The history of surgery is marked by a series of revolutionary advances usually made by a single pioneer and his or her disciples. Such advances have occurred with ever-increasing frequency over the last century.

The first surgeons were those men and women, now lost in time, who became experts at binding up the wounds, splinting the fractures and lancing the abscesses of their fellows, as well as dealing with a surprising number of other ills. We can visualize their activities in the reports of explorers and medical missionaries of the nineteenth and early twentieth centuries from such diverse and isolated places as the Atlas Mountains of North Africa, the jungles of Central Africa and the forests of Borneo. Trephination of the skull, management of arrow and other wounds, drainage of abscesses and numerous other procedures were witnessed being performed by surgeons who had never previously encountered outside visitors. Most remarkable, in 1844, Robert Felkin MD recorded and drew a ‘classical’ caesarean section performed in what is now Uganda, the patient first being intoxicated with banana wine. When Felkin left, 11 days later, both mother and child were well.

The early surgeons were pragmatic. Wounds involving brain, thoracic or abdominal viscera or the major arteries were known to be lethal and, by and large, were left untreated. Fractured limbs were straightened and splinted, and kept immobilized till clinical union was achieved. The appearance of pus in a wound, called ‘laudable pus’, was regarded as a good prognostic sign, in contrast to spreading gangrene, which usually presaged death. Remarkably, a drawing of circumcisions being performed has been recovered from Memphis, in ancient Egypt, dated as between 3000 and 2400 BCE. The operation was practised widely in the ancient world, as a ritual rather than for any surgical reason.

‘Cutting for the stone’, perineal lithotomy for vesical calculi, was performed by ancient Hindu, Greek, Roman and Arab surgeons. Many of their patients were children, but why this was a common disease in children still remains a mystery.

The pathology of war wounds underwent a radical change with the introduction of gunpowder and firearms in Europe in the fourteenth century. Gunpowder was first used at the battle of Crécy in 1346, when Philip VI of France was defeated by Edward III. The gross tissue destruction produced by musket and cannon shot provided the anaerobic conditions for tetanus and gas gangrene, which now became all too common. It was assumed that the cause was the gunpowder. The remedy? Destroy this poison in the wound with cautery or with boiling oil; the latter was the more popular since it was recommended in the standard textbook of the Italian surgeon Giovanni da Vigo (1450–1525), which went through 40 editions in many languages. Of course, the ‘treatment’ actually made matters worse.

One of the really great figures in surgery was Ambroise Paré (1510–1590), a French military surgeon who trained at the Hôtel-Dieu in Paris. At his first experience of war, in the campaign at Turin in 1537, Paré ran out of boiling oil with which to treat a barn full of severely wounded men and used simple dressings for the remainder of his patients, in what must be regarded as the first randomized controlled trial in history! He relates how, next morning, he found his ‘treated’ group were in agony, while his ‘controls’ were resting comfortably. He wrote, ‘then I resolved never again to so cruelly burn the poor wounded men’.

Further generations of surgeons, in Europe and later in the USA, pushed forward our knowledge of anatomy and surgical pathology, and attempted increasingly complex surgery, such as ligation of the major arteries, lithotomy for vesical calculi, and ever more extensive surgery for cancers of the breast and the other superficial and accessible structures. They were dreadfully impeded in their labours by the twin problems of wound infection and the agenies of the knife. These barriers were to be significantly resolved over a surprisingly short number of years between 1846 and 1867.

From the earliest times, surgeons had attempted to assuage the pain of injury and surgery. Large doses of opium or alcohol, or a combination of the two (laudanum), were often employed but with little success. The major advance was the use of the inhalation of ether, introduced by a Boston dentist, William Morton (1819–1868), first for dental extractions, and then, on 16 October 1845, for the removal of a small benign lump in the neck, performed by the senior surgeon at the Massachusetts General Hospital, John Warren (1778–1856). Three weeks later, Warren performed an above-knee amputation for tuberculosis of the knee on a 21-year-old servant girl, safely with a painless under ether anaesthesia given by Morton. The news that major surgery could be performed without pain spread as fast as news could travel – around the USA by coach and around the world by sail. Within days of the news reaching each major centre, surgeons purchased ether and constructed a copy of Morton’s simple apparatus. For example, James Robinson, a London dentist, gave ether for a dental extraction on 19 December 1845. Two days later, Robert Liston (1794–1847) carried out a completely successful above-knee amputation on a Butler with chronic osteomyelitis of the tibia at University College Hospital, London.

James Young Simpson (1811–1870), Professor of Obstetrics in Edinburgh, used ether successfully in his obstetrics practice in January 1847. However, ether had the disadvantages of a slow induction and the tendency to produce vomiting. After experimenting with a range of volatile organic fluids, Simpson hit upon chloroform, with its advantages of a pleasant smell and easy induction, and by November 1847 he was able to publish his satisfactory results. Chloroform was successfully administered by John Snow to no less a patient than Queen Victoria during the birth of her eighth child in 1851, the Queen declaring herself delighted with the result. One great barrier to surgical advance, pain, had been overcome. The specialty of anaesthesia was born, and immediately adopted by the profession.

In marked contrast, the acceptance of antisepsis was a much slower process. Most surgeons seemed to accept suppuration and pus formation as the ‘normal’ process of wound healing. The proof that microorganisms are the cause of wound infection began to be provided by the work of the chemist Louis Pasteur (1822–1895), working at the Sorbonne in Paris. His brilliant, yet simple, experiments demonstrated that the putrefaction of milk, broth and so on was produced not by exposure to air, as previously thought, but by microorganisms present in the air, which he demonstrated under the microscope.

The value of cross-fertilization of ideas in academia is exemplified by the fact that it was the Professor of Chemistry at the University of Glasgow, Thomas Anderson, who drew the attention of the young Professor of Surgery at the university, Joseph Lister (1827–1912), to Pasteur’s work, published in French journals of chemistry. Lister was intensely interested in the problems of wound healing and infection, and immediately realized that it was exposure not to the air but to the microorganisms in the air that resulted in wound sepsis. How to kill the organisms? Applying Pasteur’s technique of boiling was obviously impossible. Lister decided to use crude carbolic acid, having heard that this agent had proved effective in cleaning the stinking drains of the city of Carlisle, the smell of which resembled his surgical wards in the Glasgow Royal Infirmary!

Lister’s crucial experiment took place on 12 August 1867, not in the operating theatre but in a side ward. The patient was an 11-year-old boy who had been run over by a wagon and who had sustained a compound fracture of the tibia. The wound was treated with crude carbolic acid and dressed with gauze soaked in this agent; the fracture was immobilized in a splint. After 4 days, the dressing was changed: there was none of the usual stench of hospital infection nor its other familiar features. Six weeks after the accident, the young patient walked out of the hospital. Over the next 2 years, Lister treated 11 patients with major compound limb fractures. There was one case of hospital gangrene in a tibial fracture, requiring amputation, and one death. This was a man with a major compound femoral shaft fracture. All was progressing well until the patient had a major secondary haemorrhage after 7 weeks: the femoral artery was tied but the patient died. Reading this report, it seems likely that if blood transfusion had been available at that time, recovery might well have taken place. The other...
nine patients all recovered, free from infections. This was a remarkable result, compared with the universal infection rate and 46% mortality for compound fractures in the hospital before the carbolic acid regime was adopted. Lister delayed publishing his results until he produced a series of papers in The Lancet in 1867. He was now also able to treat tuberculosis of joints and to operate on patients with non-united fractures of the patella and olecranon, undertaking procedures that previously would have been considered malpractice, since suppuration following what amounted to conversion of a closed into an open fracture would have been almost inevitable.

Surprisingly, it took time for Lister's work to be widely adopted. Most surgeons believed that carbolic acid was another of the many hundreds of medicaments that surgeons had employed over the ages, without realizing that the Listerian method involved a totally novel attitude to wound management. In the meantime, over the next two decades following Lister's initial work, other surgeons, particularly in Germany, were advancing surgical technique by the prevention of bacterial contamination of wounds – aseptic surgery – in which instruments, dressings, drapes and so on were sterilized in autoclaves, and sterile masks, caps and gowns were employed. The use of rubber gloves was popularized by William Halsted (1852–1922) of Baltimore in 1889. By the end of the nineteenth century, surgical wards and operating theatres came to resemble the facilities we see today.

Successively, the abdominal cavity, the chest, the heart, and the cranium and its contents all became accessible to the surgeon. Important landmarks include those established by Theodor Billroth (1829–1894), who carried out a successful partial gastrectomy for a pyloric cancer in 1881; Ernest Miles (1869–1947), who performed the first successful abdominoperineal resection of a rectal carcinoma in 1907 at the Royal Cancer Hospital (later the Marsden Hospital) in London; Harvey Cushing (1869–1939) in Boston, who laid down the principles of modern neurosurgery; and Theodor Kocher (1841–1917), who established thyroid surgery in Berne, Switzerland, in work that earned him the first of the few Nobel prizes that have been awarded to surgeons.

From the 1930s onwards, surgery in all its branches has advanced by almost geometrical progression. It would require a book rather than a chapter to record the contribution of antibiotics, heralded by the publication of the isolation of penicillin by Lord Howard Florey (1898–1968) and his team in Oxford; the work on joint replacement surgery, which owes much to Sir John Charnley (1911–1982) at Manchester; and the growth of endoscopic and minimal access surgery, which owes a great debt to the introduction of fibre optics by Harold Hopkins (1918–1984), Professor of Applied Optics at Reading. The development by Sir Roy Calne (1930–) of effective drugs to prevent transplanted organ rejection – first 6-mercaptopurine in 1960, then azathioprine in 1961 and cyclosporine in 1976 – led to the foundation of modern organ transplantation surgery.

Who can foretell what exciting changes the immediate future of surgery may see?

Further Reading