
BIMILLENNIAL HISTORICAL REVIEW

Part II. Europe and surgery from AD 1500 to 1800; the modern world is shaped

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'The farther backward you can look, the farther forward you can see.'

WINSTON CHURCHILL

Introduction

The second article in this series considers the emergence of scientific medicine in Europe over the 300 years from 1500 to 1800. This remarkable period saw particular acceleration in European scientific knowledge. It encompassed the Renaissance, the publication of Vesalius' text *De humani corporis fabrica* and Copernicus' text *De revolutionibus orbium coelestium* (both in 1543), the Copernican astronomical revolution of the 16th century, the Scientific Revolution of the 17th century, and the Age of Enlightenment of the 18th century. The period saw the rise and maturation of the nation state in Europe, and the gradual realignment of religious influence in the secular state. Much of the world-wide spread in modern scientific thinking, to the Americas, to Asia and Australasia, followed the great European explorations and the consequent trade and colonization.¹

The cultural and intellectual climate

The modern Western freedoms to challenge accepted scientific or religious orthodoxies were not ever thus and the habits of experimental practice and scientific reasoning were not pre-ordained. Certain regions and nations have historically shown a greater capacity for scientific advancement than others. Those societies which tolerate diversity and promote creativity and originality tend to prosper economically and intellectually. The emergence of scientific thought has in particular been a struggle between religious orthodoxies and scientific reasoning, although paradoxically many of the great scientists were driven by a faith in the rational creativity of a monotheistic intellect, lately epitomized in Einstein's belief that 'God does not play dice'. Galileo (1564–1642), with his invention of the telescope (1609), and Nicolas Copernicus (1473–1543)

profoundly challenged conventional thinking with their recognition that the planets orbited the sun. The torments which afflicted Galileo and Copernicus continued as late as the 19th century to challenge Darwin, and can still be found today in some cultures and sects. We have nevertheless seen the retreat of alchemy and superstition in medicine and science in the past 500 years.

Communications, travel, exploration and art

Original ideas and practices require dissemination. Better roads improved land communications. Better ships and the science of navigation allowed men to travel and to communicate more effectively across water between states and continents. The great explorers of the age, such as Columbus, Magellan and da Gama, opened up the New World and expanded man's global intellectual horizons. Ideas also require a medium for record and communication. The arrival of the printing press in the 1450s transformed the written word, while Renaissance art and artists transformed the power of the visual image. Great artists flourished such as Albrecht Dürer (1471–1528), who painted medical and anatomical subjects, and influenced the works of Rembrandt, Raphael, Titian, El Greco and Cranach.

Institutions

Scientific and medical universities, academies and postgraduate institutions were the key to progress throughout Europe and flourished over the next 300 years. These academies were often no more than loose affiliations between like-minded independent scientists, private and official societies, predating the more formally consolidated organizations of modern times, with their greater capital investment in resources and equipment. The dissecting room



Fig. 1. Frontispiece of J. Guillemeau's *The Frenche Chirurgerye*, Dordrecht, I Canin, 1597. Reproduced with kind permission of the Wellcome Institute Library, London.

became a feature of many Universities, giving intimate knowledge of human anatomy to a wide professional audience. Italian art and science was pre-eminent, with famous medical schools at Padua, Bologna and Ferrara.

The growth of towns and cities, the emergence of the artisan classes and the creation of wealth all contributed to the development of scientific institutions. Many medical academies opened in 15th century Renaissance Italy, including the Academy of Experiments (*Accademia del Cimento*). The focus of advancement gradually shifted to northern Europe. The *Academie Royale des Sciences* in Paris and the *Royal Society of London* date to the mid-17th century, for example. The early 18th century saw a

flourishing of institutions throughout Europe, including Sweden, Prussia and Russia.

Many of the great hospitals were founded in this period. Cantor records that a cancer hospital was established in Rheims in the mid-1700s but later closed because of fears of contagion. The *Middlesex hospitals* in London opened the first specialist cancer wards in 1792.

Chemistry and physics from 1500–1800

Chemistry, the basis of much of our understanding of medical science, only emerged as a separate science late in



Fig. 2. An allegorical sketch of the well equipped surgeon, from a French engraving by N. de Larmessin, 1695. Reproduced with kind permission of the Wellcome Institute Library, London.

the 16th century. Robert Boyle elucidated the properties of air of the 1650s, and defined the chemical element in the *Sceptical Chemist* (1661). Joseph Priestley discovered oxygen as late as 1772, and Antoine Lavoisier described the chemical composition of water in 1784. This was the basis for the understanding of respiration, fermentation and photosynthesis late in the 18th century.

In physics, Robert Black (1728–1799) laid the foundations of thermodynamics, Newton published the *Principia Mathematica*, describing the laws of motion, in 1687. The atomic theory (John Dalton) and the discovery of current electricity (Alessandro Volta) did not emerge until 1800.

Biology and medicine 1500–1800

Leonardi da Vinci prosected 30 corpses to produce his great anatomical drawings, and pioneered wax injection of vessels

and cerebral ventricles. His anatomical achievements were the greater for being undertaken in the face of a Papal decree forbidding dissection, and were thus undertaken in conditions of great secrecy. Paracelsus (1493–1541) overturned the Aristotelean view that disease resulted from imbalance of the four humours with the concept that specific diseases have specific causes. He also sought to isolate specific remedies from the Galenic practice of compounding medicines.

Vesalius (Padua, 1514–1564) was a surgeon and anatomist who had a major influence on the craft. He taught that the trained anatomist must himself perform dissection, and his book *De Humani Corporis* in 1543 was a milestone in anatomical teaching. He was succeeded as professor at Padua by Fallopius (1523–1562) and his important textbook *Observations in Anatomy* (1561). Ambrose Pare (1510–1590), apprenticed to a barber surgeon at the age of 13 at the Hotel de Dieu in Paris, later wrote his treatise on gunshot

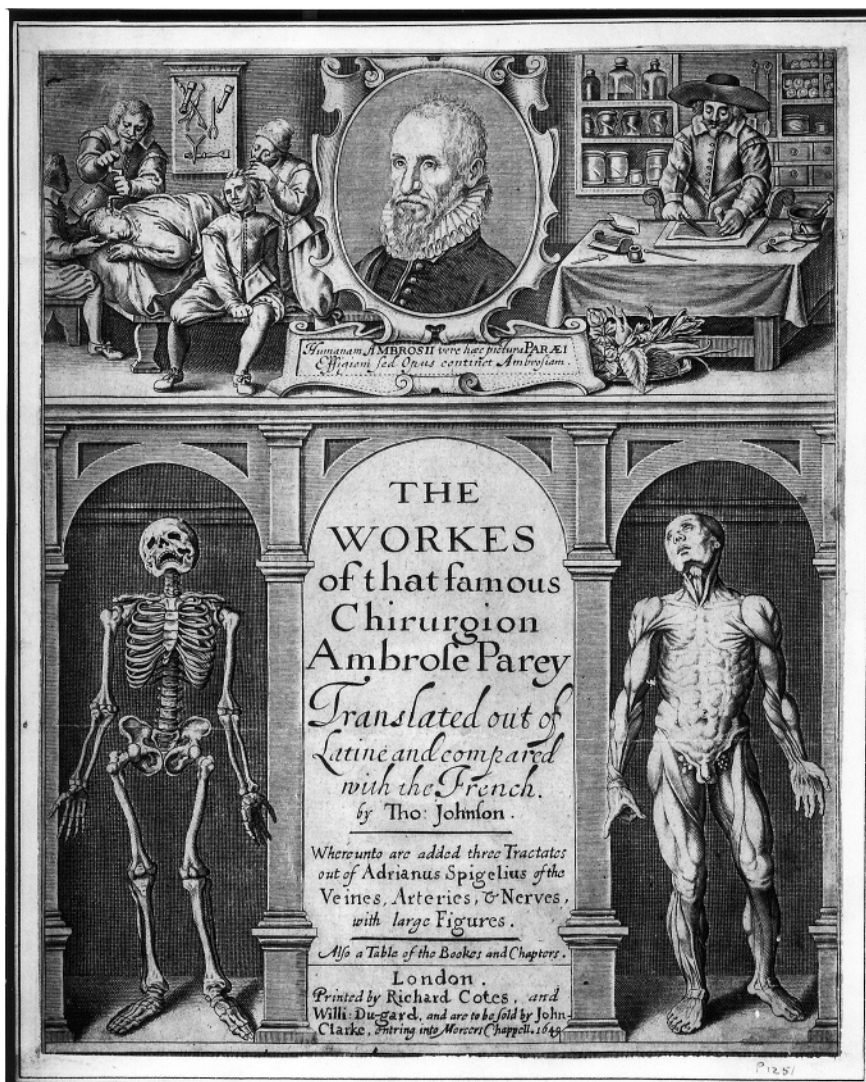


Fig. 3. Frontispiece of a translation of the *Works of Ambrose Pare*, published in London in 1649, including an illustration of trepanation, and a portrait of Pare himself. Reproduced with kind permission of the Wellcome Institute Library, London.

wounds. Fractorius (1478–1553) recognized that infectious disease was transmissible, by direct contact or indirectly at a distance. His book *De Contagionibus* (Venice, 1543), laid the basis of Germ Theory. However, the cities continued to be afflicted by the consequences of poor public health and sanitation, such that infective diseases remained a major problem. For example, bubonic plague killed 70,000 people in London as late as 1665.

In the early 17th century, British clinicians were pre-eminent. William Harvey (1578–1657) published *De Moto Cordis* in 1628 and revolutionized the understanding of the circulation. He hypothesized the existence of capillaries, subsequently visualized by Malpighi. Experiments in blood transfusion were recorded by Richard Lower (1631–1691). Percival Pott (1714–1788) and William Cheselden (1688–1752) were other notable British surgeons of the age. Elsewhere in Europe, many great observational clinicians

were in practice, including Morgagni (1682–1771) in Italy and Boerhaave (1668–1738) in Holland.

The optical lens was described by Pliny in AD 77 and by a number of later authors, including Roger Bacon in the 12th century. However, the microscope was not invented until the 17th century. Antoni van Leeuwenhoek, Robert Hooke and Marcello Malpighi were among the few serious exponents of the microscope as late as 1700. Leeuwenhoek's work also illustrates the growing importance of the scientific society as a forum for communication and advancement. Although he never published a paper, his researches became widely known through his numerous letters to the Royal Society of London, of which he became a Fellow.

By 1800, the development of scientific method, and the use of experiment driven by methodical theory and hypothesis, were in the ascendant. Carl Linnaeus (1707–1778) in Sweden laid the basis of classifications of

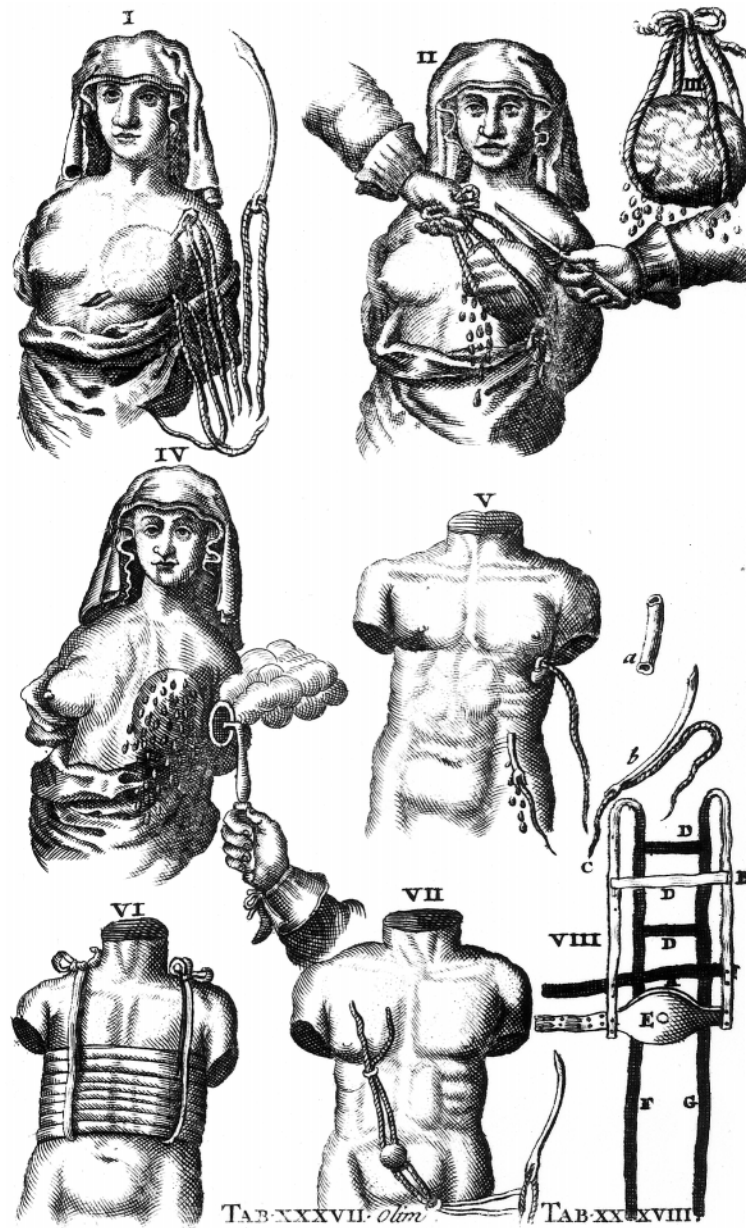


Fig. 4. Operative instruments and techniques for mastectomy with cautery: in a text by Johannes Scultetus, *Armenntarium Chirurgicum* (Amsterdam: Jansson Waesberg), 1741.

animal and plant species. William Hunter (1718–1783), whose seminal work was the study of the gravid uterus, and his young brother, the surgeon, anatomist and pathologist John Hunter (1728–1793), made important contributions to the systematic collection, study and recording of surgical, pathological and veterinary specimens.

A host of other clinicians were at work in the later part of the 18th century whose work was to lay the foundations of advancement in the early part of the next century. They included James Parkinson, the neurologist; de Larrey, the French military surgeon who introduced the wheeled ambulance; Sir Astley Cooper; Ephraim McDowell, who reported the first successful laparotomy and oophorectomy

in the USA; Abraham Colles, John Cheyne, Baron Dupytren, Rene Laennec, Thomas Addison, Thomas Hodgkin and Robert Graves. Naval surgeon James Lind resolved the scourge of scurvy at sea by introducing limes as a source of vitamin C. Edward Jenner (1749–1823) introduced vaccination for smallpox. The concept of the clinical thermometer was introduced by George Martine in 1740.

Cancer

Little is recorded of cancer even through the 18th century. The cellular composition of tissues was recognized by the

early microscopists, but this did not translate into an understanding of the distinctive biology of malignancy. Gaspare Aselli (1581–1625) discovered the lymphatic system, but even a century later, John Hunter believed cancer to be an extreme form of inflammation. LeDran (1685–1770) recognized the spread of breast cancer to the regional nodes. Percival Potts (1714–1788) recognized the aetiology of scrotal cancer in chimney sweeps. John Hill reported an association between tobacco and cancer in 1761.

Surgical practice 1500–1800

This period is noteworthy for the efforts of the surgical profession to establish itself throughout Europe, and to develop recognition equal to the more highly regarded physicians. The practice of barber-surgery continued to the end of the 17th century, until which time there appears to have been considerable conflict between these guilds and the emerging professional and academic surgical class affiliated to the major medical institutions. It is reported that surgeons were still obliged to cut the officers' hair in Frederick the Great's army at the end of the 18th century!

Many famous European medical schools were established in the early 1700s, for example the Charite in Berlin (1710) and Guy's in London (1723). In the USA, surgery began to emerge around 1750, many of the early proponents receiving a European education.

Conclusions

The surge in knowledge was yet to be widely reflected in better medical practice by the end of the 18th century.

Primitive practices such as bloodletting were still pre-eminent, standards of hygiene were dreadful, and hospitals were not widely established. Life expectancy remained below 50 years.

The changes in the intellectual firmament between 1500 and 1800 laid the basis for the exhilarating acceleration of knowledge and technology in the 19th and 20th centuries AD. By 1800, the foundations of modern medical practice and the social, cultural and economic framework of the modern industrial world were established. In the third article of this series, I will consider the impact of the 19th century on modern clinical practice.

Acknowledgements

I thank the curator of the Wellcome Centre Medical Photographic Library, London, for permission to reproduce the illustrations to the text.

Further reading

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2. Rutkow IM. *Surgery: an Illustrated History*. St Louis, MO: Mosby, 1993.
3. Cantor D. Cancer. In Bynum WF, Porter R (eds.) *Companion Encyclopaedia of the History of Medicine*, Vol 1. Oxford: Oxford University Press, 1993: 537–61.

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