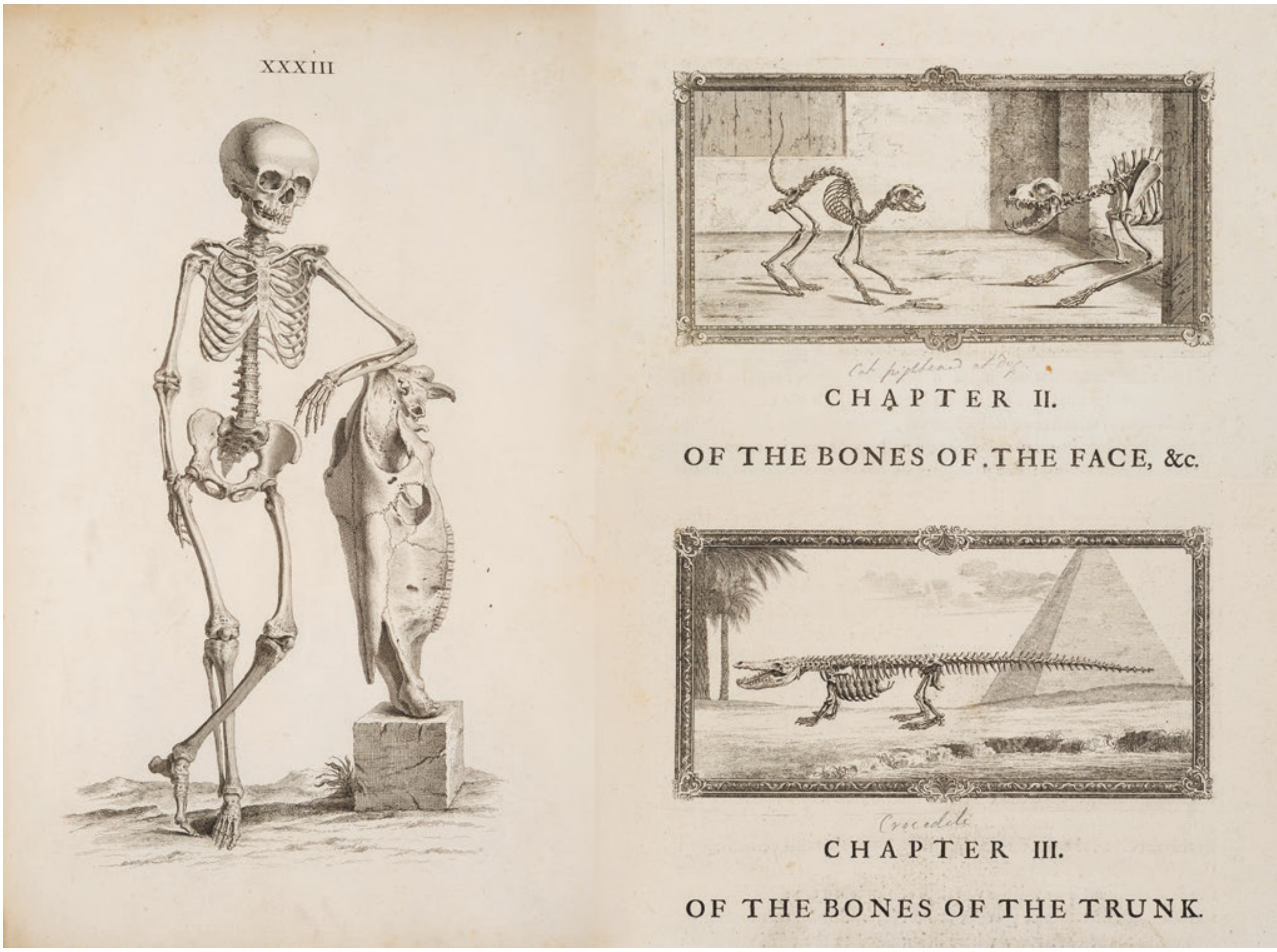


Fig. 8.84 *Left*: skeleton of a young boy resting on a horse skull; *right above*: cat frightened of dog; *right below*: the skeleton of a crocodile. (From: Cheselden W. *Osteographia,* London, (William Bowyer for the Author), 1733)

8.7.7.6 John Bell

Born in Edinburgh, **John Bell** (1763–1820) was the second son of an Anglican clergyman and elder brother of Charles [28]. Encouraged by an artistic mother, he received early training in drawing, studied at the University of Edinburgh, and entered the College of Surgeons after passing the exams when he was 23. In 1790, he opened a flourishing private school where he taught anatomy and surgery. In the meantime, he obtained an official appointment at the Royal Infirmary, which he had to abandon as a consequence of Alexander Monro's personal attack. In 1799, he retired from the hospital and from teaching and went into private practice to become the foremost surgeon of his time. In 1801, he published a three-volume textbook, *Principles of Surgery*, which enjoyed several editions and translations. He died in 1820, aged 57.

In 1793, after 3 years of teaching anatomy at his private school, Bell issued *The Anatomy of the Bones, Muscles and Joints* without illustrations. The following year, to accompany the text, he published *Engravings explaining the Anatomy of the Bones, Muscles and Joints*, a magnificent series of anatomical illustrations, drawn by himself and etched after his own images [110]. The book is divided into three sections: Section 1 describes bones and has 15 plates; Section 2 deals with muscles and has 14 plates; and Section 3 is on joints and has three plates.

The dramatic figures were meticulously prepared to fit the needs of operating surgeons. A sense of the macabre is always present, particularly evident in the section on muscles: sombre interiors, ropes suspending the corpses, and sectioned heads (Fig. 8.85). The atlas represented a more realistic and less idealized style of anatomical illustration.

Fig. 8.85 *Left*: dissection of the back muscles of the back; *right*: the muscles of the neck. (From: Bell J. *Engravings explaining the Anatomy of the Bones, Muscles and Joints*. Edinburgh, J. Paterson, 1794)

8.8 Anatomy in the Nineteenth Century

The scientific achievements that occurred in the nineteenth century, as development of chemistry and physics, evolution of biology, improvement of the microscope, and the invention of photography all positively affected the progress of anatomy, focused more and more on the study of specific parts of the body. Until the middle of the nineteenth century and well beyond, the greatest advancements in anatomy were made by the French with **Bichat, Cloquet, Blandin, Bourgery,** and **Sappey**, and by the English with **the Bells, Swann, Cooper, Lizars,** and **Maclise.**

An important improvement was made at the end of the eighteenth century in the field of printing an image. The German **Johann Alois Senefelder** (1771–1834) invented a new process, **lithography**, by using simple chemical processes to form an illustration [28]. Unlike previous printing techniques, such as engraving, which was complicated and expensive, requiring one to score cavities in the copper plate so as to contain the ink necessary to obtain an image, lithography was simple and cheap. The artist prepared the drawing with great accuracy directly on a stone (*lithographic limestone*) or on a metal plate with a smooth surface. The printing phase utilized a greasy, acid-resistant ink.

Senefelder obtained the patent in 1801, and in a short period of time, the new method replaced engraving. This allowed the production of anatomical atlases with a huge number of plates, almost impossible with the engraving technique.

8.8.1 France

The tradition of anatomy in France, initiated by **Dionis, Duverney,** and **Winslow,** continued at the end of the century and in the nineteenth century with **Bichat, Cloquet, Bourgery,** and **Sappey.**

8.8.1.1 Marie François Xavier Bichat

Marie François Xavier Bichat (1771–1802) was born in Thoirette, Jura Department. He studied mathematics and physical science in Lyon before dedicating himself to medicine and to anatomy in particular. At the completion of his medical studies, he moved to Paris where he became not only a student and assistant of **Pierre Joseph Desault** (1744–1795), a prominent surgeon, but also his best friend. At Desault's unexpected death in 1795, as a tribute to his mentor, Bichat assembled his manuscripts, wrote the obituary, and published the last volume of *Journal de Chirurgie*.

A brilliant teacher, excellent physician, and prolific writer, regrettably, he died suddenly at the age of 31 by accident.

Bichat's most important work was *Anatomie Générale appliquée à la Physiologie et à la Médicine* (General Anatomy Applied to Physiology and Medicine), a cornerstone of medical knowledge, published in 1801 without illustrations as occurred quite often among the anatomists of the past. Reports were so precise and accurate that illustrations were considered unnecessary [111]. He identified 21 tissues of the body including cellular, mucous, vascular, bony, and nervous, highlighting their characteristics in health and disease without the assistance of a microscope. His name is associated with the description of the cellular tissue located in the cheek, traditionally called the Bichat fad pad, which *contributes to beauty and pleasantness of the physiognomy*.

8.8.1.2 Jules Germain Cloquet

The application of lithography for anatomical illustration first started in Paris. **Jules Germain Cloquet** (1790–1883) issued *Anatomie de l'Homme* (Human Anatomy) between 1821 and 1831 a five-volume textbook with 300 lithographic plates [112].

8.8.1.3 Jean-Baptiste M. Bourgery

Cloquet's *Anatomie* was immediately followed by another spectacular atlas, aimed at covering the whole of anatomy with original images. This ambitious project was started by **Jean-Baptiste M. Bourgery** (1797–1849), a native of Orléans, who studied medicine in Paris from where he graduated in 1829 [28]. He immediately began to produce *Traité complet de l'Anatomie de l'Homme* (A Comprehensive Treatise on Human Anatomy), a monumental eight in-folio volume work, with over 2100 pages of text and 726 hand-colored lithographic plates, including 3600 single illustrations [113]. *Traité complet* is regarded as the most complete and probably the most impressive anatomical and surgical atlas of the nineteenth century. Volumes 1–5 are dedicated to descriptive anatomy, Volumes 6 and 7 deal with surgical anatomy and theory, and Volume 8 focuses on embryology, microscopic anatomy, and philosophy of anatomy. Issued over 23 years, from 1831 to 1854, it represented Bourgery's life's work. He died before it was complete. The artist who directed the program of dissections, who was responsible for the great majority of the illustrations, and who finished the work after Bourgery's death, was **Nicholas-Henry Jacob** (1782–1871), a student of the well-known neo-classical painter **Jacques-Louis David** (1748–1825). Bourgery supported his findings by dissections and always produced original anatomical observations, particularly of the nervous system (Fig. 8.86).

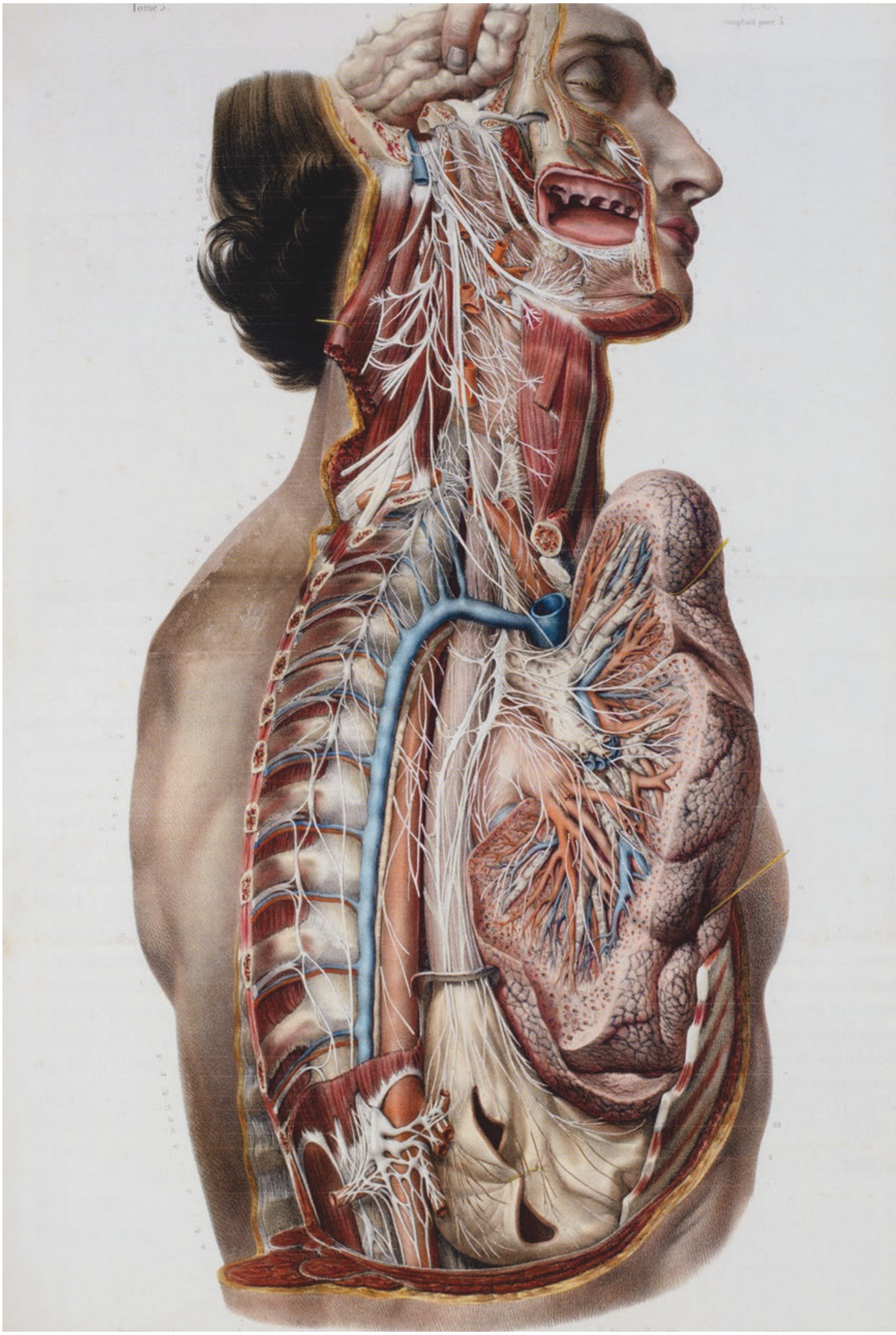


Fig. 8.86 Dissection of the face, neck, and thorax with special emphasis on the innervation. (From: Bourgery J-B. *Traité complet de l'Anatomie de l'homme comprénant la Médecine Opératoire*. Paris, C.A. Delaunay, 1831–1854)

8.8.1.4 Topographic Anatomy: Another Way to Teach Anatomy

To teach a surgeon how to direct his scalpel with safety in the deep layers as if they were transparent was considered a fundamental step by the French surgeons **Philibert J. Roux** (1780–1854) and **Pierre A. Béclard** (1785–1825), so as to avoid unpleasant complications during operations.

Philippe Frédéric Blandin

By publishing *Traité d'Anatomie Topographique ou Anatomie des Régions du Corps humain* (A Treatise of Topographic Anatomy, or Anatomy of the Regions of the Human Body) in 1826 [114], **Philippe Frédéric Blandin** (1798–1849) (see Sect. 5.2.2.6) was among the first to teach anatomy in a new way, examining single regions, showing the various layers of the body and emphasizing relationships existing between structures. The lithographic plates that accompany the text illustrate the hand, elbow, axilla, infraclavicular region, lateral neck, inguinal canal, abdomen, perineum, uro-genital region, and knee.

8.8.1.5 Marie Philibert Constant Sappey

Marie Philibert Constant Sappey (1810–1874) was Professor of Anatomy at the University of Paris and dedicated himself to the study of the lymphatic system, substantially contributing to the identification of the pathway of lymph drainage of the breast [115]. He demonstrated that each lobule of the breast drains a lymphatic flow subcutaneously, between the skin and the superficial fascia, forming the subareolar plexus, eponymously named *Sappey plexus*, finally reaching the lymph nodes in the axilla. Sappey's work was continued by his colleague **Henri Rouvière** (1876–1952).

8.8.2 England

In the twentieth century, English anatomy produced significant anatomical works in the field of neuroanatomy with **Charles Bell** and **Joseph Swan**, in topographic anatomy with **Joseph Maclise**, and in traditional anatomy with **John Lizars.**

8.8.2.1 Charles Bell

Charles Bell (1774–1842) (see Sect. 5.2.4.1) was a great anatomist who, throughout his life, strongly advocated the importance of anatomy in the progress of surgery. The two-volume *A system of Operative surgery, founded on the basis of Anatomy*, issued in 1807–1809, is a prime example of his leitmotif [116]. "I have been educated in anatomy with a strictness and severity for which I am now grateful, he said in the preface. (…) As I have built my expectation of being useful on the union of the studies of anatomy and surgery; and as I every day see reason to believe that the neglect of surgical anatomy is still a common defect of education, I have felt myself called upon at all hazards to prove the necessity of this union. (…) Having acknowledged thus much, I take this position in favor of anatomy, that there is no doing without it; no advancing in safety one step either in study or in practice without its guidance. The ignorance of it makes a surgeon shy and deceitful."

Bell's name is associated with the paralysis of the facial nerve, eponymously named *Bell's palsy* (Fig. 8.87). He published his observations and experimental demonstrations of paralysis of the face induced upon sectioning the fifth and the seventh nerve in his work *On the Nerves*, an extremely important text in the history of neurology [117, 118].

Fig. 8.87 Engraved plate showing the course of the facial nerve, drawn by Charles Bell (1774–1842). (From: Bell C. On the Nerves. *Phil Trans*. 2021; 111: 398–424)

8.8.2.2 John Lizars

John Lizars (1787–1860), a student of John Bell's in Edinburgh between 1822 and 1826, published *A system of Anatomical Plates of the Human Body*, an outstanding anatomical atlas in-folio with 101 plates—one of the most elegant achievements of the nineteenth century, with most illustrations colored by hand [28, 119]. For printing of the plates, Lizars preferred the traditional copper engraving method, despite the introduction of lithography, a less expensive procedure. Plates of the brain and spinal cord, issued directly in sepia and colored by hand, rank among the highest levels of anatomical illustration (Fig. 8.88).

William Home Lizars (1788–1859), John's brother, was the engraver of all the plates which illustrate original images of dissections. **Daniel Lizars**, the publisher, was their father.

Although very expensive, the work was a successful editorial enterprise. It went through several editions and remained the standard text in England during the nineteenth century.

Fig. 8.88 Engraved illustration of base of the brain with cranial nerves and the branches of the internal carotid artery. (From: Lizars J. *A system of anatomical plates of the human Body*. Edinburgh, W.H. Lizars, et al., 1822–1826)

8.8.2.3 Joseph Swan

A student of **Alexander Monro** in Edinburgh, and of **Astley Cooper** in London, **Joseph Swan** (1791–1874) practiced mainly in the field of anatomy. In 1820, the *Royal College of Surgeons* established a triennial award for the best essay on anatomy and physiology. Swan was awarded first prize for his research on the nervous system. *A Demonstration of the Nerves of the Human Body* represents the most spectacular and accurate work on neuroanatomy ever published in England [28, 120] (Fig. 8.89). It was originally printed in 1830 in London in elephant folio, with 25 engraved illustrations, each one with an outline duplicate. Divided into three parts, the work includes a description of the autonomic nervous system, and of the cranial and spinal nerves.

In 1838, the work was translated into French by **E. P. Chaissagnac** (1804–1879), Professor of Anatomy and Surgery at the Paris Medical Faculty, using the original English plates.

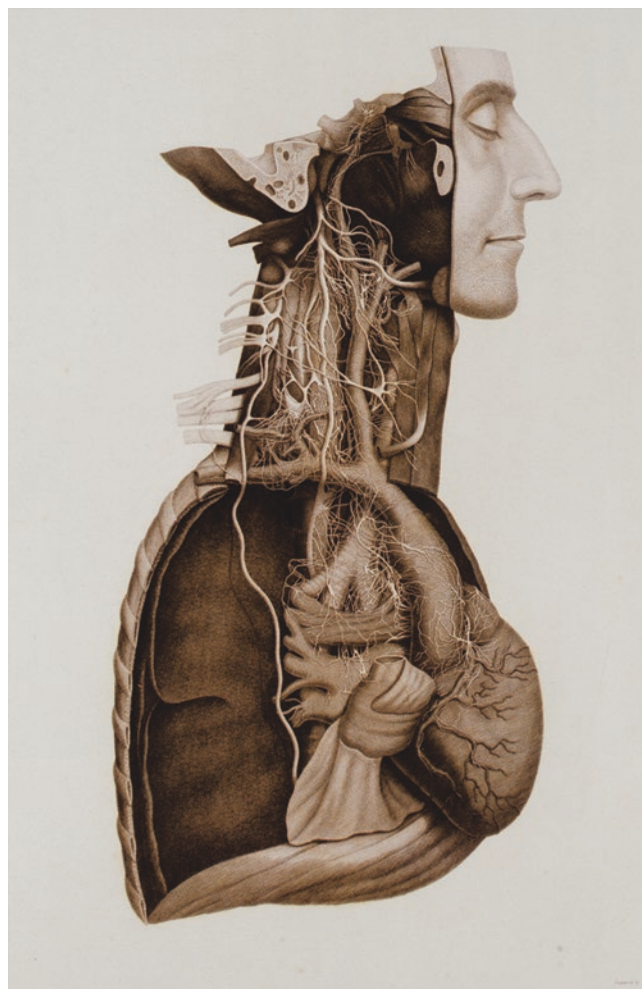


Fig. 8.89 Engraved illustration showing the nerves of the neck and thorax with particular emphasis on the vagus, the ansa cervicalis, the phrenic nerve. (From: Swan J. *A demonstration of the Nerves of the Human Body*. London, Longman, Reese, Orme, et al., 1830)

8.8.2.4 Astley Paston Cooper

For **Astley Paston Cooper** (1768–1841) and his contribution to the anatomy of the breast and to the description of the suspensory ligaments of the mammary gland, see Sect. 5.2.4.2).

8.8.2.5 Joseph Maclise

Joseph Maclise (ca.1815–1880), anatomist and surgeon, was a student of **Samuel Cooper** (1780–1848) and **Robert Liston** (1794–1847). In 1851, he published *Surgical Anatomy*, a textbook directed to students of medicine and to practitioners, with the aim of presenting "a series of dissections demonstrative of the relative anatomy of the principal regions of the human body," quoting from the author's preface, useful to provide the surgeon with a clear vision of the different layers of the body [28, 121]. The atlas is notable and impressive for its dramatic, detailed, and life-like lithographic illustrations, hand-colored only when needed, to highlight significant anatomical features (Fig. 8.90). Plates, finely executed, have an accompanying explanatory text.

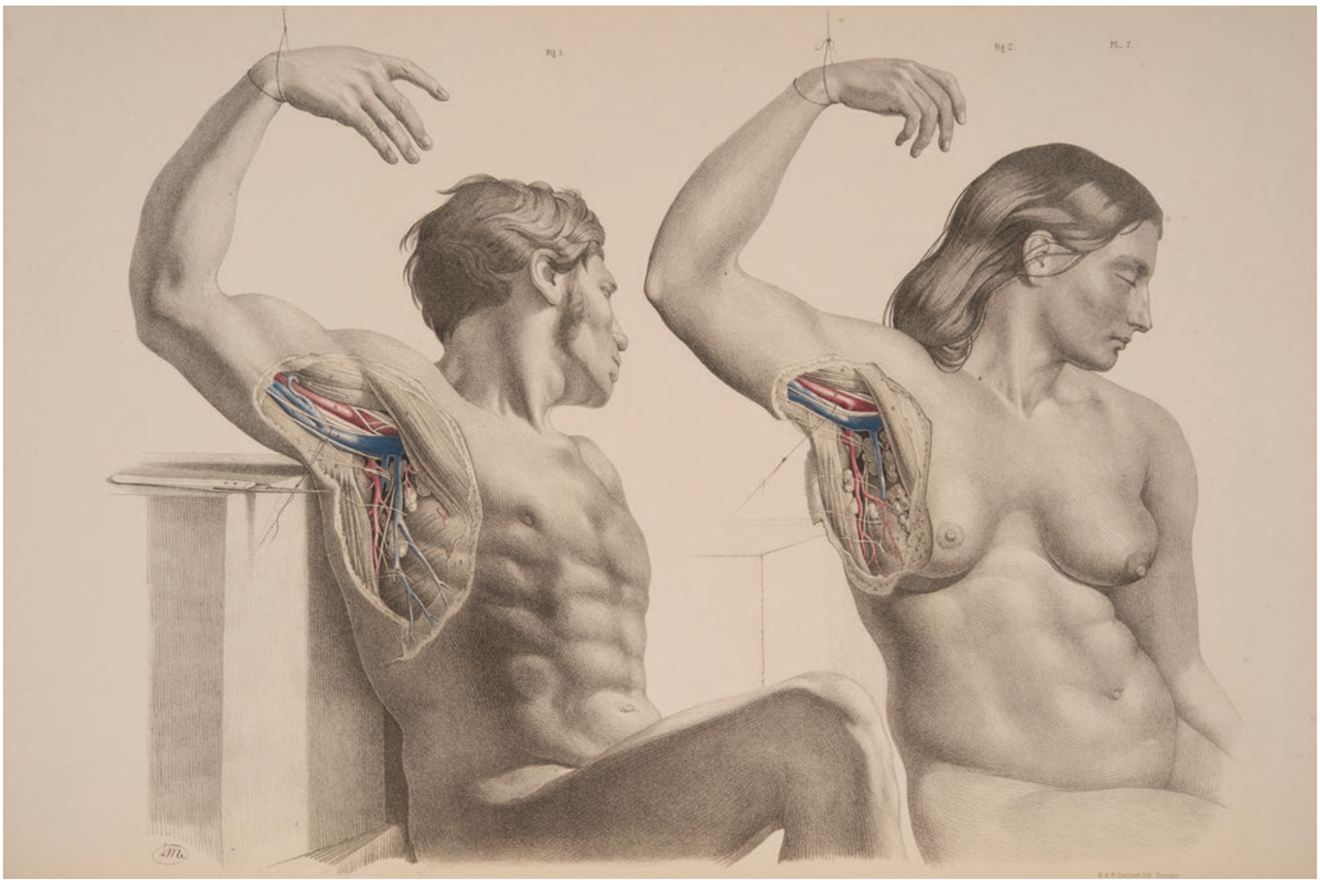


Fig. 8.90 Dissection of the axilla in man and woman. Lithographic colored plate. (From: Maclise J. *Surgical Anatomy*. London, John Churchill, 1851)

8.9 Anatomy in the Modern Period

The importance of studying anatomy in the process of learning to perform surgery was emphasized by numerous studies and research in recent years. However, these investigations did not necessarily produce a clinical application immediately. On the contrary, in the majority of cases, their influence on a practical clinical use appeared decades later. This is the case of **Carl Manchot** and **Giuseppe Sterzi**.

8.9.1 Carl Manchot

Carl Manchot (1866–1932) is known for his epoch-marking studies on skin vascularization of the human body [122] and for the identification of cutaneous territories fed by a single vessel, the basis of microsurgery (see Sect. 6.1.1.2). Manchot's research on skin vascularization were repeated in 1936 by **Michel Salmon** (1903–1973) [123] (see Sect. 6.1.1.2 "Michel Salmon" in Chap. 6).

8.9.2 Giuseppe Sterzi

Giuseppe Sterzi (1876–1919) was born in Cittadella (Padova) and graduated in medicine from the University of Pisa in 1899. He was an assistant in the Anatomical Institute of Padua University and in 1906 became an Associate Professor. While in Padua, he did research on subcutaneous tissue. In 1910, he became Professor of Anatomy at the University of Cagliari (Sardinia) and made important investigations in anatomy, embryology, comparative anatomy, and neuroanatomy. He was very interested in the history of medicine and in 1909, discovered the *Tabulae Anatomicae* by **Hyeronimus Fabricius ab Aquapendente**, housed in the Marciana Library (Venice). He died in 1919 of hemorrhagic epidemic thyphus, aged 43.

His account, *Il Tessuto sottocutaneo (Tela Subcutanea). Ricerche Anatomiche.* (On the Subcutaneous Tissue (the Subcutaneous System). Anatomical Research), published in the *Italian Journal of Anatomy and Embryology*, the official organ of the *Italian Society of Anatomy*, represents a very important contribution for the representation of the entire superficial fascia of the whole human body. He provided the first comprehensive description of the fascia in the head and neck region and demonstrated that mimic and platysma muscles are included in a division of the fascia itself into a superficial and deep layer [124]. Regrettably, he didn't realize the importance of the fascia in terms of its clinical application. More than 50 years later, **Tord Skoog** (1915–1977) first reported the use of the superficial fascia in aesthetic plastic surgery for improving face lifting outcomes [125]. In 1976, **Vladimir Mitz** and **Martine Peyronie** defined the superficial musculo-aponeurotic system (SMAS) and categorized its clinical employment [126].

8.10 Conclusions

Leonardo da Vinci represents the quintessence of the Renaissance man, artist and scientist. He longed to publish a textbook with **Marcantonio della Torre** where he would assemble his numerous amazing anatomical drawings. Regrettably, the sudden death of della Torre from plague in 1511 impaired the achievement of this project.

Similarly, **Michelangelo** accepted the request to illustrate **Realdo Colombo's** *De re Anatomic*a. The premature disappearance of Colombo prevented him from providing the images for the book, which was issued unillustrated, apart from the beautiful woodcut dissection scene on the title page, attributed to the renowned artist **Paolo Veronese** (1528–1588).

We can affirm that artistic anatomy was born in 1543 with **Andreas Vesalius**. In a sort of mutual exchange, anatomists were attracted to art, while painters and sculptors were fascinated by anatomy. In an effort to correlate art and anatomy, a magnificent series of atlases have been produced over the centuries, with the aim of studying and examining the human body in detail, in particular the face and the hands, to illustrate muscles and their function, and to emphasize limb movement.

Understanding of anatomy requires dissection. A great thrust in the study of anatomy and in increasing the number of dissections was provided by the artists. Painters and sculptors of the Italian Renaissance became interested in anatomy for the sake of reproducing human forms and proportions accurately in their works of art.

However, in the past this was forbidden. **Claudius Galen** (ca.AD 129–199) based his anatomical knowledge on the dissection of animals such as pigs and apes, studying their bones, muscles, and internal organs. Even during the Arabic domination of medicine, and the ascendance of the School of Salerno beginning in the ninth century, the study of anatomy mainly relied on animals. In 1281, cadaveric dissection was first allowed in Bologna, and this marked the beginning of the teaching of human anatomy in a university environment. **Mondino de' Luzzi** (1270–1326) was the first lecturer [5]. This explains why his dissections attracted an increasing number of students and doctors to Bologna, coming from various European cities where dissections were not allowed. In 1316, Mondino wrote *Anothomia*, the first text entirely devoted to anatomy.

Initially, manuscripts were supplemented by diagrams, on occasion by illustrations in the form of sketches of the specific organs such as the human eye, the heart, or the male and female urogenital tracts. With the discovery of printing, in the middle of the fifteenth century, things changed completely and anatomical illustration, initially crude and inexact, was introduced in textbooks. The first images represented the cadaveric dissections, or the human skeleton, or the abdominal viscera to roughly show the composition of the human body.

A common denominator of the anatomical textbooks was the involvement of renowned artists who prepared the plates, although in the majority of cases, the artists remained anonymous.

The superb Images of *Fasciculo de Medicina* by **Johannes de Ketham**, the first printed illustrated medical textbook (1491), have been associated with either the Venetian painter **Gentile Bellini** (1429–1507) and his school, or with **Andrea Mantegna** (1431–1506).

The name of the artist of **Berengario's da Carpi** *Commentaria* (1521), although extensively studied, is unknown. It has been connected with either **Ugo da Carpi** (1480–1530), a well-known printmaker of the period, or with the mannerist painter and sculptor **Amico Aspertini** (ca.1475–1552).

To prepare the beautiful illustrations of *De humani corporis Fabrica* (1543), **Vesalius** involved **Johannes Stephanus van Calcar** (ca.1499–1546), a disciple of Titian, who worked under Vesalius' direct supervision.

The colored plates of *De lactibus, sive lacteis venis* by **Gaspare Aselli** (1627), were most likely by the Milanese engraver and painter **Cesare Bassano** (1584–1648).

The amazing engraved images of **Giulio Casserio's** *Tabulae Anatomicae*, published in 1627, were drawn by **Odoardo Fialetti** (1573–ca.1637), a disciple of the Venetian painter **Tintoretto** (1518–1594).

In 1685, the Dutch anatomist **Govard Bidloo** engaged the Belgian painter and printer **Gérard de Lairesse** (1640–1711) to prepare the 105 large engraved plates, drawn after nature, to illustrate his *Anatomia humani Corporis*. The atlas is regarded as one of the finest examples of baroque style ever published.

The spectacular illustrations of **Bernhard Sigfried Albinus'** *Tabulae sceleti et musculorum corporis humani*, considered as the zenith of anatomical imagery, were made in 1747, by **Jan Wandelaar** (1690–1759), a student of **Gérard de Lairesse**, the artist for Govard Bidloo's atlas.

In 1746–1748, **Jacques Fabien Gautier d'Agoty** issued *Myologie complètte* [sic] *en couleur et grandeur naturelle* along with the anatomist **Guichard Joseph Duverney**. Gautier, a painter and printmaker, made the drawings and the mezzotint plates.

Giovanni Domenico Santorini's *Septemdecim tabulae* were posthumously issued in 1775 with the author's portrait and possibly most of the anatomical plates drawn by **Giovanni Battista Piazzetta** (1682–1754), a renowned Venetian painter.

For his superb large folio atlas on the lymphatic vessels, *Vasorum lymphaticorum* (…) issued in 1787, the anatomist **Paolo Mascagni**, engaged **Ciro Santi**, a celebrated artist, who left his home town of Bologna to establish himself in Siena, and to personally assist with the cadaveric dissections, precisely preparing the images.

Nicholas-Henry Jacob (1782–1871), a student of the well-known neo-classical painter **Jacques-Louis David** (1748–1825), was the artist who participated in the massive program of dissections and who was responsible for the great majority of the illustrations of the *Traité complet de l'Anatomie de l'Homme* by **Jean-Baptiste M. Bourgery**, issued over a 23-year period, from 1831 to 1854.

Were anatomical atlases expensive? Yes, they were. Atlas production required an exorbitant investment. First of all: ink and paper. For atlases, highly rated thick paper was necessary. Secondly, the employment of an artist (and sometimes a well-known artist was recruited for the management of anatomical illustrations) was often priceless. Thirdly, the cost of the wood cutter for wood blocks, or later of the engraver for copper plate preparation, was huge. Moreover, the cost of the printer should be added. Finally, the price of the binding was always separated, either calfskin with a spine tooled in gilt, or vellum, or paper covered boards. The end result was a very expensive work, which sold poorly on the market and the author had great difficulties in recouping his expenses. **Jacques Gamelin's** atlas was issued in 1779 in 2000 copies, but despite the high quality of the illustrations, it had scarce success and only a few copies were sold. For this, the author was bankrupted and put in jail. **Paolo Mascagni's** atlas on lymphatic circulation, issued in 1787, had huge production costs due to the large copperplates, drawn by the renowned artist, **Ciro Santi**, and finely copper engraved. This obliged the author to draw on his salary and to mortgage his family estate. At his premature death, the family inherited not only plates, drawings, sketches, and records, but also debts.

To reduce the costs of production, **William Cheselden** decided to sell copies of his atlas *Osteographia*, issued in 1733, from his own house. Despite this, he probably did not retrieve the invested money.

In a few cases, the anatomist was also the artist who made the illustrations and even the engraver. This ideal situation occurred rarely. The Italian **Antonio Scarpa** drew the plates personally, and engaged **Faustino Anderloni** as the copper engraver. **John** and **Charles Bell** not only drew the images of anatomy and surgery, but they were also trained in engraving them.

As early as 1800, with the advent of lithography, the cost of production of illustrations dropped dramatically. This explains why, following **Jules Cloquet's** *Anatomie de* *l'Homme* (Anatomy of Man), the first lithographic anatomical text, issued in 1821, numerous comprehensive atlases were published, such as *Traité complet de l'Anatomie de l'Homme* by **Jean-Baptiste Bourgery**, with more than 700 colored plates, or those by Blandin, Swan, Maclise, and others.

To whom were the anatomical books and atlases addressed? They were prepared mainly for teaching purposes and in theory addressed to students of medicine. However, students could not afford to pay the huge costs of an atlas. The Frenchman, **Jacques Fabien Gautier d'Agoty**, on the title page of *Myologie complètte* [sic] *en couleur et grandeur naturelle*, issued in 1746, and regarded as one of the most expensive anatomical atlases ever published because of the complex mezzotint-colored process used for illustrations, defines his work *Ouvrage unique. Utile & nécessaire aux Étudians & amateurs de cette Science* (A Unique Work. Useful and Necessary to Students and Lovers of This Science). He was probably joking when he wrote this phrase. How could a student be well-off enough to buy such an expensive item?

Ambroise Paré, who was a very practical person and a strong supporter of the importance of anatomy as a prerequisite for surgery, added a chapter on basic general anatomy to illustrate his pocket books that were devoted to surgery and to the management of wounds, using woodcut figures plagiarized from Vesalius. These small-size inexpensive editions were meant to be included in the knapsack of the field surgeon, who may have some desperate last-minute doubts regarding anatomy on the battlefield.

Initially, and until the discovery of anesthesia, anatomical atlases were addressed to physicians, surgeons, university libraries, and monasteries—and on occasion to painters and sculptors who were interested in discovering the muscular layers existing under the skin envelope and limb movement, although specific atlases were issued for this purpose by Genga, Gamelin, and others.

An atlas, as complete and detailed as Vesalius' *De humani corporis Fabrica*, was too exhaustive for a surgeon whose range of procedures was generally limited, mainly confined to limb amputation, fracture reduction, treatment of sores, healing of wounds, cataracts, and stone removal. For this reason, at the request of students and surgeons, Vesalius issued *Epitome*, a skillful condensation of all the material to be found in *Fabrica*, especially summarized for practical use.

After the introduction of anesthesia on October 16, 1846, things changed completely. Major and more aggressive operations became the routine, and detailed anatomical expertise was essential to avoid the risk of complications.

Piracy and plagiarism occurred quite often. One of the most striking examples in history was the quarrel between the Dutchman **Govard Bidloo** and the Englishman **William Cowper**. In 1685, Bidloo issued a spectacular 105 large format copper engraved plate atlas. On the occasion of a visit to Leiden, Cowper met Bidloo and obtained the plates directly from him, with the excuse of providing better circulation of the work. On his return to England, Cowper pasted his own name over Bidloo's on the engraved title page, added his own portrait to the text, and in 1698 published *Anatomia Corporum Humanorum* in Oxford, never mentioning Bidloo's name. Bidloo unsuccessfully tried to report Cowper's fraud to the *Royal Society of London*, which refused to take any action against one of their own members.

Vesalius' plates were known to have been plagiarized over the years by **Johannes Dryander, Thomas Geminus, Ambroise Paré, Jean Tagault,** and **Juan Valverde de Hamusco**.

The relationship between anatomy and surgery has always been very close. Understanding the minute anatomical details of the different layers of the body has permitted surgery to evolve and at the same time surgical procedures to be performed with greater safety. It is through knowledge of anatomy, achieved either with dissections or through the study of anatomical illustrations, that the surgeon becomes acquainted not only with the composition of the human body, but with how the body functions—its physiology.

In the preface of *A System of Operative Surgery, Founded on the Basis of Anatomy*, issued in 1807–1809 [116], Charles Bell wrote: "I take this position in favour of anatomy, that there is no doing without it; no advancing in safety one step either in study or in practice without its guidance. The ignorance of it makes a surgeon shy and deceitful."

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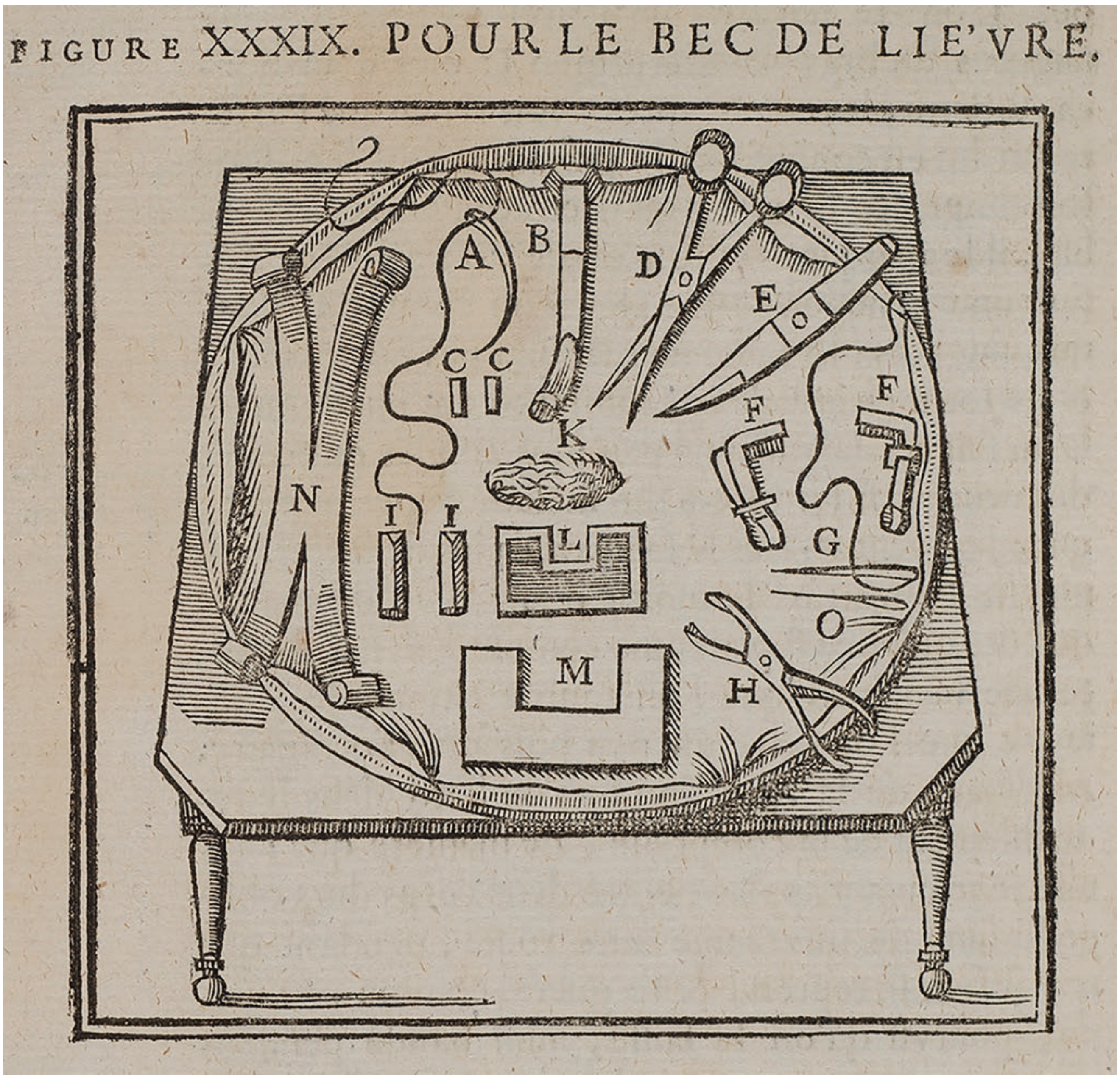
Cleft Lip and Palate

9



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Cleft Lip and Palate: Salient Events

- Cleft lip repair is not practiced in remote ages. **Celsus** (ca. 460–375 BC) in his book *On Medicine* reports lip defect approximation. In the western world, the first description of cleft lip surgery is by **Jehan Yperman** in the first decade of the fourteenth century. **Pierre Franco** (ca. 1500–1578) illustrates the technique of cleft lip suture in detail in 1561. In the same year, **Ambroise Paré** (ca. 1500–1578) publishes the first image of a cleft lip approximation.
- Sporadic cases of cleft lip repair, always by margin approximation, using a triangular needle and a figure eight suture with a twisted waxed thread, are reported during the eighteenth century in France by **Georges de La Faye** (1699–1781), in Germany by **Lorenz Heister** (1683–1758), in England by **William Cheselden** (1688–1752), and in Italy by **Giuseppe Sonsis** (1736–1808).
- During the nineteenth and twentieth centuries, the technique for cleft lip closure evolves significantly to a more elegant incision and aesthetic suture. **Joseph-Francois Malgaigne** (1806–1865) and **Germanicus Mirault** (1796–1879) pioneer this new trend. In particular, Mirault describes a triangular flap, later used by **Victor Veau** (1871–1949) in 1938, to close unilateral cleft lip. The German **Werner H. Hagedorn** (1831–1894) invents the quadrilateral flap to obtain better aesthetic results long term. Numerous complicated variations for cleft lip closure are proposed over the years.
- Cleft palate repair begins later, in the second decade of the nineteenth century. Before that, obturators are used to improve speech, and to avoid the presence of food in the nostrils. Priority of cleft palate suture is shared by **Carl Ferdinand von Gräfe** (1787–1840) and **Philibert Joseph Roux** (1780–1854). Initially, palatal closure is by simple approximation without undermining. Reopening due to tension is the most common complication. In 1826, **Johann Friedrich Dieffenbach** (1794–1847) first reports the dissection of the palatal mucosa to release tension. In 1861, **Bernhard von Langenbeck** (1810–1887) describes the dissection of two muco-periosteal flaps and their approximation to the contralateral side, with lateral relaxing incisions. It is a revolutionary improvement in cleft palate surgery. Reopening rarely occurs and more predictable results are obtained.
- Often after surgery, the soft palate doesn't meet the posterior pharyngeal wall, and air escapes through the nose during speech—the most common complication. This condition, named hypernasality or velopharyngeal insufficiency, requires surgical treatment to reduce air escape and make speech understandable. An inferiorly or superiorly based mio-mucosal flap outlined on the posterior pharyngeal wall and sutured to the soft palate, the so-called velopharyngeal flap, is proposed first by **Karl Schönborn** in 1875, later by **W. Rosenthal** in 1924, and by **Gustavo Sanvenero-Rosselli** in 1934, respectively, with successful results. This operation is named velopharyngoplasty.
- The importance of close cooperation between the cleft surgeon and a speech therapist for a proper speech rehabilitation program is first emphasized by **Victor Veau** in his book *Division Palatine* (Cleft Palate) in 1931 and later by **Elisabeth Muriel Morley** in her book *Cleft Palate and Speech* in 1945, creating the bases for the team approach to cleft palate management.

9.1 Cleft Lip Repair

9.1.1 Before the Fourteenth Century

As **Blair Rogers** pointed out, cleft lip repair was not mentioned in the medical literature until the middle of the fourteenth century [1]. However, **Aulus Cornelius Celsus** (25 BC–AD 50) (see Sect. 1.7.1), authored *De Medicina* (On Medicine) in eight volumes in Rome in about AD 30 [2]. In Book Seven, Chapter 9, he reported on lip closure (possibly lip defect sequelae of tumor excision) by means of two advancement flaps (*see* Fig. 1.16).

During the Byzantine period (see Sect. 1.8.3), **Paulus of Aegina** (ca. AD 625–690) in Book Six of *De Materia Medica* (On Medicine), devoted to surgery, described closure of lip defects (Greek: *colobomata*) using a technique very similar to that of Celsus [3].

Abu-l-Qa-sim (**Albucasis**) (AD 936–1013), from Cordoba (Spain), was the most significant representative of Arabian surgery and a proponent of cautery for different clinical applications (see Sect. 2.1.1). In *Al Tasrif* (On Surgery) (Book One, Chapter 18), largely inspired by **Paulus of Aegina**, he reported closure of lip defects employing a very delicate type of cauterization [4].

9.1.2 From the Middle Ages to the Renaissance

The first descriptions of cleft lip treatment in medical literature appeared in this period.

9.1.2.1 Jehan Yperman

About the first decade of the fourteenth century, the surgeon **Jehan Yperman** (ca. 1260–1331), a native of the Flemish city of Ypres, and a student of Lanfranchi (died 1315) (see Sect. 2.4.1.6), wrote a manuscript *Cyrurgie* (Surgery) in the Flemish language dealing mainly with facial injuries and malformations. Regrettably, the long forgotten tract was not published until 1863 [5]. It is regarded as the first documented description of the management and repair of uni- and bi-lateral cleft lip, using a scalpel to freshen the borders.

Closure of the defect was done by suturing the margins together using a triangular needle and a twisted waxed thread. Another long needle was passed through the lip at a certain distance from the cleft to maintain the approximated edges using a figure eight suture, thus avoiding possible wound breakdown.

9.1.2.2 Heinrich von Pfolfprundt

In 1460, the Bavarian surgeon **Heinrich von Pfolfprundt** (ca. 1415–1465), wrote *Buch der Bündth-Ertznei* (The Book on Wounds) in the vernacular, basically devoted to the management of wounds in general, and to gunshot wounds in particular [6]. The manuscript remained hidden in the library of Ertfurt University (Germany) and was discovered and published in 1868, that is, after more than 400 years, by **H. Haeser** (1811–1885) and **A. Middeldorpf** (1824–1868) (see Sect. 2.4.2.2 "Heinrich von Pfolfprundt" in Chap. 2). (*see* Fig. 2.12). Apart from a detailed and important section on nasal reconstruction, where the Brancas' method with skin harvested from the arm is described, von Pfolfprundt reported on harelip repair. The cleft borders were incised with a scalpel and a suture passed through the whole thickness of the lip to keep the union stable. A bandage was applied at the completion of the surgery.

9.1.2.3 Hyeronimus Brunschwig

In about the same period, the Strasbourg wound surgeon **Hyeronimus Brunschwig** (ca. 1450–1512) issued *Cirurgia*, the first printed textbook on surgery, fully illustrated, and written in the vernacular [7] (see Sect. 2.4.2.2 "Hyeronimus Brunschwig" in Chap. 2). In Tract Three, Chapter 11, he reported on the treatment of *hasen scharten* (cleft lip) where the patient was fastened to a chair and operated in the sitting position. He used scissors to freshen the cleft margins. An interrupted waxed suture was used to approximate the margins. To reduce bleeding, a self-retaining clasp was applied to the lip. Brunschwig's armamentarium was illustrated (see Fig. 2.15). At the completion of the procedure, a complicated dressing was applied.

During the Renaissance, three great surgeons reported on the management of cleft lip in France: **Pierre Franco, Ambroise Paré,** and later **Jacques Guillemeau.**

9.1.2.4 Pierre Franco

Pierre Franco (ca. 1500–1578) (*see* Fig. 3.44) was born in Turriers in Provence (southern France) (*see* Sect. 3.2.1). Initially, he was an itinerant surgeon, who learned surgery probably through apprenticeship and direct observation, and devoted himself to herniotomy, lithotomy, treatment of cataracts, and fractures. In 1545, being a Huguenot, for religious reasons he established a surgical practice in Lausanne (Switzerland). In 1556, he published *Petit Traité*… (Small Treatise…), which was later expanded and reissued in 1561 with the following title *Traité des Hernies* (…) (Treatise on Hernias (…) dealing with hernias, bladder stones, cataracts, pterygion, cleft lip, amputations, and tumors [8] (*see* Fig. 3.45). He died in about 1578.

Franco's account of cleft lip is among the first reports on this topic. In Chapter 118, he states: "<u>On cleft of mouths and lips either congenital or acquired</u> **-** Cleft lips are sometimes congenital, due to a defect of nature. On occasion, they are caused by an accident, like a fall, hit, or cut. Similarly, they are separated without division of the jaw or palate. Sometimes the cleft is only minimal, while in other cases the cleft is as long and wide as the lip or mouth and so large to include the incisors and occasionally also the canines. It happens that the small and thin cartilaginous structures in the nostrils, called alae, are absent. In case the palate is also cleft, the patient must talk through the nose, with great discomfort when one listens to his speech formation due to the defective mouth. However, when this opening is closed, he speaks normally. Those who have a cleft palate are more difficult to treat, as they always speak through the nose. If the palate is partially cleft and one can close it with some cotton, he will speak better or as well as if there is no cleft, or better if one can apply a plaque of silver or lead in some way, hoping that it remains stable (…). There are some ignorant people who believe that since God has given this congenital defect, it cannot be repaired, which is something crazy. Guidon (i.e., Guy de Chauliac) calls it heretical (…)."

In Chapter 119, Franco continues: "<u>The treatment of cleft lips</u>—First of all, the skin of the lips where they have to be approximated one to the other, have to be cut either with a knife, or with scissors, or with another instrument, like cautery. Then one can apply, if he wishes, some astringents to diminish pain, leaving it on the wound for one or two days. If cautery is used, it is better to wait until the eschar has fallen (…). Once achieved, the margins should be joined one to the other and observed that they are well united. We can do this in the following way: using two pieces of lint, triangularly shaped, whose size depends on the patient. This solution is very clean and it produces less pain and gives a better scar because there is no needle, which is better and desirable especially on the face and particularly for girls. Once the eschar has fallen, we can apply the mentioned lints that must be covered with a poultice (…) (note, the recipe is supplied) to be applied on the margins of the cleft on each side (…) It is important to let them become dry before suturing so that they will adhere more firmly until the edges touch, using the hand to bring them together, or a pad, if necessary, when they are far away.

In Chapter 120, Franco emphasizes: "<u>Another procedure</u>—As we have said, the other method is to suture the margins, using the instruments mentioned. We must use needles as we do for other wounds: having the needle threaded, it is necessary to include a good amount of margin so that it holds better, passing from the inner to the outer (margin) and placing two or three (sutures) according to the case. Then with the thread, one has to make two or three twists around it, and not more, to avoid that the thread impairs the remedies, so we will reach the margins and prevent their joining completely. One can use pads, as we shall describe. In fact, when the margins are far apart, and they are under tension, the needles cut the flesh and the margins separate. In this case, it is necessary to do it again. If margins are so far apart that they cannot be brought together, they must be cut inside, preserving the muscles as much as possible, to maintain movement. However, if it is necessary, one can cut them, rather than leaving a defect. One should avoid cutting the skin from outside, because by this method the margins can be approximated easily, as I have done a number of times. The pads which are applied to hold the edges together are made in this way. We must take two pieces of wood in the form of a square. They are one finger thick and two fingers wide, depending on the individual, and according to the cleft margin, and should be covered with fine linen. They must be placed on the two cheeks one on each side of the cleft, being sutured in back to a cap which comes forward to the middle of the cheek, or to a bandage, which passes behind the neck and below the ears. Then take another bandage, which is attached to the first by two ends above the ears by passing it over the head. (…). By this method the margins are maintained together better. They must be left on until consolidation occurs (…)."

Finally, Franco concludes his account on clefts in Chapters 121 and 122: "Another type of cleft lip, named hare's teeth—This type of cleft lip is usually named hare's teeth because they are in front of the mandible instead of the incisors. There are teeth that protrude from the mouth, sometimes one, sometimes two, often accompanied by the mandible which is divided on both sides and continues on the palate, which is divided on either side, with these two (teeth) remaining in the middle, with a part of the mandible, to which they are attached, so protruding that they cannot be covered by the mouth—something impossible to see. Chapter 122: Treatment of hare's teeth—As for the method of treatment, it is the one that is outlined above except that they cannot be covered, there is no danger of cutting off the excess (i.e., the premaxilla) with cutting forceps or with a small saw, leaving the flesh over them, for it will be possible to suture the margins together (…)." A detailed description follows about the technique for premaxilla excision and suturing the cleft's margins afterwards.

9.1.2.5 Ambroise Paré

Ambroise Paré (1510–1590) born in Laval, near Mayenne (northern France), was an army surgeon and dedicated himself to the management of wounds. He is regarded as the greatest and the most talented surgeon of the Renaissance for his significant contributions to surgery (see Sect. 3.2.2). This is the description of his method of cleft lip suture accompanied by the first image in medical literature [9]: "When the wound is great and deep, and the lips distant, these sutures (i.e., traditional) can be of little or no use. For this you must employ quadrangular or triangular needles, so that they may readily and easily enter into the flesh, without much pain, with a waxed thread and passed through the margins of the wound, and then wrapping the thread five or six times (just after that manner which women use to fasten their needles on their sleeves, or tailors to their caps). The needles shall be there until the perfect agglutination of the wound. This type of suturing is done to the lips, but is also necessary for hare lips, that is lips divided since birth, by an error of the forming faculty. But such a suture will have no effect on agglutination if there remains any skin between the lips of the wound. Therefore, it is necessary to cut away all the remnants of skin; otherwise no union will take place. Other kinds of sutures are of no great use in wounds of these types, as the parts are in perpetual motion for eating and speaking. Otherwise the thread will cut the flesh. For which reason, with such needles, we have to take enough flesh, as it appears in the illustration" (Fig. 9.1).

Fig. 9.1 First image of a cleft lip suture in medical literature. The needle is passed through the freshened margins of the cleft, and the thread is wrapped around it in a figure eight to maintain the margins approximated. (From: Paré A. *La méthode curative des playes & fractures de la teste humaine*. Paris, Iehan le Royer, 1561)

9.1.2.6 Jacques Guillemeau

Born in Orléans, **Jacques Guillemeau** (1550–1612) was the favored pupil of Ambroise Paré—and also his father-in-law. He was a surgeon at Hôtel-Dieu, the most important hospital in Paris, and personal physician to Kings Charles IX, Henry III, and Henry IV of France. He devoted himself to surgery on the battlefield and contributed to obstetrics, surgery, management of wounds, cleft lip, and ophthalmology (see Sect. 3.2.3). In 1598, his contributions to anatomy and surgery were gathered in *Les Oewres de Chirurgie* (Collected Surgical Works) and dedicated to King Henry IV [10]. Les *Oewres* contains the first printed illustration of a unilateral cleft lip in medical literature (Fig. 9.2). The technique for cleft closure basically overlaps with that of Ambroise Paré with the only difference that Guillemeau added two symmetrical relaxing crescent incisions in the cheek—*seulement au cuire, sans penetrerer en la bouche (*only in the skin, without entering the mouth)—to facilitate approximation.

Fig. 9.2 First printed illustration of a unilateral cleft lip in medical literature. Closure is by approximation of the margins, using the same procedure described by A. Paré (1561), supplemented by two relaxing incisions (F) in the cheek, to reduce tension. (From: Guillemeau J. *Les oeuvres de Chirurgie*. Paris, Nicolas de Louvain, 1598)

9.1.2.7 Gaspare Tagliacozzi

In Italy, **Gaspare Tagliacozzi** (1545–1599), from Bologna (see Sect. 3.3.5.2), renowned for his revolutionary work on the art of reconstructing noses, *De Curtorum Chirurgia per Insitionem* (On the Surgery of Injuries by Grafting) that first appeared in Venice in 1597 [11], described the management of uni**-** and bi**-**lateral cleft lip in detail in Chapter 19 of Book Two, devoted to the restoration of the lips. Let's see what he wrote: "I will first discuss the treatment of harelip, which is the simplest defect to cure. The treatment, the same for either lip, has its origin in the nature of the disease, that is, the separation of the parts that had to be united. (…) The first task is to abrade the parts, allowing the blood to blend and thereby initiate coalescence. Having abraded the parts, he (i.e., the surgeon) approximates the margins, sutures them together, protects them as they heal and returns them to soundness. With his left hand, he grasps the part of the lip that is to be scraped and using a very small and sharp knife he removes the skin evenly, until the blood flows into the angle of the cleft itself (this operation may be done quickly and safely with a pair of scissors). The same must be done on the other side. Then he must approximate the margins on both wounds with his hand and unite them with sutures. The surgeon must observe that the needle passes through more than just the surface by directing it into the lip from the outside and pulling it out from the inside. He must tie the threads with a double knot, tighten them again, tie a single knot and finally cut them. He must check that the sutures are not placed too close to the margins of the wound, as the weakness of the wounded parts makes the threads more likely to become loose, but at a good distance. (…) The size of the wound will determine the number of sutures needed. After the surgeon has finished suturing the wound, he should protect the area with egg white and rosewater both to the inside and outside of the wound. (…) Some sutures may be removed by the end of the fourth day. (…) The lips cannot coalesce very quickly, not only because of the softness of their substance, but also because they are constantly moving."

9.1.3 In the Seventeenth and Eighteenth Centuries

There was not much progress in surgical cleft lip repair during the seventeenth and eighteenth centuries. The technique was almost the same, with the same incisions, and the same type of suture, with minimal variations. The only difference with respect to the past was that treatment of cleft lip, rarely reported by ancient authors, became an integral part of major surgical textbooks of the period, often with additional images.

9.1.3.1 Hieronymus Fabricius ab Aquapendente

Hieronymus Fabricius ab Aquapendente (ca. 1533–1619), one of the leading Italian anatomists and surgeons of the late Renaissance and early seventeenth century (see Sect. 4.1.5.1), first published *Opera Chirurgica in duas partes divisas* (Surgical Works divided in two parts) in 1617, without illustrations. The work was reissued numerous times as *Opera Chirurgica in Pentateuchum et Operationes Chirurgicas distincta* (Five Books on Surgery and Various Surgical Operations) [12].

In Part Two, entitled *Operationes Chirurgicae* (Surgical Operations), Fabricius described various surgical procedures, and in particular, in Chapter 32, he describes his technique for treating the cleft lip *quomodo curta labia resarcinutur* (how cleft lips could be repaired). Long needles were used to approximate the separated parts once the margins had been freshened.

9.1.3.2 Johannes Schultes (Scultetus)

An image of cleft lip repair was illustrated in the celebrated *Armamentarium Chirurgicum* (Surgical Armamentarium) by the German **Johannes Schultes (Scultetus)** (1595–1645), issued in 1655 [13].

9.1.3.3 Pierre Dionis

During the eighteenth century in France, **Pierre Dionis** (1643–1718) (see Sect. 4.2.2.1 “Pierre Dionis” in Chap. 4), in his *Cours des Operations de Chirurgie, démontrées au Jardin Royal* (Courses of Surgical Operations, demonstrated at the Royal Garden), issued in 1707 [14], not only described the repair of the cleft lip, but showed the surgical table, accurately arranged, with the instruments regarded as essential for performing a correct operative procedure, namely, curved needles, hemostatic clamps, scissors, and scalpel for freshening the cleft border and post-operative bandage (Fig. 9.3).

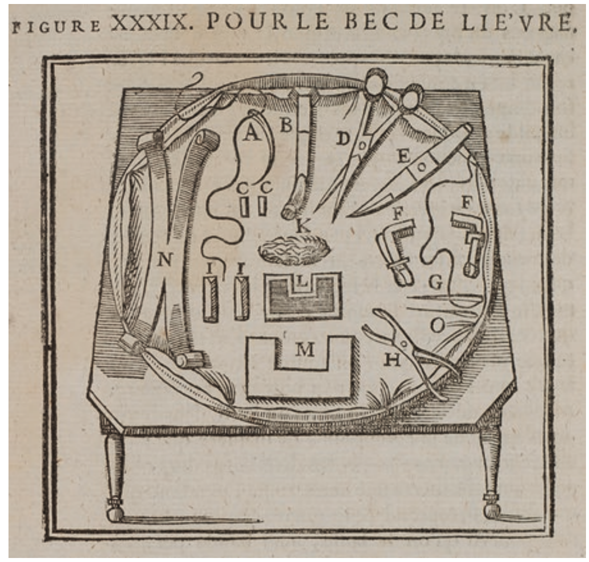


Fig. 9.3 An eighteenth-century operating table with the instruments necessary for cleft-lip closure. Among them, curved needle with thread (A), scissors for freshening the margins (D), scalpel (E), hemostatic pincers (F), head bandage (N). (From: Dionis P. *Cours des Opérations de Chirurgie*. Paris, Laurent d’Houry, 1707)

9.1.3.4 René Jacques Croissant de Garengeot

René Jacques Croissant de Garengeot (1688–1759) in *Traité des Opérations de Chirurgie* (Treatise on Surgical Operations) (1731) [15] illustrated how to grab the congenitally divided upper lip with the left hand, and at the same time how to scrape the cleft margin using a pair of scissors with the right hand (see Sect. 4.2.2.1 "René Jacques Croissant de Garengeot" in Chap. 4) (Fig. 9.4).

Fig. 9.4 The freshening of the margins with scissors for cleft lip approximation in the eighteenth century. (From: Garengeot R J. *Traité des Opérations de Chirurgie*. Paris, Huart, 1731)

9.1.3.5 Georges de La Faye

Georges de La Faye (1699–1781) reported two cases of bilateral cleft lip in *Mémoires de l'Académie Royale de Chirurgie* in 1743 [16]. In the first case he excised the premaxilla to facilitate margin approximation. In the second case, he sutured the lateral segment to the premaxillary bone. He claimed that the final result was very pleasing (see Sect. 4.2.2.1 "Dionis Georges de la Faye" in Chap. 4) (Fig. 9.5).

Fig. 9.5 Treatment of bilateral cleft lip with excision of the premaxilla to facilitate cleft approximation by George de la Faye (1699–1781). *Upper*: before surgery; *Lower*: after surgery. Possibly the first representation of a bilateral cleft lip in medical literature. (From: La Faye G. *Observations sur les Becs-de-Lièvre venus de Naissance*. Mém. Acad. R. Chir. 1743; 1: 605–618)

9.1.3.6 Lorenz Heister

In Germany, **Lorenz Heister** (1683–1758) issued *Chirurgia* (Surgery) in 1718. It was one of the most important surgical tracts of the eighteenth century, in which he showed the different operations performed at that time [17]. He also illustrated his technique for cleft lip repair, which is basically similar to that of Ambroise Paré (see Sect. 4.2.2.3 “Lorenz Heister” in Chap. 4) (Fig. 9.6).

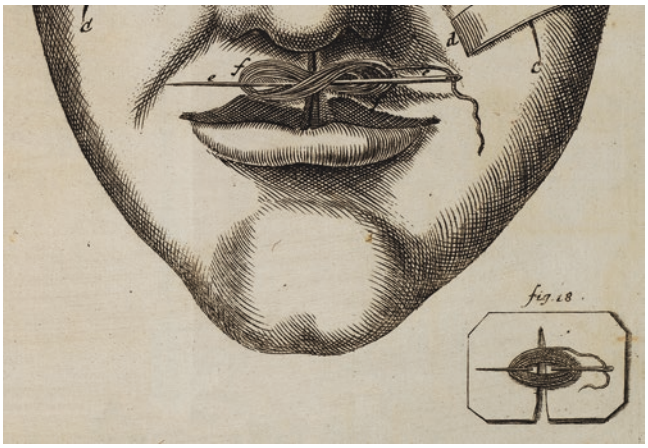


Fig. 9.6 Unilateral cleft lip suture according to Lorenz Heister (1683–1758). (From: Heister L. *Chirurgie*. Nürnberg, Heirs of J. Hoffmann, 1724)

9.1.3.7 William Cheselden

In England, **William Cheselden** (1688–1752) added an appendix with his own surgical *Observations*, accompanied by engraved plates, to **Henry-Francois Le Dran’s** *Traité des Opérations de Chirurgie* (Treatise of the Operations in Surgery) translated into English. Regarding the treatment of unilateral cleft lip, he showed the pre-operative examination of the patient, the treatment plan, and the instruments necessary to perform the correction [18]. To remove a protruberant tooth grown within the cleft, he suggested the use of a nail-nipper (see Sects. 4.2.2.1 and 4.2.2.2 “William Cheselden” and “Henry-François Le Dran” in Chap. 4) (Fig. 9.7).

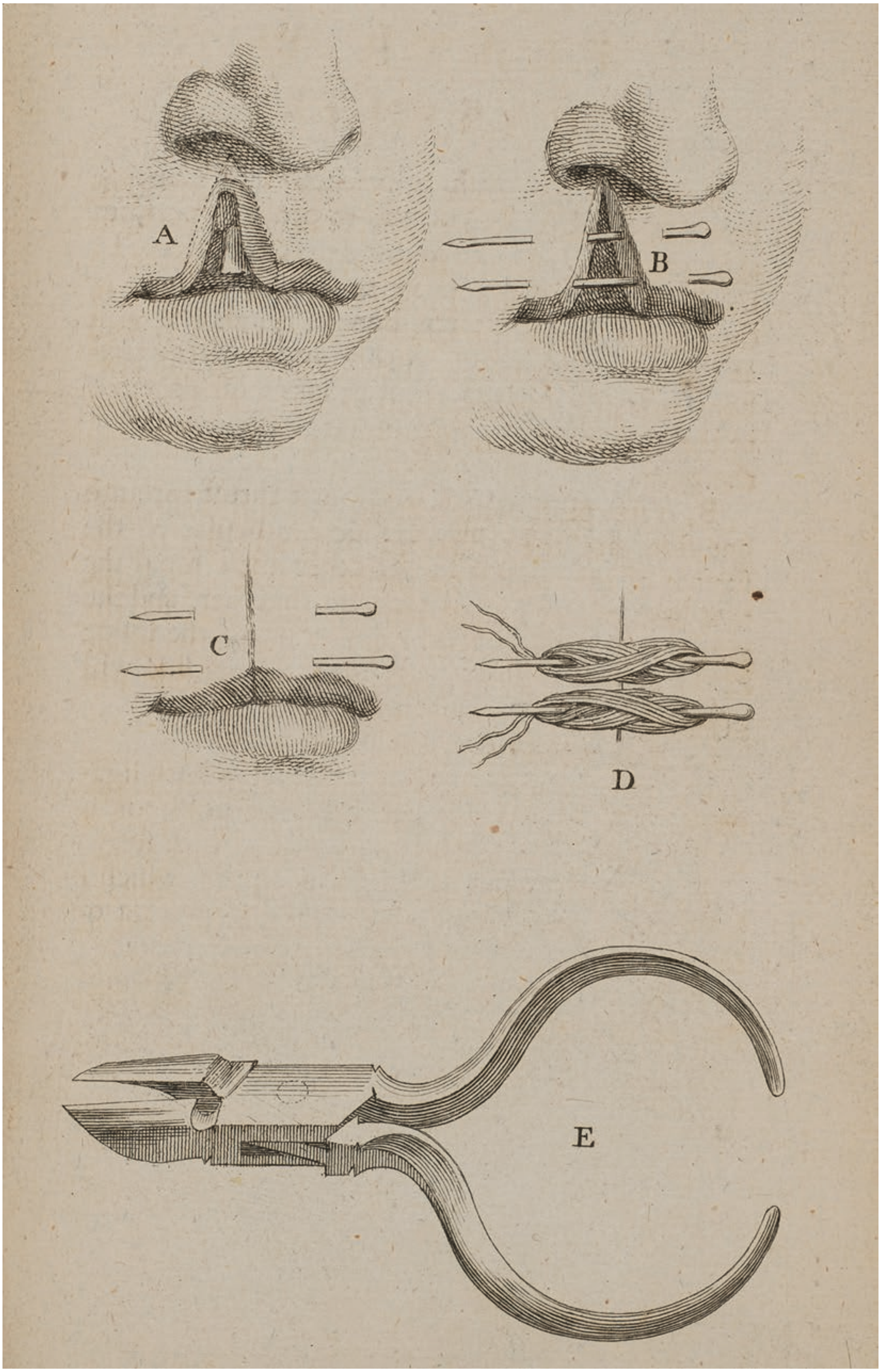


Fig. 9.7 The technique for unilateral cleft lip suture practiced in the eighteenth century (**A**–**D**). At the bottom (**E**), the "nail-nipper" for removing some alveolar bone and facilitate cleft approximation. (From: Le Dran H-F. *Operations in Surgery*, (…) Translated by Thomas Gataker. With Remarks, Plates of the Operations and Set of Instruments by William Cheselden. London, C. Hitch and R. Dodsley, 1749)

9.1.3.8 Giuseppe M. Brunazzi

In Italy, **Giuseppe M. Brunazzi** (*fl.* second half of the eighteenth century), a surgeon in Cesena (east of Bologna), published an ingenious device to relieve tension of the cleft edges and facilitate the repair. The author affirmed that by abrading the margins, the gap spontaneously heals and the defect closes [19] (Fig. 9.8).

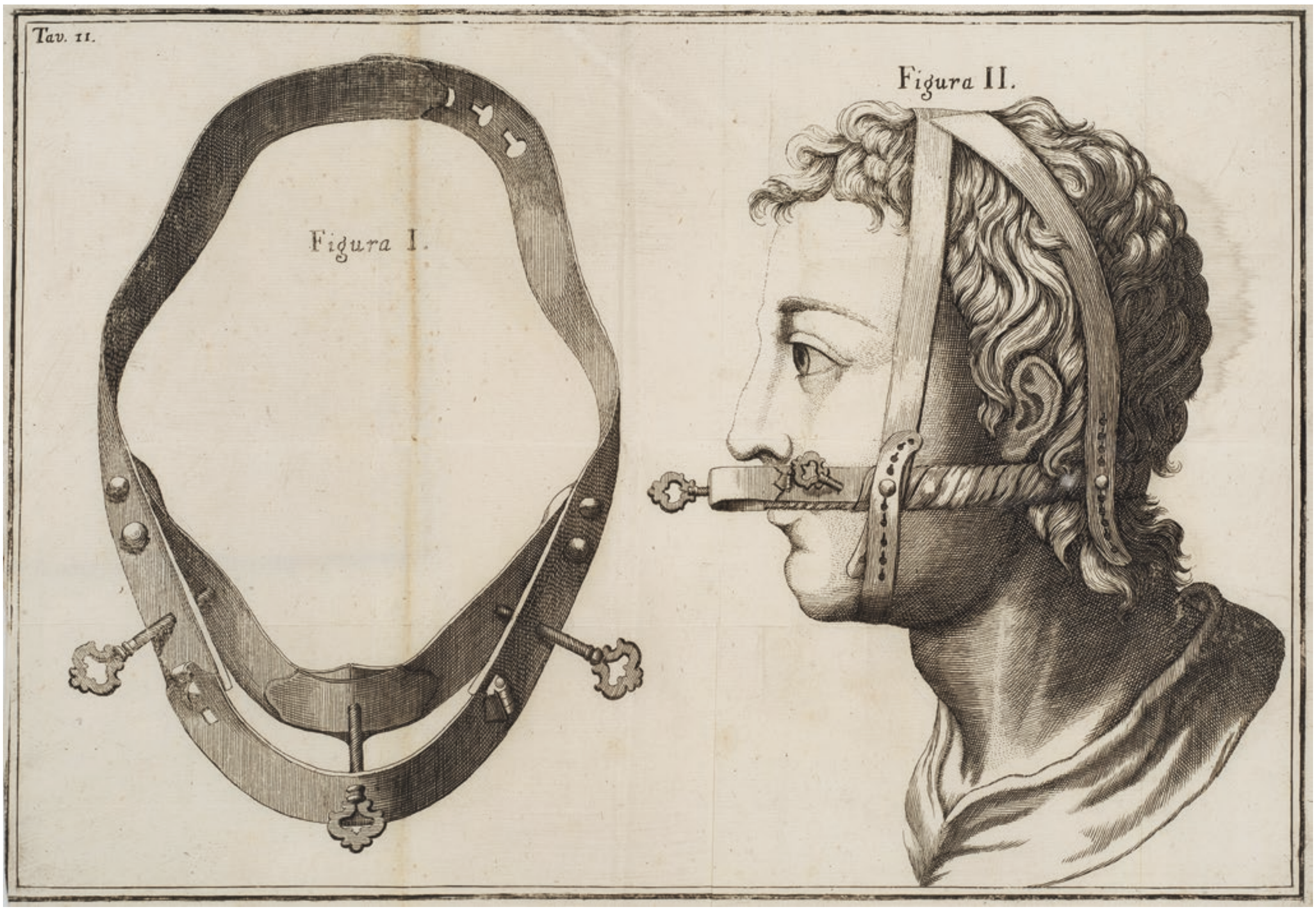


Fig. 9.8 A device invented by Giuseppe Brunazzi (*fl.* eighteenth century) to facilitate margins approximation in cleft lip. (From: Brunazzi G. *Memoria su di un nuovo metodo di unire il labbro leporino col mezzo di una macchinetta*. Faenza, L. Genestri, 1790)

9.1.3.9 Giuseppe Sonsis

In 1793, **Giuseppe Sonsis** (1736–1808), a surgeon in Cremona (northern Italy), reported two cases of cleft lip in *Memoria Chirurgica sul Labbro Leporino Complicato* (Surgical Memoir on the Complicated Cleft Lip) [20]. The first patient was a two-year-old child, affected by bilateral cleft lip and palate, whereas the second was an eighteen-year-old boy with unilateral cleft lip and palate. The post-operative results were particularly attractive (Fig. 9.9).

Fig. 9.9 *Left:* Bilateral cleft lip before surgery; *right:* after surgery, operated on by Giuseppe Sonsis (1736–1808), surgeon in Cremona (east of Milan). (From: Sonsis G. *Memoria chirurgica sul labbro leporino complicato*. (Surgical Memoir on the Complicated Cleft Lip) Cremona, G. Ferraboli, 1793)

9.1.4 In the Nineteenth and Twentieth Centuries

During the nineteenth and twentieth centuries, the technique for cleft lip closure evolved significantly, and cleft lip pins were finally abandoned for a more delicate and aesthetic type of suture.

9.1.4.1 Joseph-François Malgaigne

Joseph-François Malgaigne (1806–1865), one of the greatest surgeons of France of the nineteenth century and at the same time a distinguished scholar [21] (see Sect. 5.2.2.7), published his own technique for cleft lip repair, *Nouvelle Méthode pour l'Opération du bec de lièvre* (A New Method for Cleft Lip Repair), in an 1844 issue of *Journal de Chirurgie*, a monthly scientific publication on surgery that he founded and directed [22]. Basically, to approximate the margins, he designed a two-flap method, trying to preserve tissue as much as possible, "by borrowing as needed from the neighboring parts. (…) It is the utilization of these lost cuttings that constitutes the new method." He closed the margins with a straight line obtaining an unpleasant asymmetrical tubercle in the vermilion border. There was no illustration in the abovementioned article. Malgaigne's drawing was published some time later in *Manuel de Médecine Opératoire* (Handbook of Operative Medicine) [23] (Fig. 9.10).

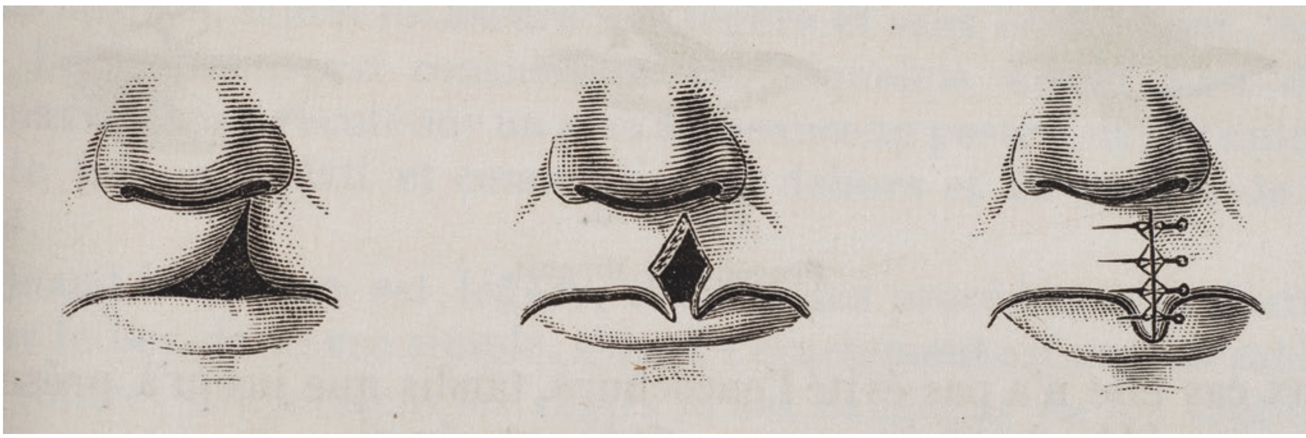


Fig. 9.10 Malgaigne technique for unilateral cleft lip suture, resulting in an asymmetrical tubercle. (From: Malgaigne JF. *Manuel de Médecine Opératoire* (Handbook of Operative Medicine). Paris, Germer Baillière, 1877)

9.1.4.2 Germanicus Mirault

The method proposed by Malgaigne was certainly an improvement over the traditional procedures for cleft lip closure, but not sufficient to achieve a perfect result as **Germanicus Mirault** (1796–1879), a surgeon from Angers (western France), pointed out. For this reason, a few months later, Mirault published *Lettre sur l'Opération du Bec-de-lièvre* (Letter on the Operation for Cleft Lip) split into two separate issues of *Journal de Chirurgie*, in which he firmly contradicted Malgaigne's method [24]. He suggested the use of only one horizontal incision producing a triangular flap on the cleft side, which could fit a similar incision in the opposite side. In this way, Malgaigne's unaesthetic tubercle was not present. However, the illustrations published in *Journal de Chirurgie* were very poor, and one of them was printed in reverse. Mirault reissued the letter, very important in the history of cleft lip surgery, as a separate account, improving the quality of the images and tracing the details of his technique, where he proposed a sort of triangular flap to close the lip defect [25] (Fig. 9.11). Despite this, and because of the absence of technical drawings, understanding of his procedure remained a true dilemma. Not until 1871 did Mirault publish a report of his technique and finally added two self-explanatory illustrations [26] (Fig. 9.12).

Commenting on Mirault's procedure, **Victor Veau** (1871–1949), one of the most renowned cleft surgeons of all time, in his book *Bec-de-lièvre* (Cleft Lip) (1938) [27], wrote (page 99): "Mirault is the giant of cleft lip surgery. (…) His first publication (1844) is unclear, due to the absence of self-explanatory illustrations. (…) After a long period of silence, Mirault returned to this question in a small twenty-page account, where an excellent image of his technique is reported. (…) Regrettably, as the publication did not appear in a scientific journal (…) it remained completely unnoticed. It is a shame. (…) For my part, after long consideration, I arrived at a very similar scheme. The only difference between what Mirault has done in 1871, and what I am currently doing in 1937, is that I am outlining the flap outside instead of outlining it inside" (Fig. 9.13). Veau was a proponent of the orbicularis oris muscular suture.

Born in Angers (western France), into a family of doctors (his father was an ophthalmologist), **Germanicus Mirault** studied medicine in Angers. After his father's death, he moved to Paris to complete his studies. For a period of time, he was a student of Malgaigne. He graduated in 1823 and returned to Angers, becoming Surgeon-in-Chief at Angers Hospital. An excellent surgeon, particularly for facial repairs, treatment of cleft lip and diseases of the eye, he was also a great teacher and very generous with poor patients. He was a corresponding member of the *Academy of Medicine* and of the *Society of Surgery* and was awarded the Legion of Honor in 1850. He retired in 1867, at the age of 71. During the war of 1870, he resumed his surgical activity until he died in 1879.

Fig. 9.11 The letter addressed by Germanicus Mirault (1796–1879) to Joseph-F. Malgaigne (1806–1865), in which he contradicts Malgaigne's procedure for cleft lip closure, proposing his triangular flap technique instead. *Left:* Unilateral cleft lip before and after surgery; *right:* bilateral cleft lip before and after surgery. (From: Mirault G. *Mémoire su l'Opération du bec de lièvre* (…) *adressée à M. Malgaigne*. Angers, Cornier et. Lachèse, (1845))

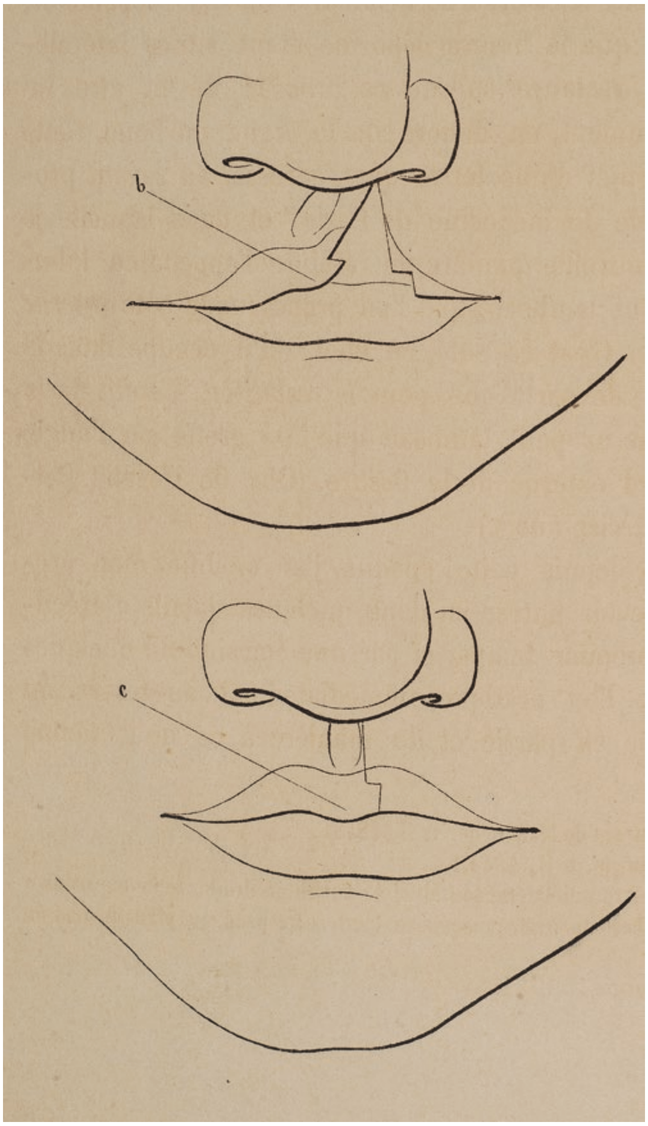


Fig. 9.12 Mirault's technique for closing unilateral cleft lip is clearly illustrated for the first time. (From: Mirault G. *De la résection sous périostée du Vomer appliquée à la cure du Bec-de-Lièvre bi-latérale*. Angers, P. Lachèse, Belleuvre, & Dolbeau, 1871)

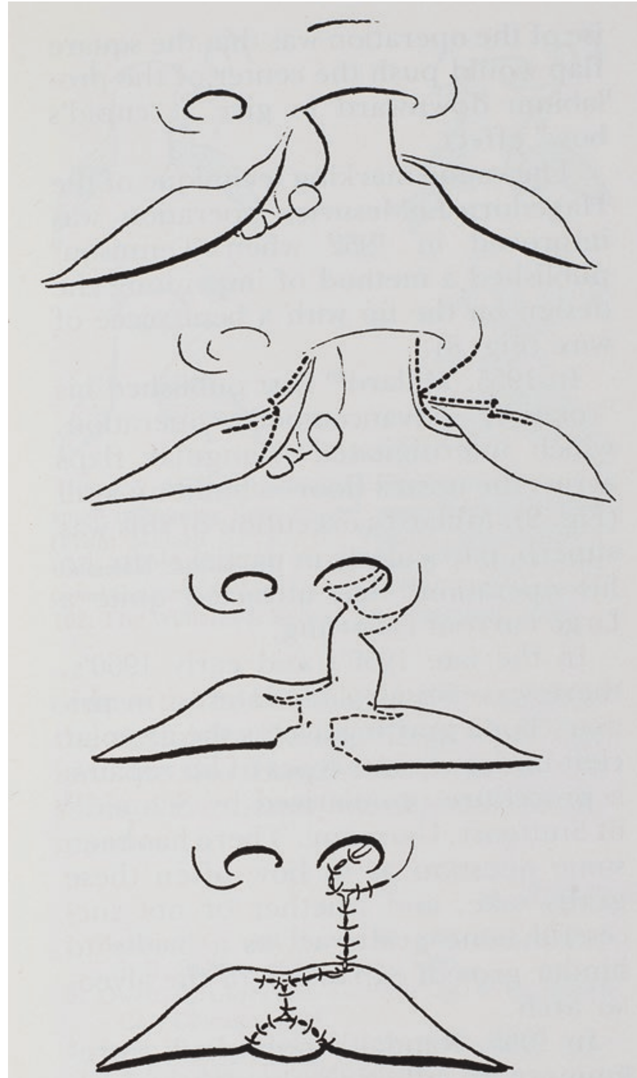


Fig. 9.13 Veau procedure for closing unilateral cleft lip. (From: Veau V. *Bec de lièvre. Formes cliniques. Chirurgie*. Paris, Masson & C., 1938)

9.1.4.3 Werner H. Hagedorn

In the late nineteenth century and during the early twentieth century, a flood of different types of flaps appeared: triangular, quadrilateral, round, zig-zag, and many others too numerous to mention. They were proposed by different surgeons all over the world to improve the quality of results. Surgeons unanimously noted that the simple longitudinal V-closure produced an unpleasant visible retraction of the lip. The German **Werner H. Hagedorn** (1831–1894), who worked in Magdeburg, was the inventor of the quadrilateral flap to bypass the above mentioned consequences [28] (Fig. 9.14). Hagedorn's quadrilateral flap was resurrected in the 1940s and 1950s by **A. B. LeMesurier** [29] and **Charles W. Tennison** [30].

9.2 Palate Anatomy and Cleft Palate Repair

9.2.1 Anatomy

Palate anatomy, with its complex velar and pharyngeal musculature, was described over the centuries by numerous anatomists, each one adding some important detail.

9.2.1.1 Leonardo da Vinci

Leonardo da Vinci (1452–1519) is credited with having drawn the first front view image of the oral cavity and the side view of the dissection of the velum and pharyngeal muscles, highlighting the existing relationship between the soft palate and posterior pharyngeal wall in about 1510 [31] (Fig. 9.15).

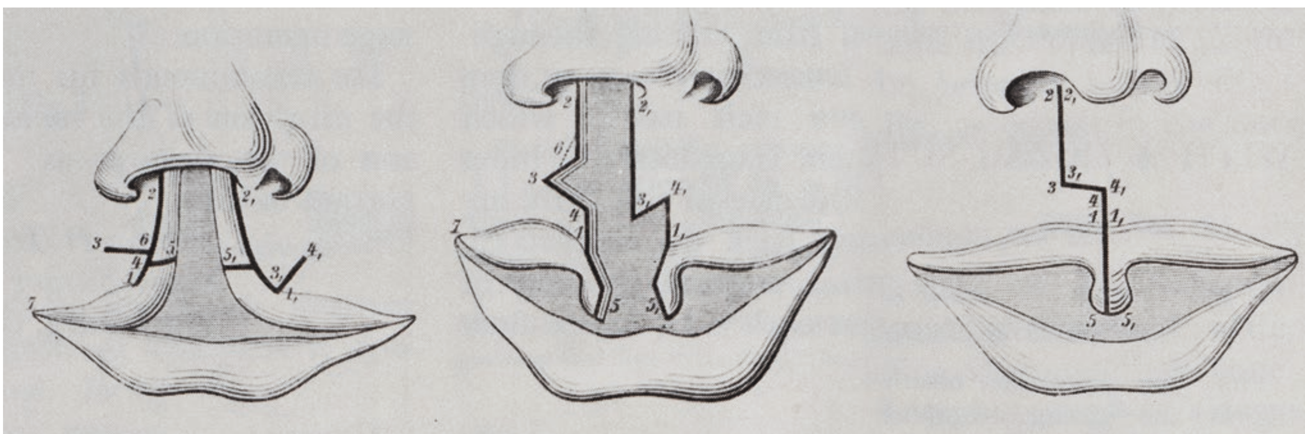


Fig. 9.14 Hagedorn procedure for closing unilateral cleft lip. First report of the quadrilateral flap technique. (From: Hagedorn WH. *Die Operation der Hasenscharte mit Zickzagknaht*. *Centralbl Chir*. 1892; 19: 281)

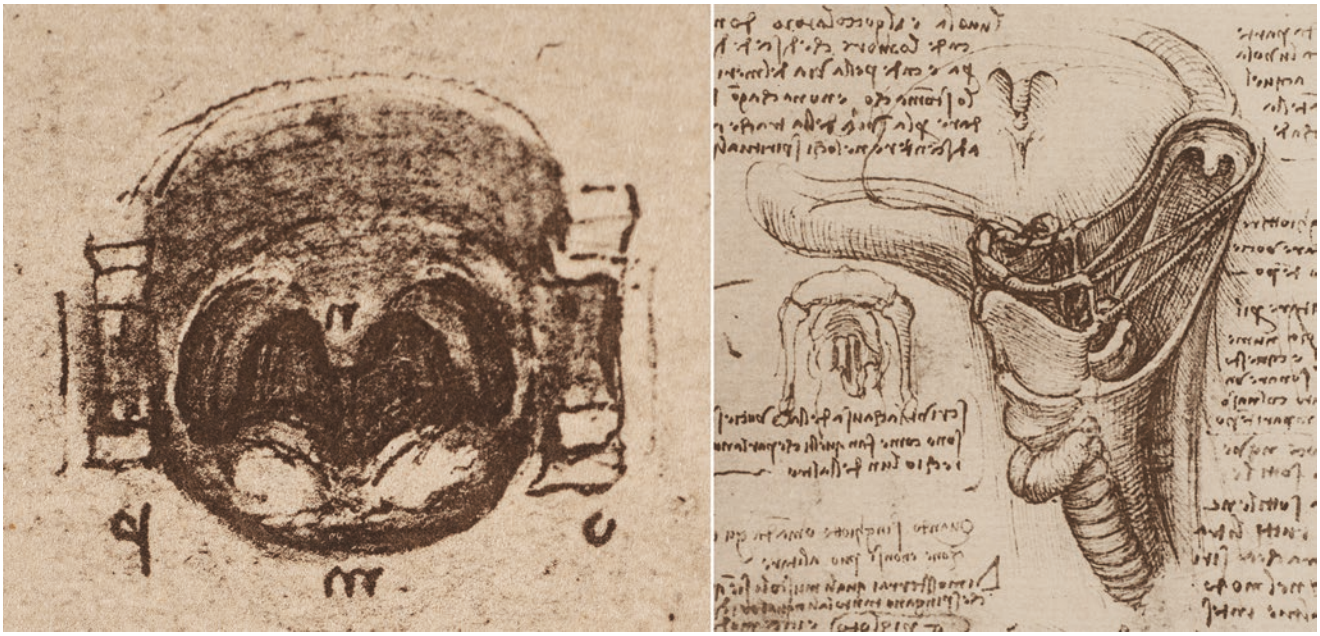


Fig. 9.15 Leonardo da Vinci (1452–1519). *Left*: First image of the oral cavity; *right*: lateral view of the tongue, velum, posterior pharyngeal wall. With palato-glossus muscle. About 1510. (From: Leonardo da Vinci. *I manoscritti di Leonardo da Vinci della Reale Biblioteca di Windsor: dell'Anatomia, fogli A-B pubblicati da Teodoro Sabachnikoff*. Paris, E. Rouveyre, 1898)

9.2.1.2 Johannes Dryander

In 1537, **Johannes Dryander** (1500–1560) produced the first printed representation of the oral cavity, showing the bony and soft palate and the floor of the mouth [32] (*see* Fig. 8.24).

9.2.1.3 Hieronymus Fabricius ab Aquapendente

In his account *De Locutione et eius Instrumentis* (On Speech and Its Organs), issued in 1601, **Hieronymus Fabricius ab Aquapendente** drew an amazing engraved plate, illustrating the anatomical structures participating in voice production: the larynx, soft palate and its musculature, posterior pharyngeal wall, and tongue [33]. On the same plate, Fabricius emphasized the close relationship existing between the organs of the voice and the hearing apparatus (*see* Fig. 8.39).

9.2.1.4 Antonio Maria Valsalva

In 1704, the Italian **Antonio Maria Valsalva** (1666–1723) (see Sect. 8.7.4.3 "Antonio Maria Valsalva" in Chap. 8) accurately illustrated the musculature of the velum and pharynx and in particular the tensor veli palatini muscle that he called the muscle of the tube. He identified the functional role of the different muscles in speaking and hearing [34].

9.2.1.5 David Cornelius de Courcelles

The Dutch anatomist **David Cornelius de Courcelles** (born 1710), a scholar of **Bernhard S. Albinus**, who worked in Leiden, in his *Icones Musculorum Capitis* (Illustrations of the Muscles of the Head), depicted the oral cavity with the velopharyngeal musculature [35]. The images he produced have the same accuracy and abundance of anatomical detail typical of Albinus' school (Fig. 9.16).

Fig. 9.16 Dissection of the bony palate and palato-pharyngeal musculature. (From: Courcelles DC. *Icones musculorum capitis*. Leiden, Typographia Dammeana, 1743)

9.2.1.6 Jacques Fabien Gautier d'Agoty

In 1775, the French anatomist and engraver **Jacques Fabien Gautier d'Agoty** (ca. 1717–1786) (see Sect. 8.7.6.4 "Jacques Fabien Gautier d'Agoty" in Chap. 8) included an amazing mezzotint colored illustration of the posterior view of the palate musculature (Fig. 9.17), illustrating the anatomy of the vocal organs, tongue, larynx, palate, and pharynx in the book *Histoire Naturelle de la Parole, ou Précis de l'origine du Langage* (Natural History of Speech, or considerations on the origin of the Language) issued in 1776 by **Antoine Court de Gebelin** (1719–1784) [36].

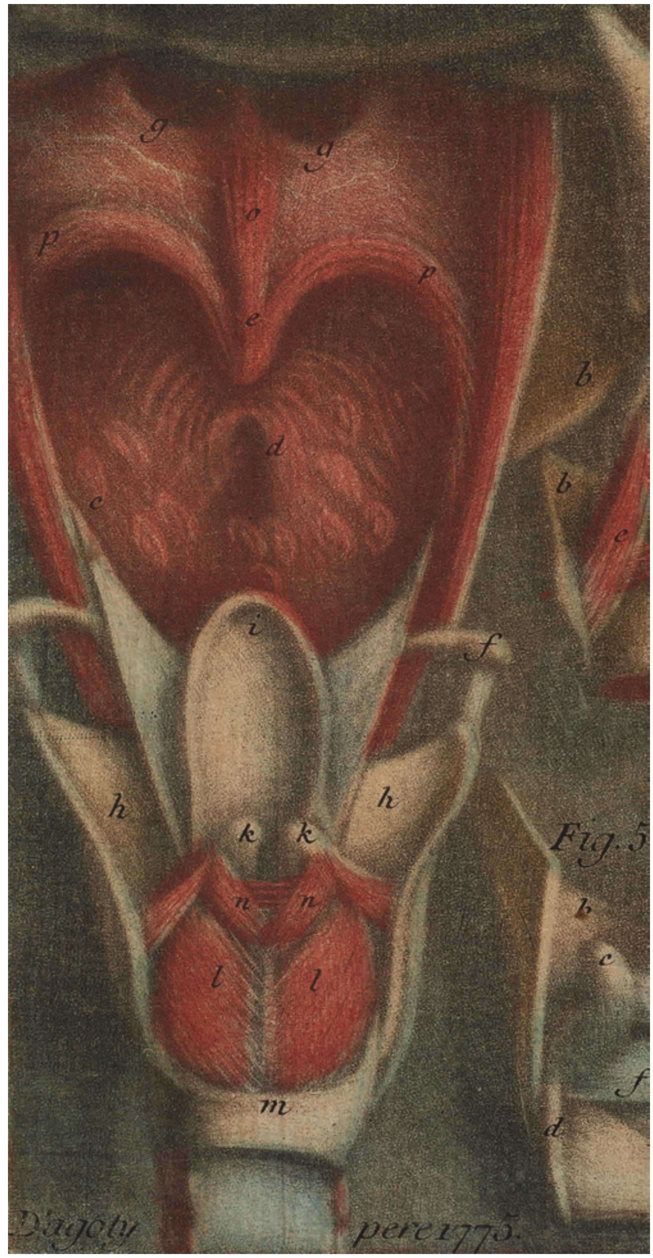


Fig. 9.17 Mezzotint colored illustration of the posterior view of the palate musculature, drawn by Jacques Fabien Gautier d'Agoty in 1775. (From: Court de Gebelin A. *Histoire naturelle de la parole*. Paris, chez l'Auteur, 1776)

9.2.1.7 Wolfgang von Kempelen

Understanding the closure of the nasal passage between the oro- and naso-pharynx during phonation was first reported in 1791 by the Hungarian **Wolfgang von Kempelen** (1734–1804) in *Le Mécanisme de la Parole* (The Mechanism of Speech), the first monograph on phonetics, which contains the anatomical description of the organs of the voice with their function, as well as the studies performed by the author on phonemes and sound production [37]. The illustrations showed how the palate elevates during phonation on front and profile view (Fig. 9.18).

A detailed description of the anatomy of the palate and of the mechanisms of palate movement during speech was reported by **Victor Veau** in his book *Division Palatine* (Cleft Palate) (1931) [38].

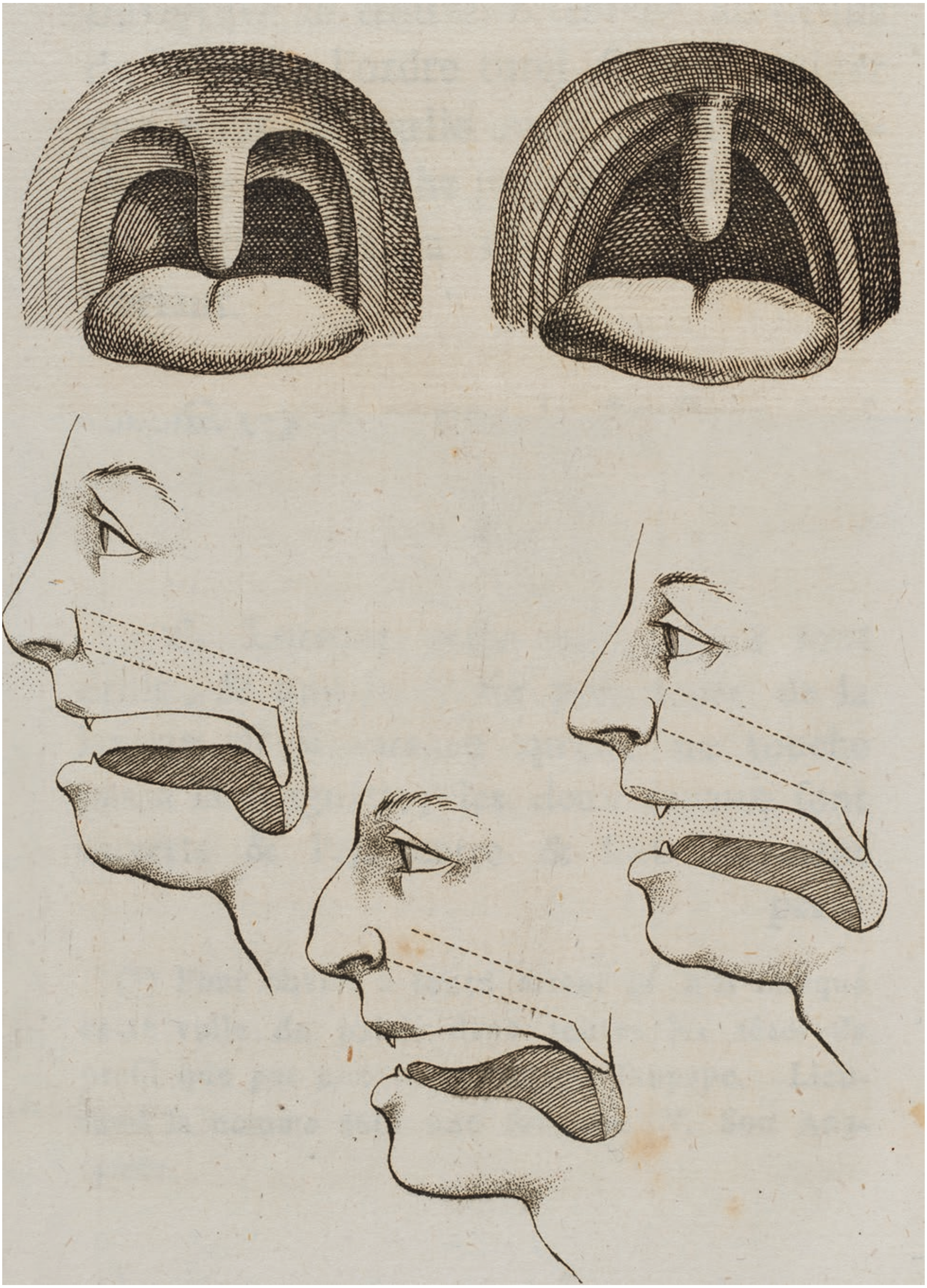


Fig. 9.18 Closure of the nasal passage during phonation. *Upper*: Soft palate at rest and elevating during phonation, front view; *lower*: soft palate at rest and elevating during phonation, profile view. (From: Kempelen W. von. Le mécanisme de la parole. Vienna, J.V. Degen, 1791)

9.2.2 Surgery

Cleft palate repair was not performed until the second decade of the nineteenth century as Rogers noted [39]. In our opinion, two obstacles prevented any sort of treatment of this area. The oral cavity is very prone to bleeding. Thus, surgeons feared that patients could swallow the blood, with the most likely risk that bronchi would be filled with blood. Moreover, it was difficult to bring light into the deep structures of the oral cavity and to have the proper armamentarium.

This probably explains the timidity of most surgeons in the past and why cleft palate surgery started so late.

9.2.2.1 Management of Cleft Palate Before the Sixteenth Century

Before that, very few reports on cleft palate management occurred in the literature.

Ambroise Paré

Ambroise Paré first described metal obturators to close palatal perforations in 1561 [9]. They were applied using forceps and held in position with a little sponge to fill in palatal defects and restore normal speech (Fig. 9.19a, b). There is no mention of their use for congenital causes, but for closing perforations resulting from gunshot traumas or syphilis.

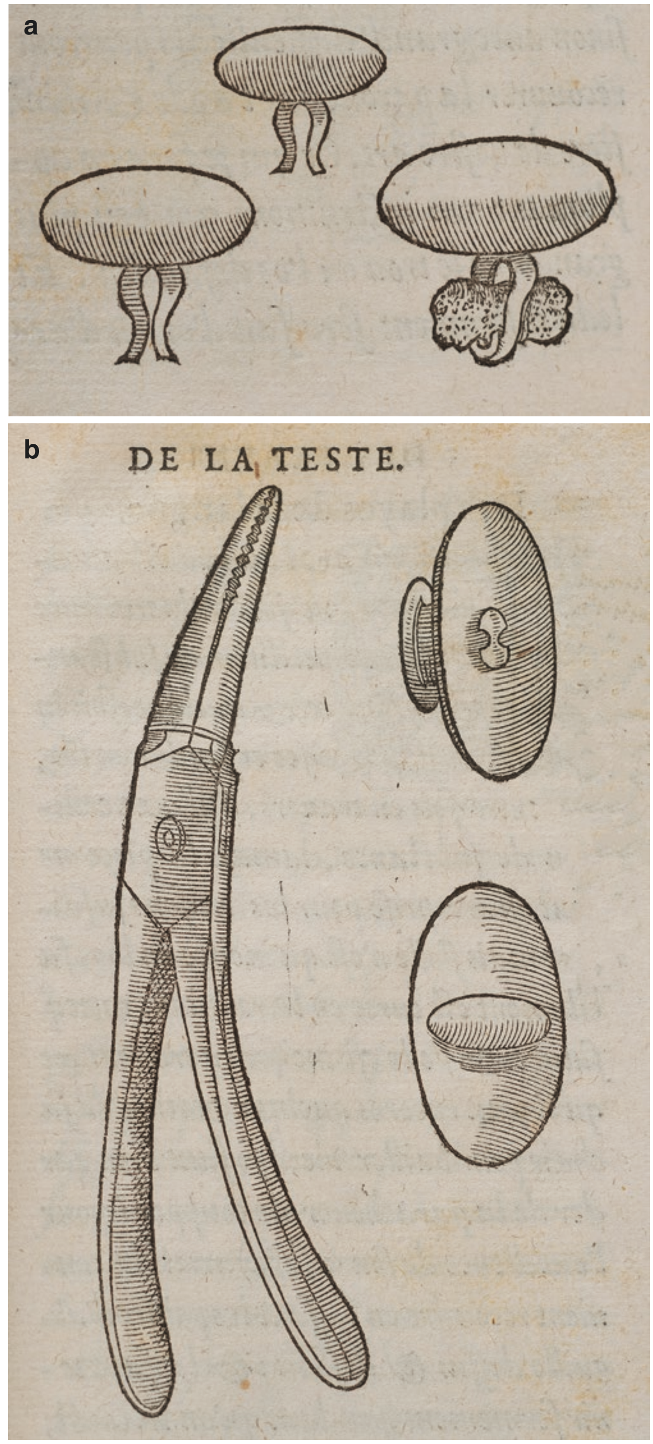


Fig. 9.19 First image of metal palatal obturators with sponge (**a**), and without sponge (**b**) to close palatal defect, and restore normal speech. Image of the instrument necessary to place them into position. (From: Paré A. *La méthode curative des playes & fractures de la teste humaine*. Paris, Iehan le Royer, 1561)

Hieronymus Fabricius ab Aquapendente

Hieronymus Fabricius ab Aquapendente, in Book Two, entitled *Operationes chirurgicae (Surgical Operations)*, of his *Opera Chirurgica in duas partes divisas (*Surgical Works divided in two parts*)*, first published in 1617, emphasized that newborns with cleft palate were unable to speak and suck and often died as a result [12]. In an attempt to avoid this dramatic situation, Fabricius advocated the use of a silver plaque, firmly attached to the palate, so as to close the defect (Chapter 35).

9.2.2.2 First Cleft Palate Closure in the Second Decade of the Nineteenth Century by Carl Ferdinand von Gräfe and Philibert Joseph Roux

In the second decade of the nineteenth century, the German **Carl Ferdinand von Gräfe** (1787–1840) and the Frenchman **Philibert Joseph Roux** (1780–1854) independently described the simple closure of a congenitally divided palate. Von Gräfe announced its successful approximation in a brief note published in 1817, in German, in a local scientific journal [40]. The operation, performed in 1816, and presented on December 27th before the *Medico-Surgical Society of Berlin,* consisted of the cauterization of the cleft's margins to freshen the borders and in their approximation with sutures. Perfect healing occurred, and the patient could swallow quite well and speak clearly post-operatively. However, a wound breakdown occurred later and the palate reopened.

Three years later, in 1820 [41], von Gräfe modified the procedure, creating new dedicated instruments and operated on more cases. He issued a detailed report on the technique, supplemented by pre- and post-operative images of a patient with cleft palate (Fig. 9.20). One year earlier, in 1819, Roux performed a similar operation and published an article on this topic, in which he claimed to be the first to have successfully closed a congenital cleft palate [42]. The operation was performed with the patient in sitting position. Roux passed three wax coated loops in the palatal mucosa using a curved needle, so that he could draw the margins towards the midline until the union seemed to be firm. The sutures were cut close to the knots. The post-operative course was uneventful, despite the fact that the two margins of the uvula remained divided. At the end of the operation, the voice became almost normal.

Interestingly, Roux's patient, John Stephenson (1797–1842), a medical student from Montreal (Canada), concerned about his nasal speech, described his own unique case in his graduation thesis that was discussed the following year in Edinburgh [43]. Stephenson became a leading surgeon in Montreal and was later appointed Professor of Anatomy.

Roux's paper was not well received, due to the envy of numerous colleagues who objected that von Gräfe was the inventor of the method, not Roux. Priority regarding the procedure became a matter of national honor, shared between France and Germany. Thirty-five years later, in his textbook *Quarante années de pratique chirurgicale* (Forty Years of Surgical Practice), issued in 1853 [44] (see Sect. 5.2.2.12), Roux reconsidered the question of the priority of the cleft palate operation and remarked that von Gräfe's case was indeed performed in 1816, that is, 3 years before his, but first of all it was unsuccessful and secondly it was published as a short note in a local German journal, with no circulation in France. He concluded that this is why his case deserves priority.

In 1825, Roux issued the first essay on this topic, *Mémoires sur la Staphyloraphie ou la suture du voile du palais* (Memoire on Staphyloraphy or Suture of the Velum) [45], in which besides offering a detailed description of the procedure, he added illustrations of the pre- and post-operative results of cleft palate suture, and he coined the term staphyloraphy to name the operation (Fig. 9.21).

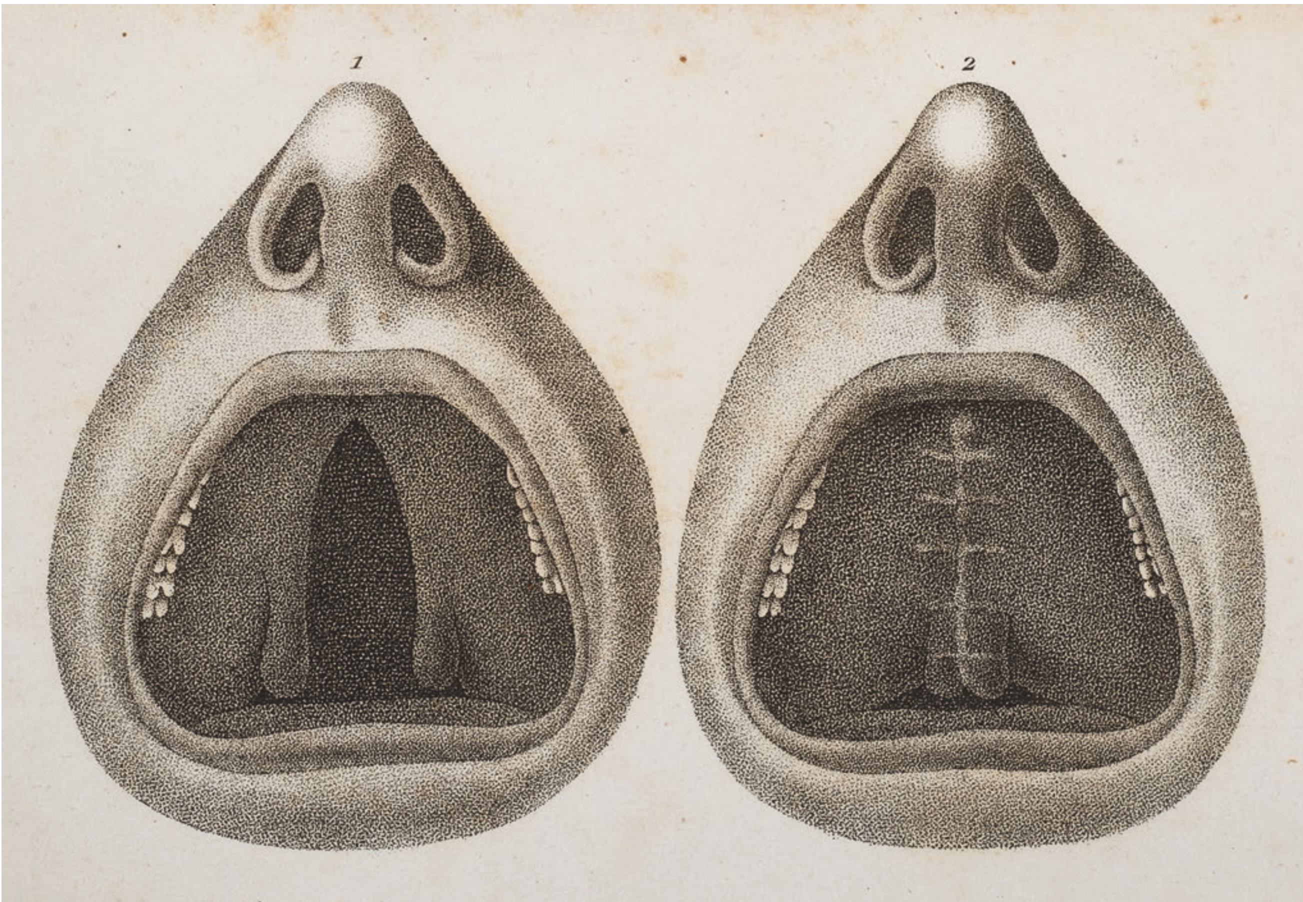


Fig. 9.20 Cleft palate suture according to Carl F. von Gräfe (1787–1840). First cleft palate closure in medical literature. (From: Gräfe CF von. *Die Gaumennath, ein neuenentdecktes Mittel gegen angeborene Fehler der Sprache*. J Chir Augenheilk. 1820; 1: 1–54)

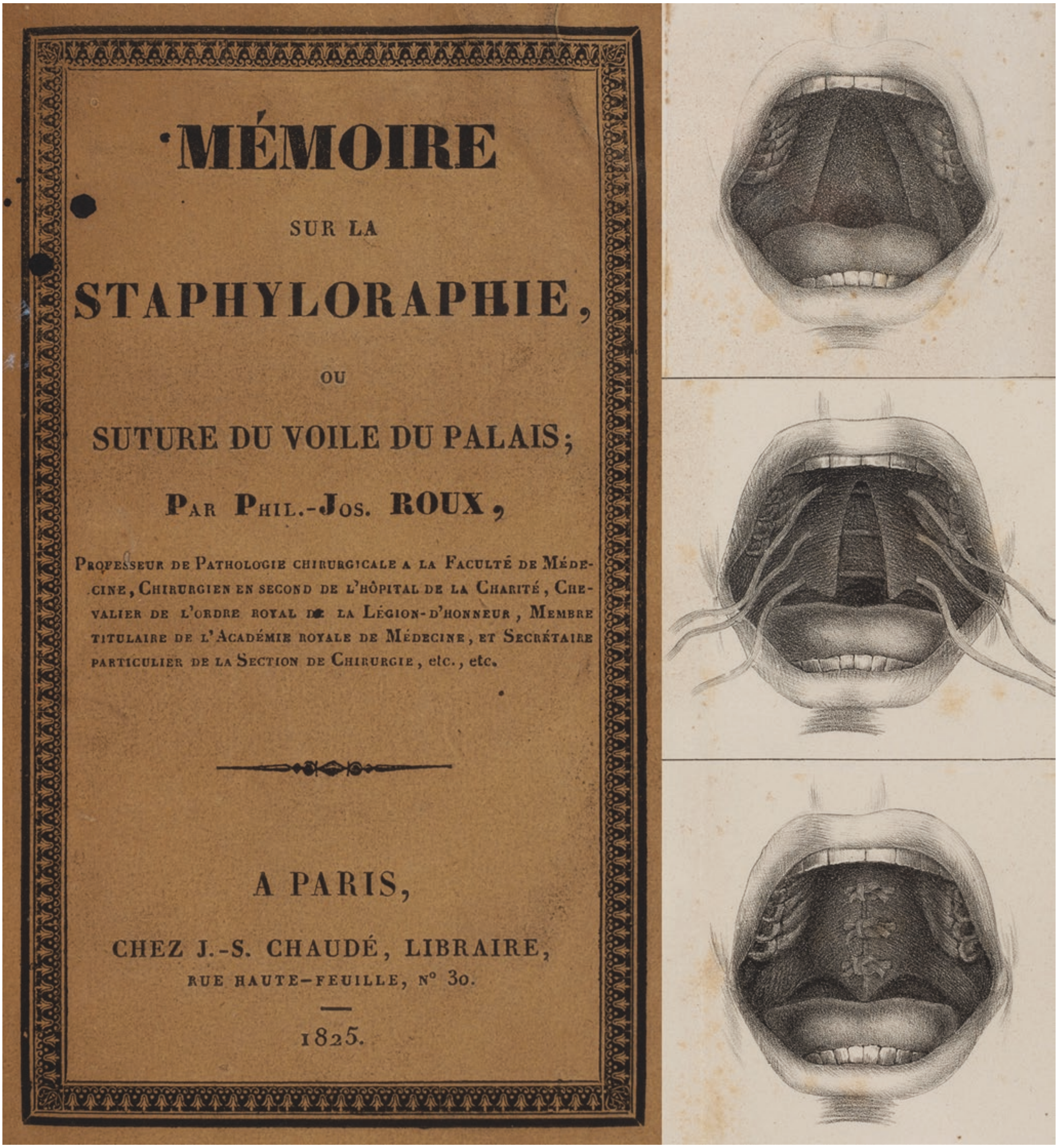


Fig. 9.21 Cleft palate suture, according to Philibert J. Roux (1780–1854). *Left*: illustration of the cover; *right:* pre- and post-operative view. From: Roux P.J. *Mémoires sur la staphyloraphie*. Paris, J.-S Chaudé, 1825

9.2.2.3 Cleft Palate Surgery Spreads Rapidly

One of the major concerns of cleft palate surgery was the high incidence of reopening, due to the tension that occurred when attempting to close the palatal defect and to the lateral traction induced by the opposing action of the palatal muscles.

Johannes Dieffenbach

To release tension and to facilitate approximation, in 1826, **Johann Friedrich Dieffenbach** (1794–1847) first reported the dissection of the mucosa, with lateral incisions of the anterior mucosa of the velum, as well as the transection of the fibers of the levator muscle on both sides [46]. According to him, tension immediately subsided.

Treatment of Cleft Palate in America and in England

On the wave of the successful outcomes by von Gräfe, Roux, and Dieffenbach, numerous surgeons in America and in England began to close cleft palates.

John P. Mettauer (1787–1875), regarded as one of the best surgeons in the USA, published an account, *On Staphyloraphy* in 1837 [47], probably the first in America, where he described using little, lateral mucosal incisions to relieve tension, based on Dieffenbach's report. He created his own dedicated instruments, achieving considerable success in cleft palate closure.

Another early palate surgeon in America was **Jonathan Mason Warren** (1811–1867) working at the Massachusetts General Hospital in Boston, the son of John Collins Warren (1778–1856). In 1846, he attended the famous *Ether Day*, the first public demonstration of the use of anesthesia in surgery (see Sect. 5.2.8.6). He was one of the first surgeons to perform a closure of the velum and of the bony palate, the so-called uranoplasty in 1843, following the teachings suggested by Dieffenbach with relaxing incisions. In 1848, he reported on twenty-four cases of palatal suturing with favorable outcomes in 90% of his cases [48]. He tried to close minor fistulas of the hard palate with a second operation. In major cases, he provided the patient with an obturator or a gold plaque.

In England, despite not adding much to the traditional operations, early palate surgeons were **William Fergusson** (1808–1877), a native of Scotland, who moved to London where he established an important surgical practice, treating numerous cases of cleft lip and palate [49], and **Robert Liston** (1794–1847), also from Scotland, a supporter of the relaxing incisions for cleft palate closure [50]. Even though he belonged to the later group of cleft palate surgeons, mention should be made of **Francis Mason** (1817–1886), of St. Thomas Hospital and Kings College Hospital in London, known for having published one of the first illustrated monographs on the subject in 1877 [51].

Bernhard von Langenbeck

The great breakthrough in cleft palate surgery came from the German **Bernhard von Langenbeck** (1810–1887). In his milestone paper, *Die Uranoplastik mittelst Ablösung des mucös-periostalen Gaumenüberzuges* (Uranoplasty by means of muco-periosteal covering undermining), published in 1861, he proposed the dissection of two muco-periosteum flaps and their approximation to the contralateral side, with lateral relaxing incisions carried out parallel to the alveolar ridge [52]. The muco-periosteum of the hard palate was undermined and elevated from the bone, using specially devised curved, blunt raspatories, still used today, crucial for releasing the muco-perichondrium. Dissection extended from the canine backward to the velum. The levator and palato-pharyngeus muscles were divided. The two bipedicled flaps, so outlined, were approximated along the midline and tightly sutured using silver wire. It was essential not to interfere with the vascularization of the muco-perichondrium, respecting the descending palatine artery. With this type of procedure, the complete cleft, soft and hard palate could be reconstructed in a single stage with more predictability (Fig. 9.22 *left*). Ice was used as anesthetic. For performing palatal operations, von Langenbeck devised his own surgical instruments (Fig. 9.22 *right*).

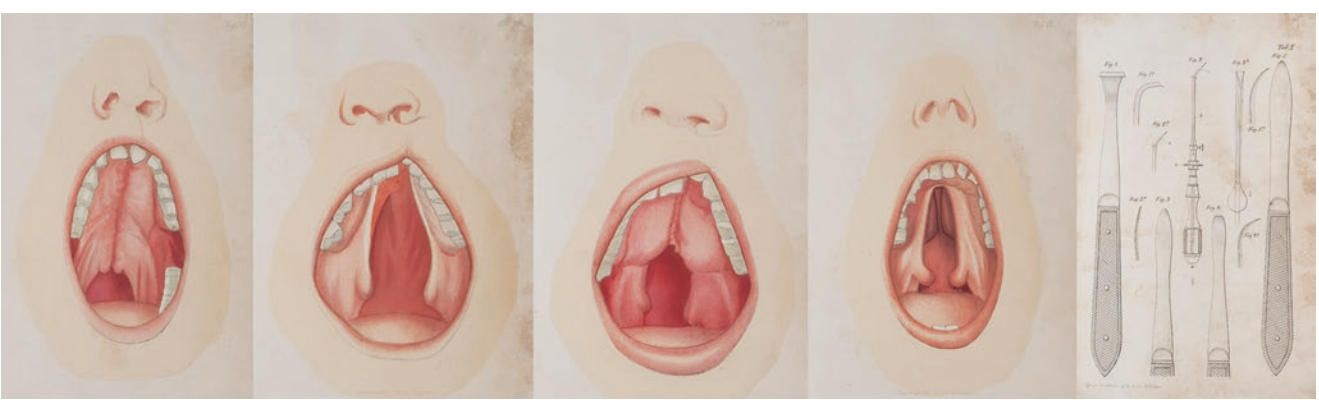


Fig. 9.22 Cleft palate suture with undermining of the muco-periosteum and lateral relaxing incisions, according to B. von Langenbeck. *Left*: Case 1. Midline scar and lateral incisions 16 days after surgery; *center left*: Case 2. Pre- and post-operative view of the patient 3 weeks after surgery; *center right*: Case 3. Before surgery. Successful healing with minimal residual fistula in the soft palate; *right*: The instruments necessary for the operation. The curved elevators are still used today. (From: Langenbeck B.R. *Die Uranoplastik*. *Arch klin Chir*. 1861; 2: 205–287)

Victor Veau

Victor Veau (1871–1949), in his classic monograph *Division Palatine* (Cleft Palate), insisted on the reconstruction of the palate by layers: the nasal and oral mucosa, and the levator muscle between them, to achieve a functional, mobile palate. He dissected the lateral pharyngeal spaces using the pterygomandibular raphe as access, to better mobilize the palatal flaps, reducing tension [38].

9.3 Velopharyngeal Insufficiency

The results of staphyloraphy (velar closure) and uranoplasty (hard palate closure) obtained by von Langenbeck did not fulfill expectations in terms of speech improvement. Sometimes a fistula persisted, or more often the velum remained too short (Fig. 9.22, *center left*; Fig. 9.18, *lower*) and didn't meet the posterior pharyngeal wall to close the passage of air through the nose. This condition, known as hypernasality or velopharyngeal insufficiency, was pointed out by numerous authors, among them **Christian A. Theodor Billroth** (1829–1894) (see Sect. 5.2.1.12), one of the leading surgeons of the second half of the nineteenth century, who greatly contributed to cleft palate surgery, taking care of the problems of nasal air escape, following palatoplasty [53], and the German **Gustave Passavant** (1813–1893).

Passavant observed that in short palate, when the patient articulates the sustained phoneme */a/,* the soft palate elevates without reaching the posterior pharyngeal wall. He noticed that at the level of the atlas, often the constrictor pharyngis superior muscle forms a ridge, later eponymously named Passavant's ridge, a sort of functional hypertrophy of the muscle, regarded as a natural attempt to reduce the existing passage [54].

9.3.1 Posterior Extension of the Soft Palate

As early as 1862, Passavant concentrated his efforts on developing new procedures to reduce nasal air escape, to improve speech, and to minimize hypernasality. First of all, he proposed the posterior extension of the soft palate, by suturing the palatopharyngeus (or pharyngopalatinus) muscle beyond the uvula.

Following his suggestions, the German **Gustav Simon** (1824–1876) [55] described *die Vereinigung der Arcus pharyngo-palatini zur Herstellung einer normalen Sprache* (the approximation of the pharyngopalatinus muscle for obtaining normal speech) and illustrated the technique with a self-explanatory plate (Fig. 9.23). The suturing of the pharyngopalatinus muscle beyond the uvula with the aim of reducing nasal air escape and improving speech was revived and published by the Italian plastic surgeon **Gustavo Sanvenero Rosselli** in 1934 [56].

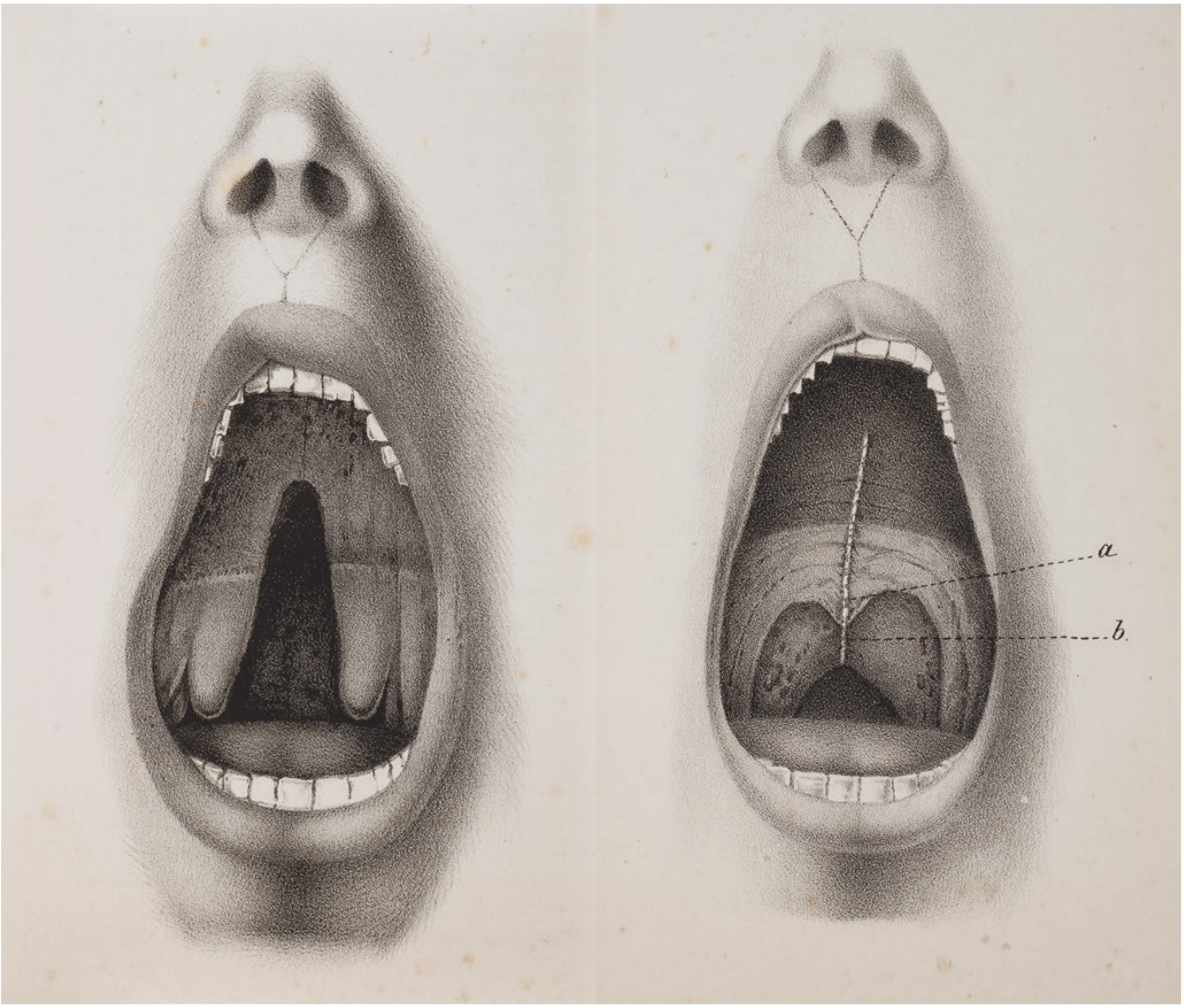


Fig. 9.23 Cleft palate suture with approximation of the palato-pharyngeus (or pharyngo-palatinus) muscle extending the palate suturing beyond the uvula, for speech improvement. *Left:* before; *right:* after surgery. (From: Simon G. *Über die Uranoplastik*. Danzig, Ziemssen, 1864)

9.3.2 Velopharyngeal Synechia: Push Back—Velopharyngoplasties

Velopharyngeal Synechia In this group of operations, one has to include the so-called *push-back* procedures, designed to lengthen the palate, maintaining its dynamics. In 1924, the American surgeon **George Dorrance** (1824–1949) performed a complete undermining of the entire palatal fibromucosa, which was moved backwards, to reduce nasal air escape [57]. Dorrance is particularly well known for having issued a comprehensive review on the history of cleft palate surgery [58].

The natural evolution of Passavant's second option was the outlining of a mucosal flap, 4–5 cm long and 2 cm wide, triangularly shaped, caudally based, harvested along the midline in the posterior pharyngeal wall, incorporated and sutured between the two halves of the soft palate (Fig. 9.24). This operation, very significant in terms of speech improvement, was perfected in 1875 by **Karl Wilhelm E. Joachim Schönborn** (1840–1906) a student of **Bernhard von Langenbeck** at Berlin University. He was appointed Professor of Surgery in 1871 at Königsberg [59]. Thus, Schönborn is best remembered for the first report of a velopharyngeal flap in medical literature, the so-called velopharyngoplasty, for correcting velopharyngeal insufficiency (or incompetence).

Velopharyngoplasties include two types of mio-mucosal flaps, both outlined on the posterior pharyngeal wall, one inferiorly based, first designed in 1924 by the German maxillo-facial surgeon **Wolfgang Rosenthal** (1882–1971) [60], and the other superiorly based, first designed in 1934 by the Italian plastic surgeon **Gustavo Sanvenero-Rosselli** (1897–1974) [56]. The latter, more viable and reliable, allows better fixation of the flap to the velum (Fig. 9.25).

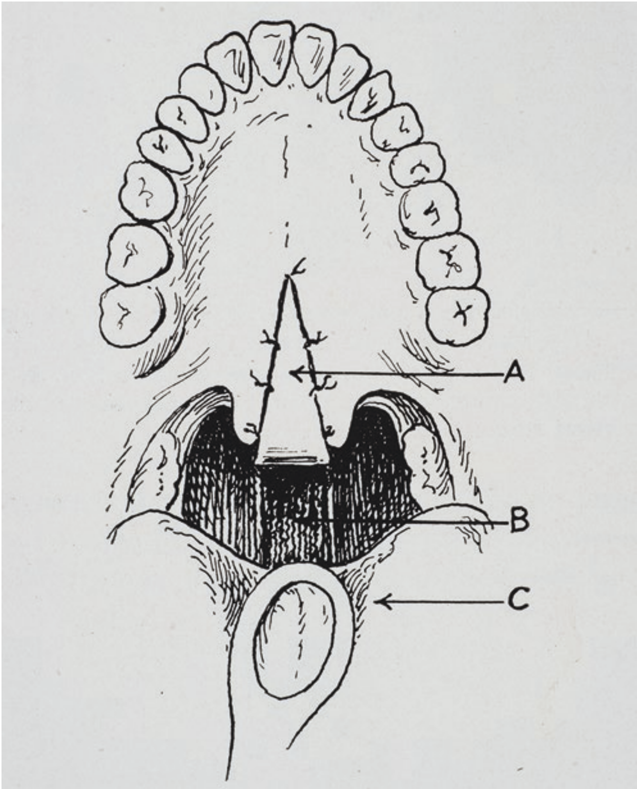


Fig. 9.24 The velopharyngoplasty devised by Karl Schönborn (1840–1906) for elongating the velum and improving speech was perfected in 1875. (From: Schönborn K. *Über eine neue Methode der Staphylorapie*. *Arch klin Chir*. 1875; 19: 527–531)

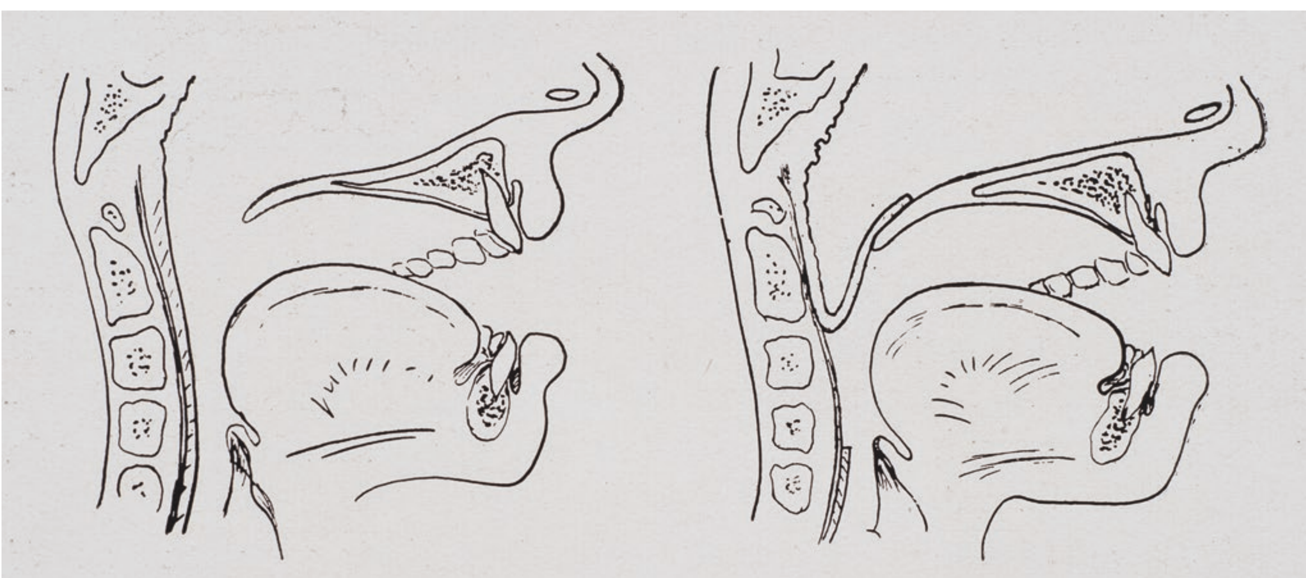


Fig. 9.25 The superiorly based velopharyngeal flap, devised by Gustavo Sanvenero-Rosselli (1897–1974), for improving speech. (From: Sanvenero Rosselli G. *La divisione congenita del labbro e del palato*. Roma, Luigi Pozzi, 1934)

9.3.3 Advancement of the Posterior Pharyngeal Wall

As a third choice, Passavant proposed bringing the posterior pharyngeal wall forward. In doing this, he folded a flap of pharyngeal mucosa on itself, creating a bulge capable of reducing the velopharyngeal space [61] (Fig. 9.26).

The idea of advancing the posterior pharyngeal wall to meet the velum to improve velopharyngeal insufficiency was attempted in 1900 by the Austrian **Robert Gersuny** (1844–1924) with paraffin injections [62], a procedure that later ceased because of the dramatic consequences (paraffinomas). Other materials were used instead, such as parcels of fat [63], and nowadays fat injection is a less invasive alternative to major surgery [64].

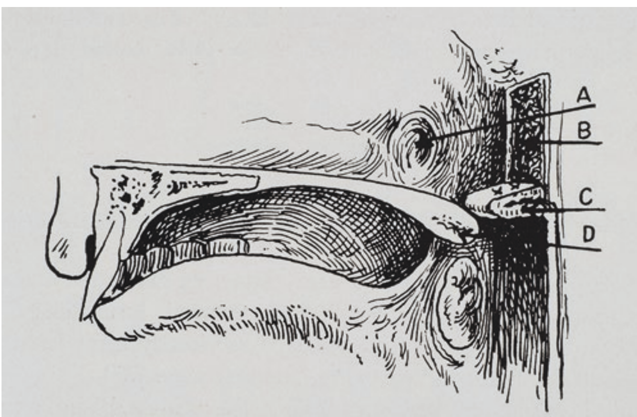
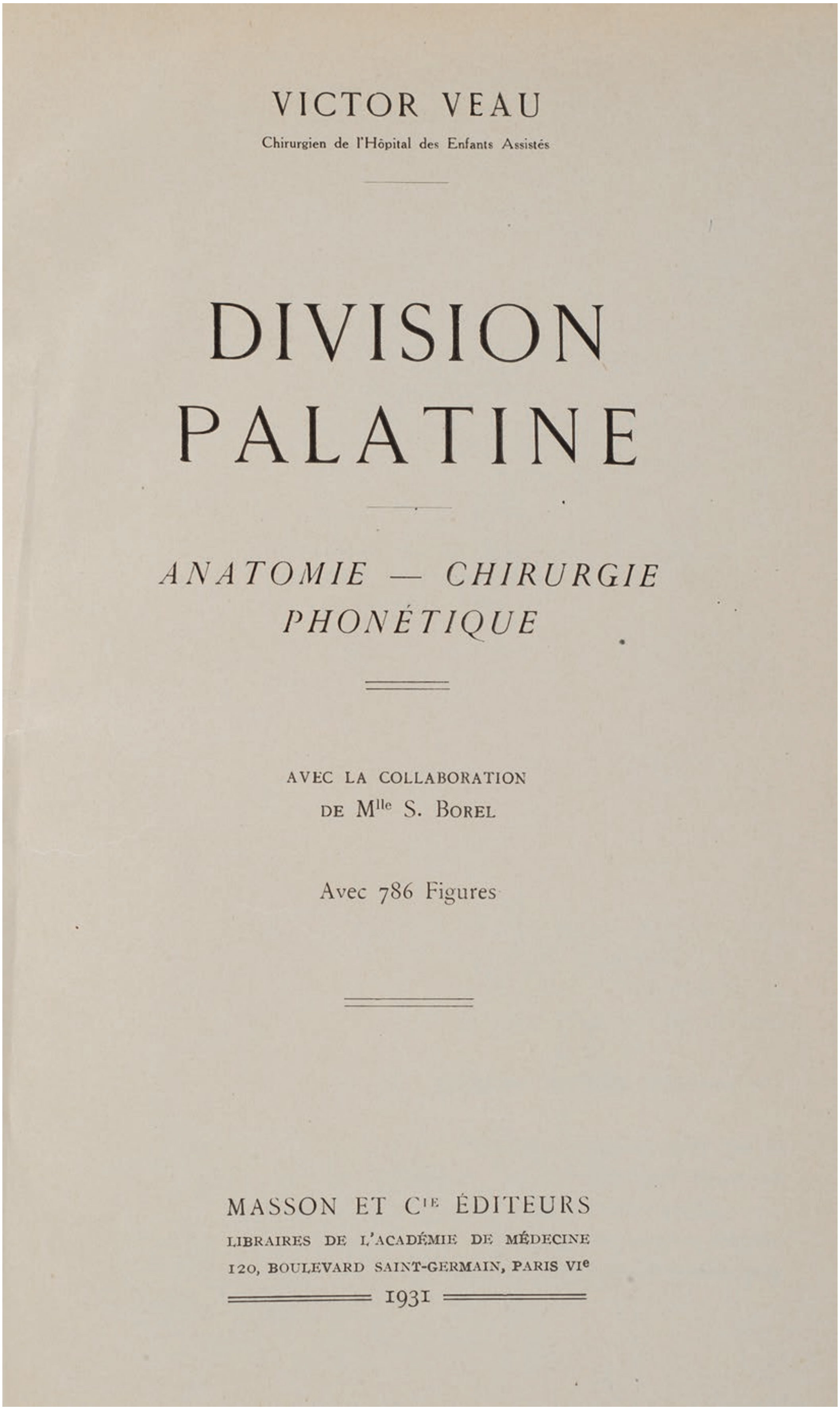


Fig. 9.26 Velopharyngoplasty according to Gustave Passavant (1813–1893) in 1879 with plication of a quadrilateral flap outlined on the posterior pharyngeal wall to reduce the space between oro- and naso-pharynx, so as to correct velo-pharyngeal insufficiency. (From: Passavant G. *Über die Verbesserung der Sprache nach der Uranoplastik. Arch klin Chir*. 1879; 23: 771–780)

9.4 Speech Rehabilitation: The Team Approach

The value of speech therapy represents the key point after cleft palate surgery to improve speech results. As early as 1880, the Swiss-Austrian surgeon, **Christian A. Theodor Billroth**, emphasized that to correct speech defects postoperatively, patients should learn how to properly use muscles devoted to speech [53]. In France, **Victor Veau** insisted on the importance of speech training. An entire section of his book *Division Palatine* (Cleft Palate) [38] (Fig. 9.27) is devoted to his cooperation with the speech therapist **Suzanne Borel-Maisonny** (1900–1995), one of the founders of the school of phonetics. In England, **Elisabeth Muriel Morley** (1899–1993) was speech therapist to **William M. Wardill** (1894–1960) in Newcastle-upon-Tyne, a skilled surgeon who greatly contributed to cleft palate treatment. She is well known for having published the first textbook on this topic, *Cleft Palate and Speech*, in 1945, which marks the importance of the close cooperation between the cleft surgeon and the speech pathologist to insure a correct follow-up and rehabilitation program. The book focuses attention on the necessary partnership among the surgeon, dental surgeon, and speech therapist for correct treatment of cleft palate: the foundation of the team approach [65].



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ANATOMIE — CHIRURGIE PHONÉTIQUE

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Fig. 9.27 Title page of the textbook by Victor Veau *Division palatine*. (From: Veau V. *Division Palatine. Anatomie. Chirurgie. Phonétique*. Paris, Masson & C., 1931)

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Conclusions

10

Although illustrated with masterpiece images that are found in numerous kinds of publications from all periods of civilization, this book is not intended as a mere history of plastic surgery. On the contrary, it traces the progress of reconstructive work developed by surgeons from ancient times until World War II. It shows the evolution of wound healing through the ages, the impact of anatomy on the advancement of surgery, and the understanding that the great majority of techniques reported in the past are still used today, although improved.

For primitive man, wounds represented a real problem. We can only speculate how wounds were managed in prehistoric times. Healing was most likely left entirely to nature; however, it is not possible to document it since no information about ancient wound treatment and closure is available to us.

Surgery is excisional by definition. It removes a swelling, a growth, or a malignancy. It restores skin defects by margin approximation after trauma or deals with fractures, dislocations, and sores. In the past, reconstructive procedures were seldom recorded. However, closure of tissue loss was reported in the Smith Papyrus (sixteenth to seventeenth century BC) and in the writing of Celsus (25 BC–AD 50) and Paulus of Aegina (AD 625–690).

Appreciation of reconstructive work came later, during the Renaissance, along with the rise of the concept of beauty, perceived not only by artists, but also by nobles as well as laymen who became less prone to accept a facial disfigurement. In fact, patients eager to minimize it underwent a reconstructive procedure.

Gaspare Tagliacozzi (1545–1597), a truly innovative surgeon, emphasized the definition of plastic surgery in *De curtorum chirurgia per Insitionem* and indicated its mission: *My procedure* (i.e., plastic surgery) *restores what nature has given and chance has taken away*. (Book One, Chapter 11) [1]. In other words, the surgeon should try to re-establish a condition as close to normal as possible. *The main purpose of this procedure,* he wrote, *is not the restoration of the original beauty of the face, but rather the rehabilitation of the part in question* (…). *I would not disagree, however, with the claim that this operation does, in fact, restore the beauty of the face*. Hence, the dual scope of a reconstructive operation: restoration of the beauty of the face and re-establishment of function.

We entitled our book *Plastic Surgery: Origins and Development—An Illustrated History*. The illustrations derive from old books, patiently assembled over many years to establish a historical library of plastic surgery. Consulting them provides a palpable contact with the past, and in the meantime allows us to discover what our forefathers did—and to identify the origin and the precedence of an idea, a technique, or a procedure.

Very often, scientific publications begin with "A new method for…" or "An innovative technique for…." But are these procedures and techniques really new, or is it perhaps a question of not having done the historical and bibliographical research? The French physician and philosopher **Émile Littré** (1801–1881), in his treatise *Oeuvres complètes d'Hippocrate* (Complete Works of Hippocrates), saw the issue clearly: *There is no development, even the most advanced of contemporary medicine, that is not found in embryo in the medicine of the past* [2].

We often realize that the so-called new techniques derive from ideas which have already been published, but forgotten. In other words, people rediscover the wheel. The history of reconstructive surgery is replete with striking examples.

In 1974, **Ralph Millard** described what he considered the innovative *flying seagull flap*, outlined on the forehead and transposed to the lower half of the nose to repair a defect [3]. However, Millard's flap reproduces almost exactly the *fleur de lys* design, published 136 years earlier by **Pierre Léon Auguste Labat** (1803–1847) in 1838 [4] (Fig. 5.32).

Full-thickness tissue loss of the lower eyelid is best repaired using cheek rotation, a technique described by **Jack C. Mustardé** (1916–2010) and now eponymously named the Mustardé flap [5]. However, the same flap was published

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by the Dutchman **Johannes F. Esser** (1877–1946), 50 years earlier, in 1918, in a book entitled *Die Rotation der Wange* (Cheek Rotation) [6] (Fig. 6.20) where the author showed the numerous applications of this method for facial reconstruction.

One of the basic principles of modern cheiloplasty is the use of lip tissue to repair a defect by transposing two full-thickness flaps from the alar base downward to the mentolabial groove, thus re-establishing the continuity of the oral sphincter. The technique, first described and illustrated by **Victor von Bruns** (1812–1883) in 1857 [7] (Fig. 5.24), was re-introduced by **Miodrag Karapandzic** in 1974, almost 120 years later, and is now eponymously named the Karapandzic technique [8].

In 1932, to correct moderate breast hypertrophy and ptosis, the Austrian surgeon **Ernst Eitner** (1867–1955) advocated a circular incision around the areola, followed by gland undermining, wedge excision of the upper pole, and reconstruction of the mammary cone to elevate the Nipple-Areola Complex (NAC) (Fig. 7.32). The technique has numerous advantages. Only a single scar around the areola is created, without the need of a vertical or submammary incision. Moreover, the vascularization to the nipple is not jeopardized [9]. In 1990, almost 60 years later, the French surgeon **Louis Benelli** described a similar operation [10]. To avoid nipple enlargement, he suggested a continuous cerclage of the areola using a non-resorbable suture, passed as a purse string in the dermis. He named this method the *round-block*.

The Parisian maxillofacial surgeon **Maurice Virenque** (1888–1946) reported the plication of the deep aponeurotic layers of the face, the use of suspension loops to maintain a stable result, and the reposition of sagging tissues with a vertical vector (Fig. 7.56, *upper left*, *upper right*, *lower left*, *lower right*). In his technique, the incision started in the temporal region, in front of the hairline, continued in front of the auricle, reaching the earlobe, where it ended. Two loops of chromic catgut, acting as purse-string sutures, were placed on the fascia superficialis, which was plicated, moved cranially with a vertical vector, and anchored to a fixed point, usually the parotid aponeurosis, to avoid the downward displacement of the deep facial layers. The knot was tied under tension. A third loop was placed laterally to the orbital pillar, anchored to the parotid aponeurosis, with a knot under tension.

Virenque's publication, *Traitement Chirurgical des Rides de la Face et du Cou* (Surgical Management of the Wrinkles of the Face and Neck), issued in 1927, has great importance in the history of facelifting [11]. Regrettably, it is seldom acknowledged and quoted.

Seventy years later, in 1999, **Patrick Tonnard** and **Alexis Verpaele** in Belgium rediscovered, improved, and popularized Virenque's technique. They named it the MACS lift [12].

These are just a are few examples, selected from among the numerous cases available in the literature.

The lessons drawn from history reveal that so-called new techniques and new flaps are very often variations of what has already been published. We must be humble and recognize that nothing is new under the sun [13].

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