The Hunterian Oration

ON

THE PROGRESS OF SURGERY FROM HUNTER'S DAY TO OURS.

DELIVERED BEFORE THE ROYAL COLLEGE OF SURGEONS
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BY

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TO-DAY, Mr. President and Gentlemen, we celebrate the two hundredth anniversary of the birth of John Hunter, the founder of modern scientific surgery, the creator of our Museum, and the patron saint of our College. Since 1814 an oration—the Hunterian Oration—has been given, at first annually and then, after 1855, biennially, in this College in his memory. A large proportion of these orations have dealt with one or more of the numerous branches of Hunter's activities; in fact, it has always seemed to me that there is scarcely any part of the work of Hunter which has not been commemorated in one way or another at one of these orations.

On examining the conditions as given in the trust deed which created this oration it is stated that "the Oration is to be delivered in the theatre of this College on the 14th February, and such Oration is to be expressive of the merits in Comparative Anatomy, Physiology, and Surgery, not only of John Hunter, but also of such persons who have become deceased, whose labours have contributed to the improvement and extension of surgical knowledge."

The provisions of the trust creating this oration being so wide I have thought it advisable on this occasion—the bicentenary of the birth of John Hunter—to devote the time allotted to me for the purpose in giving a short review of the progress of surgery since Hunter's day to ours, in the course of which I propose to make reference to a few of the most distinguished scientific investigators, the results of whose work have proved to be of the greatest value to the science and practice of surgery.

Hunter has been regarded, quite rightly, both in this country and to a lesser extent in foreign countries, as the practical founder of modern scientific surgery. After his earliest surgical days (1760–70) he formulated the idea that it was absolutely essential for a practising surgeon—who wished to practise his art with the greatest prospect of success and benefit to his patients—to have a very close and detailed knowledge of the structure and functions of man in health; that he should also be familiar with, again in every detail, the changes which take place in man during the onset, course, and development of any disease which he is called upon to treat; and furthermore that he should also have a comprehensive and detailed knowledge of the vital processes which take place in the tissues of the patient during the period of recovery from disease and after the performance of a surgical operation. From these facts it will be seen that Hunter fully realized that a minute and thoroughly comprehensive knowledge of the pathological processes occurring in inflammation and growth is the real basis of a considerable amount of practical surgery. This holds to the present day.

The method of investigation which Hunter appears to have carried out when examining any subject was the following. He first made himself master of the details and minute structures of an organ or tissue, and then investigated its functions. In making these investigations he did not hesitate to compare the structures and functions of animals with those of man. Having made this extended structural and functional examination he reflected upon and reviewed the whole, and then came to conclusions. After he had done this, he then in a similar way investigated the structure and functions of organs and parts of living bodies in connexion with the onset, course, and result of disease. This consideration of structure and function in normal conditions, followed by a consideration of the structure and function in similar diseased conditions, is really the basis upon which Hunter commenced to make

surgery a real science. He for one thoroughly understood that in order fully to comprehend the nature of a disease of an organ it is absolutely essential to be familiar with the structure and functions of such an organ under healthy conditions.

In connexion with the ideas which were formulated by Hunter concerning the practice of surgery it is very interesting to read his physiological works and his speculations on the "basis of life." The condition of physiology in Hunter's student days was very little advanced. Hunter himself appears to have derived a considerable portion of his knowledge of physiological processes occurring in man from his direct observation of similar processes occurring in animals and even in plants, in addition to the modifications which he observed in man during the treatment of his patients.

Hunter, like every true physiologist, instead of trying to theorize as to what was the exact chemical or physical basis of life, investigated all the signs and conditions under which life shows itself, and also dissected where possible, or examined in minute detail, all structures which showed signs of life. By these means he was able to formulate within his own mind what he himself understood by life, or "the vital principle," or whatever the condition may be called. Hunter believed that "life existed in every part of the animal body," and this life, or "vital principle" as he called it, made every part of the animal body susceptible to the impressions which excite action.

Since Hunter's day every advance in our knowledge of chemistry and physics has been used in attempting to explain the onset and course of disease, and the actual biochemical and biophysical processes which occur in living matter or matter endowed with the characteristics of life. So far, however, these researches have given us more enlightened ideas of the chemical and physical conditions under which "life" may exist and may be destroyed, but no ultimate chemical or physical explanation has been discovered of the true or real chemical or physical basis of life.

IMMUNITY AND PREVENTION OF DISEASE.

The first subject which I wish to discuss as being of supreme importance in the progress of surgery is what is now called immunity and prevention of disease.

During the period of Hunter's life (1728–1793) little or nothing was suspected or known of what we now describe as immunity. Edward Jenner (1749–1823), an intimate friend and pupil of Hunter, was the first medical practitioner in this country to appreciate the great value of inoculation against disease. He noticed in his practice that milkmaids who had contracted cow-pox from the udders of cattle when milking did not take small-pox. According to Baron, in his *Life of Dr. Jenner*, the first inoculation was performed by Jenner upon a country boy aged 8½ years (named James Phipps), in May, 1796. He inoculated the boy with the matter obtained from vesicles upon the skin of a milkmaid suffering from cow-pox. Almost two years later, in a similar manner, he inoculated his own son along with several other children. As a result of these investigations inoculation of children with the exudation from the vesicles of persons suffering from cow-pox was used as a protection against the possible subsequent development of small-pox.

As we all now know, laity and otherwise, the ravages of small-pox have practically been set aside in this country by the systematic practice of vaccination. It is very rare nowadays in England to meet with anyone who has features disfigured with pits, the result of previous small-pox.

BIOCHEMISTRY.

The discoveries in biochemistry, such as those of von Behring (1854–1917), Koch (1843–1910), Ehrlich (1854–1915), and Wassermann (1866–1925), have given us very valuable means both of diagnosis and treatment.

Diphtheria Antitoxin.—Von Behring, in 1890, discovered the antitoxin of diphtheria, and found that by injecting this antitoxin into patients affected with the disease diphtheria could be controlled and rendered practically innocuous. Up to that time a considerable proportion of patients suffering from diphtheria died from one condition or another, a large number of them having to be

submitted to tracheotomy on account of laryngeal obstruction due to diphtheritic membrane. In England, at the present day, owing to the general use of von Behring's diphtheria antitoxin, it is extremely rare to see a patient suffering from diphtheria in whom tracheotomy is necessary. At St. Bartholomew's Hospital, in my student days, tracheotomy for tracheal obstruction due to diphtheria was a very common operation. Nowadays it is practically never seen. In 1890 the number of patients treated in this way was 47, and in 1927 there was none.

Antitetanic Serum.—Antitetanic serum, which was discovered by von Behring and Kitasato in 1892, was used extensively in the prevention and treatment of tetanus during the great war. The soil of the low-lying lands of Flanders is said to be almost always infected with the bacillus of tetanus (discovered by Nicolaier in 1884); hence gunshot wounds sustained by soldiers in this area were prone to become infected with the organism, which caused an attack of tetanus. It has been stated that the death rate among inoculated soldiers suffering from tetanus during the great war was 23 per cent. as compared with 53.5 per cent. in those who had not received preventive treatment.

Other diseases which have been treated successfully, either by prevention or cure, in a similar biochemical manner are hydrophobia, typhoid, and anthrax.

Many attempts have been made to render patients immune from streptococcus infection by the injection of vaccines, etc. At the present time, however, it does not appear that any certain remedial measure, biochemical or otherwise, apart from surgical asepsis, has been found which can be relied upon for absolutely preventing the occasional occurrence of a streptococcal or staphylococcal infection after an operation. Some success has been claimed for the use of an antistreptococcal serum in connexion with possible infection by the streptococcus, but the exact value of this is not clear at present. Certainly, in my experience, there is no streptococcal antitoxin or serum which can be injected into a patient and be absolutely relied upon to prevent or cure infection with virulent pathogenic streptococci.

Insulin.—The biochemical researches of Banting and Best of Toronto in 1921 and subsequently led to their discovery in, and isolation from, the pancreas of a substance which was named "insulin." The administration of this substance so improved the metabolism of carbohydrate material by diabetic patients that in many cases operations which previously had been thought inadvisable and dangerous have been rendered possible, and the lives of a large number of patients very considerably prolonged. Best has recently stated that, in his opinion, the lives of about 200,000 diabetic patients have been temporarily saved by the use of insulin.

GENERAL ANAESTHESIA.

Another most important epoch in the progress of surgery was the discovery of general and local anaesthesia. Although a certain amount of anaesthesia—usually induced by inhalation or taking internally of narcotic substances such as mandragora, hyoscyamus, certain types of hemp, opium, etc.—had been practised during surgical operations in early days, in Hunter's time this method of alleviation or diminution of pain seems to have been practically entirely forgotten, and to have gone out of use.

As I have already said, every discovery of importance in chemistry and physics which has been made since Hunter's day can truthfully be said to have been utilized sooner or later by application to surgical diagnosis and treatment. Thus the discovery of hydrogen in 1766 by Cavendish, of nitrogen in 1772 by Rutherford, and of oxygen and nitrous oxide gas in 1774 by Priestley, were the real beginnings of the application of chemical substances for the production of anaesthesia in surgical operations. Nitrous oxide gas appears to have been made use of first as an anaesthetic for the diminution of pain in the extraction of teeth. It is stated that Humphry Davy, about 1800, had used this gas for the alleviation of pain due to a diseased tooth. He afterwards stated, as a result of this experience, that "nitrous oxide seems capable of destroying pain. It may be used in surgical operations where there is no great effusion of blood." Unfortunately

this suggestion of Davy's was not made use of by surgeons, and it was not until almost fifty years later that the value and use of nitrous oxide gas for the induction of anaesthesia were appreciated and understood.

Faraday, another chemist, seems to have been one of the first to recognize the anaesthetic properties of ether. In 1818 he pointed out that "when the vapour of ether is mixed with common air and inhaled the effects are similar to those caused by the inhalation of nitrous oxide."

From this period onwards a number of observers made use of the inhalation of gases to diminish pain during surgical procedures. Henry Hill Hickman—a young man who became a member of this College in 1820, and practised in Ludlow, Shropshire, from 1820 to 1828—made experiments, in the autumn of 1820, on the possible anaesthetization of animals, at first with carbonic acid and then with nitrous oxide. His proposals concerning the use of nitrous oxide gas for the production of anaesthesia and its utilization in connexion with surgery were received very sceptically and generally condemned by the surgical profession in this country. So much so that he communicated with the King of France asking that an inquiry be made by the physicians and surgeons of that country as regards the value and correctness of his experiments. This communication was sent to the Académie Royale de Médecine de Paris, which body appointed a committee to investigate the matter. Nothing, however, came of this, although Hickman requested that he might be allowed to demonstrate the result of his experiments to the Paris Academy. Unfortunately, this young and enterprising surgeon died from tuberculosis the following year at the age of 29.

Crawford Long, a medical practitioner in Georgia, appears to have been the first American surgeon to make use of ether in the production of anaesthesia during the performance of a surgical operation. On March 30th, 1842, he gave ether to a patient for the removal of a tumour from the neck. This case being so successful, Long continued to make use of ether for surgical operations, and performed eight such operations between 1842 and 1845. Long, although he made no secret of his discovery, did not publish the fact to the world, and it was not until others had made a similar discovery that his experience became generally known. Two years later, in 1844, Wells, a dentist in Hartford, Conn., made use of anaesthesia by nitrous oxide for the extraction of teeth. Although Wells had attempted to produce anaesthesia with ether, he had not been able to continue to do so, owing to the difficulties and choking sensations which were produced. Morton, however, who had been a pupil of Wells, was familiar with the properties of ether, and independently discovered its anaesthetic qualities four years after the discovery by Long. Apparently the first public exhibition of surgery without pain was given in Massachusetts General Hospital in October, 1846, when a patient was operated upon by Warren for removal of a vascular tumour of the neck, after being anaesthetized with sulphuric ether.

Ether was first used in England for the induction of general anaesthesia during the performance of an operation (removal of a tooth) in December, 1846, and two days later ether was administered to patients at University College Hospital by Squire for Liston, who amputated the lower extremity through the thigh in one patient, and also in another removed an ingrowing toenail.

During the following year (1847) Simpson of Edinburgh used ether in obstetric practice, and found that the pains of labour could be abolished thereby, whilst the uterine contractions were not interfered with. The next year (1848) Simpson, who was somewhat dissatisfied with the use of ether on account of the irritation which it produced in the lungs and bronchial passages, first made use of chloroform. This substance was discovered at about the same time by two investigators—by Soubeiran in 1831, and by Liebig in 1832; its composition was first accurately described by Dumas in 1835.

Since this period (1847–48) ether, chloroform, nitrous oxide, in many and various combinations, and other substances have been used for the induction of surgical anaesthesia. Recently a most important combination which has been made use of is that of nitrous oxide, oxygen, and a

small amount of ether or chloroform. This combination is especially useful and safe when administered by the intratracheal method.

LOCAL ANAESTHESIA.

Cocaine.—Cocaine as an alkaloid was first isolated, apparently by Godeke, about 1855, and some points as regards its power of producing local anaesthesia were noticed. No definite advances were made, however, until 1874, when Bennett showed that cocaine, applied to living tissues, had the power of causing local anaesthesia. V. Anrep, however, in 1878, appears to have been the first to investigate completely the anaesthetic properties of cocaine by injecting a dilute solution (0.003 to 0.5 per cent.) underneath the skin, and in connexion with this made the suggestion of its possible value for producing anaesthesia for surgical operations. In the following year (1879) its powers of producing local anaesthesia were demonstrated in connexion with the eye. This use of cocaine was worked out in complete detail by Karl Koller, who showed that complete anaesthesia of the eye could be produced by the use of a 2 per cent. solution. The results of Koller's experiments were first published and discussed at an ophthalmological congress in Heidelberg in 1884. Since then this drug has been used increasingly for the production of anaesthesia in all kinds of surgical operations. Some difficulties were met with at first in connexion with poisoning by absorption, but these were soon overcome.

Novocain.—Considerable progress in the method of induction of local anaesthesia has been made since that date by the discovery of novocain, a synthetic product derived from coal-tar (para-amido-benzoyl-diethyl-amino-ethanol hydrochloride) by Alfred Einhorn in 1905. So much so that at the present time a considerable number of major surgical operations, such as removal of tumours of the thyroid, gastrotomy, radical operation for hernia, etc., and even almost any major and minor operation, can be done painlessly, and in certain cases with greater safety to the patient, by the use of a dilute solution of novocain, administered by the infiltration method.

Stovaine.—Another variety of anaesthesia, or analgesia—spinal—can be induced by the injection of a solution of stovaine into the lower portion of the spinal theca. This form of anaesthesia is especially used in operations on the portion of the body below the diaphragm, such as prostatectomy, hysterectomy, etc., when there are contraindications, such as affections of the lungs, etc., to the administration of a general anaesthetic.

The net result of all these discoveries and improvements in connexion with surgical anaesthesia—general and local—is such that almost any desirable and justifiable operation can now be performed by the dexterous surgeon, well trained in anatomy and technique, painlessly and with very slight anaesthetic risk to the patient, when the administration of the anaesthetic is carried out by a well trained anaesthetist.

PATHOLOGY AND MICROSCOPICAL DIAGNOSIS.

The publication of Virchow's (1821-1902) work on cellular pathology in 1858 was a great incentive to surgeons to study the histological basis of a considerable number of surgical diseases, especially all forms of new growth. From this period (1858) to the present time there has

been a continuous advance in our knowledge of the pathology of surgical affections, one of the latest, perhaps, being the recognition of the different histological characteristics of malignant growths. This has enabled surgeons to be in a much better position as regards giving a correct prognosis after an operation for malignant disease. These advances have been made possible by the improved construction of the microscope and the knowledge of the reactions of human and other tissues to different varieties of dyes and stains.

The improvements which have been made in the microscope since Hunter's day have been very considerable. In Hunter's time the microscope was an instrument which was little more than a simple magnifying lens.

The principles of the compound microscope were discovered and developed by many physical observers, one of whom was Joseph Jackson Lister, the father of Lord Lister, in 1830. The discovery of the principle of the homogeneous immersion lens, followed by great improvements in the construction of lenses which were called apochromatic, have made possible a large number of researches in histology and bacteriology. As examples of the microscope in use in Hunter's day and of that now in use I have had placed on the table two—one a microscope of 1760, and as used by Hunter, and the other a modern one. I also show you the microscopes used by Pasteur and Lister.

The first surgeon to utilize reflected light in the investigation of deep spaces or cavities of the body was Bozzini of Frankfurt-am-Main, who invented, in 1805, a form of urethroscope and also other forms of "scopes." Each consisted of a hollow tube along which light was reflected by a mirror. No practical results, however, emanated from this discovery at the time, and its use remained quiescent apparently for a considerable period. The next observer to make use of reflected light in the examination of patients was Helmholtz, who invented the

ophthalmoscope in 1851. His original ophthalmoscope was, as regards its success in working, dependent upon the reflection and concentration of a source of light, usually a candle or a lamp. By its use ophthalmology became established on a scientific basis. Soon afterwards, in 1855, Manuel Garcia invented the laryngoscope, which was used by Torek of Vienna; then followed the rhinoscope, discovered by Johann Czermak in 1859. Nitze and Leiter made the most rapid advances in the utilization of reflected light for interior investigation of the body by combining the principles of the telescope and reflected light, and the production of the cystoscope in 1877.

The value of these instruments for investigation of the recesses and cavities of the body was enormously increased by the invention of incandescent light. Paul Jablochkov, in 1876, invented the electric candle; Swan and Stearne of England and Edison of America improved upon this invention and produced incandescent electric lighting in 1880. David Newman of Glasgow improved the cystoscope as designed by Nitze and Leiter, and in 1883 was the first to make use of incandescent light in connexion with it. With this instrument (Fig. 1) it became easily possible for the practised manipulator to investigate and diagnose the various conditions affecting the urinary bladder. The laryngoscope was also further developed and improved, and the diagnosis of surgical affections of the interior

FIG. 1.—Cystoscope with electric lighting as used by David Newman. (a) In position for introduction. G, Speculum of hollow vulcanite the apex of which, H, is movable by handle I. (b) In position after it has been introduced into the bladder. K, Speculum, the apex of which, J, has been moved by the handle L so as to enable the observer to see through the glass disc which closes the end within the bladder. (c) Electric lamp and handle which is introduced passed along the speculum after introduction.

of the larynx was made possible in their early stages. Other forms of "scopes" for the investigation of the interior of the body which rapidly followed the earlier discoveries were the sigmoidoscope by Bodenhamer in 1863, afterwards perfected by Kelly of Baltimore and Strauss of Berlin; the oesophagoscope by Kussmaul in 1869, as well as the first gastroscope during the same year (later perfected by Mikulicz in 1881); and the bronchoscope by Gustav Killian in 1898.

The latest application of the combination of the telescope and electric light for clinical and diagnostic purposes is the thoracoscope. A similar but much larger instrument is used for investigation of the interior of the stomach. The practical value of the gastroscope, however, in diagnosis is somewhat problematical, owing to the difficulty of correctly interpreting the conditions seen through it, and the fact that it cannot be used readily and with advantage when a patient has been anaesthetized.

One example of the application of improved mechanical methods to surgery was the invention of the lithotrite and vesical evacuator by Bigelow in 1878. With this instrument patients were successfully treated and cured of stone in the urinary bladder without any cutting operation. Since Bigelow's day the instrument has been considerably improved in detail, including the addition of an electric light attachment, though the essentials are absolutely the same. Expert operators can obtain excellent results by this method. In hot and tropical countries such as Egypt and India, where stone is prevalent and the natives are not readily amenable to the discipline, aseptic and otherwise, necessary for a successful surgical operation, this method in the hands of the skilled operator has enormous advantages.

ANTISEPSIS AND ASEPSIS.

The next avenue of progress in surgery is that branch of biology and biochemistry which we call bacteriology. Hunter, of course, was ignorant of bacteriology, since bacteria had not been discovered in his day. It is of interest to note that in his surgical lectures given in 1785 he states, in connexion with fermentation: "Fermentation appears to be a process peculiar to dead vegetable or animal matter, and when we find a tendency to fermentation we may conclude that there is a defect of the living principle." The modern science of bacteriology and its possible application to surgery really commenced in 1857, when Pasteur published his paper on lactic fermentation, and subsequently his paper on the influence of oxygen on the development of yeast and on alcoholic fermentation, in 1861.

The adoption by Lister of his antiseptic doctrine in connexion with surgery in 1867, which really followed the work of Pasteur, was the commencement of what may be known as advanced surgery on a scientific basis. The general acceptance of Lister's doctrine and its application to practical surgery was slow in this country. However, in the late eighties and early nineties its practice became general, and was quickly followed by the aseptic doctrine. The practice of modern surgery is really based on a combination of antiseptics and asepsis, principally the latter. All the points, however, on the subject of Lister were discussed by last year's Hunterian orator. It is sufficient

for me to say that the practice of asepsis and antisepsis in surgical operations has enabled surgeons to submit to operation with success every organ and almost every part of the human body. The surgery of the abdomen was first perfected, especially by von Billroth of Vienna, in connexion with gastro-intestinal operations, and by Spencer Wells and Lawson Tait as regards operations upon the ovaries, uterus, and Fallopian tubes; then that of the brain and cranial contents, and more lately that of the thorax and its contents.

The net result of the practice of asepsis in operations is that infection of and suppuration in operation wounds is almost non-existent in most modern hospitals, and the mortality from surgical operation has been very greatly reduced.

TRANSFUSION OF BLOOD AND ITS APPLICATION TO SURGERY.

Transfusion of blood, either directly from one individual to another or indirectly, was first practised, apparently, on animals by Lower in 1665, and on man by Denys of Paris in 1667. No definite progress was made, however, in the

application of this procedure to surgery until the latter part of the nineteenth and the beginning of the twentieth century.

Eisenberg, in 1901, discovered that the blood serum of both diseased and normal individuals, when injected into another individual of the same race, was liable to haemolyse the blood of the receptor. After this discovery Jansky, in 1907, divided the blood of human beings into four groups, and in 1910 Moss repeated this investigation and graded individuals according to the character of their blood into four groups.

Further, the advances made possible by our knowledge of biochemistry and bacteriology have enabled the indirect method of transfusion of blood to be very much perfected. So much so that at the present time it is quite an easy matter for a person who has mastered the technique to obtain blood from a suitable selected donor, keep it sterile and uncoagulated by the sodium citrate method, and to inject it immediately into the blood vessels of the recipient. These procedures are now in quite constant use in hospitals and surgical practice in certain types of serious injury or disease, especially when a large amount of blood has been lost by the patient, and have proved of great advantage in enabling operations to be

done, and the lives of patients saved thereby which otherwise would have been lost.

RADIOLOGY.

Another "milestone" in the progress of surgery between Hunter's day and ours is marked by the successive discoveries of x rays and radium.

The discovery of x rays by Wilhelm Roentgen (1845-1923), professor at Würzburg, in 1895 was the commencement of a series of great advances in surgical diagnosis. At first the use of x rays in this direction was mainly confined to injuries to and diseases of the bones. When, however, the possibilities of this discovery were more appreciated and understood it was found possible to extend the clinical use of x rays in diagnosis to other conditions. Thus, as regards the internal organs and viscera, especially portions of the

FIG. 2.—Amputations as performed in the days of Hunter.

FIG. 3.—Amputation at shoulder-joint, as performed in 1820 after introduction of the straight amputation knife.

alimentary canal, the existence of diseased conditions was readily demonstrated by the taking of a skiagram of the diseased, or presumed diseased, region and organ, after the administration by the mouth or the rectum of barium sulphate or bismuth nitrate. Thus the diagnosis of ulcers and neoplastic growths of the stomach and duodenum, narrowings in different portions of the alimentary canal, such as occur in carcinoma of the oesophagus, or carcinoma of different portions of the alimentary canal, especially the lower portion of the large intestine above the rectum, was made possible. The determination of the position of deep-seated fistulous conditions between the viscera has also been made possible.

The value of x rays in connexion with the diagnosis and treatment of disease has in many cases, and especially by the laity, been much exaggerated. To the practising clinician x rays, when intelligently and scientifically used, can, as we all know, be of enormous advantage. They are of great value in the detection and localization of different forms of calculi, especially those in the ureters and kidney. One of the later developments of the use of x rays in diagnosis is the investigation of the ureters and pelvis of the kidney by what are known as "ureterography" and "pyelography." By these means of investigation many obscure cases of disease in the kidneys and ureters have been diagnosed satisfactorily, and subsequently operated upon with great prospects of cure.

Calculi in the gall bladder for a long time evaded the attempts of the x -ray practitioners definitely to detect them. Occasionally when suspected they could be demonstrated on an x -ray plate or film, but often no evidence was apparent, although the clinical signs and symptoms pointed to their presence, and at operation they were found. Improved x -ray machinery and the intravenous injection of tetraiodophenolphthalein or tetrabromophenolphthalein, and its excretion by the liver, at the present time, however, usually enable definite evidence to be found of the presence of cholecystitis and calculi in these cases. As everyone knows, a patient is much more ready to submit to an operation for removal of a calculus in the ureters, kidneys, urinary bladder, or gall bladder if its presence can be shown on an x -ray film or plate than if it is only assumed. In a similar manner x rays have been of use in detecting the presence of stone in the pancreatic duct or deep-seated calculi in the submaxillary salivary gland.

During the recent great war x -ray diagnosis was increasingly made use of in the detection and localization of injuries to bones and the presence of bullets and other metallic substances which had entered the bodies of wounded soldiers.

Following the discovery of x rays by Roentgen, Monsieur and Madame Curie, in 1898, discovered radium in pitch-

blende derived from mines in Joachimstal in Bohemia (now Czechoslovakia). The salts of this metal were found to possess very marked radio-active qualities, and have been used, especially of recent years, in the treatment of various diseases, and particularly in forms of new growth. There is no doubt that certain types of sarcoma and carcinoma are very sensitive to the action of radium, and a number of patients have apparently been cured by the use of the salts of this metal.

Radium has been applied in various ways, but in the treatment of disease the best results have been obtained by the implantation of either radium needles or radium seeds in the margins of diseased tissues. As in the case of x rays, the exact value of radium in the treatment of malignant disease cannot yet be determined. Unfortunately, a large supply of radium is very expensive and difficult to obtain. The indications, however, appear to be that if an increased quantity of radium or its salts can be obtained and made available for clinical use, then considerably improved results in the treatment of malignant disease may be made possible.

FIG. 4.—Operation as performed in the early days of "Listerian" practice. The patient has been anaesthetized and the carbolic spray is being used.

CRANIAL AND SPINAL SURGERY.

In connexion with the surgery of the cranium and its contents Broca's investigations into the localization of function, and especially his localization of the centre of articulate speech in the left frontal convolution, enabled him to perform the first fixed operation for cerebral abscess, which was assisted by localization of function in connexion with "motor aphasia," in 1861; since then numerous researches into the localization of cerebral functions have enabled neurologists and neuro-pathologists to determine

the site of a large number of intracranial growths.

Quite a considerable proportion of the advances in cerebral and spinal surgery has been due to two Fellows of this College—Victor Horsley (1857–1916) and William Macewen (1848–1924), now deceased.

Recently much assistance has been obtained in the exact localization of a tumour within the spinal canal by the injection of lipiodol into the spinal canal and subsequent examination with x rays. The lipiodol shows as an opaque shadow on an x -ray plate; consequently any narrowing or encroachment upon the intraspinal space by a tumour becomes evident. Similarly injection of lipiodol into the trachea, bronchi, and lungs has enabled the clinician, on subsequent examination by x rays, to demonstrate positively on plate or film the extent and nature of abnormal intrathoracic conditions.

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SPECIALIZATION IN SURGERY.

The numerous methods—chemical and physical—available to the clinician and the pathologist for the investigation of patients suffering from surgical affections are so varied that at the present time it is not usually possible for one

FIG. 5.—An operation being performed at the present day.

diagnostician to make all the investigations which are necessary in the examination of an individual patient. Thus, in the practice of surgery in the present day, we have skilled specialists in many branches, such as histology, biochemistry, cytology, bacteriology, and radiology; and further, in the use of special instruments, such as the laryngoscope, ophthalmoscope, cystoscope, sigmoidoscope, and bronchoscope. This division of activities has led to the establishment of specialist practitioners, many of whom limit their activities, diagnostic and otherwise, to one particular organ.

From the point of view of progress in surgery there is no doubt that this specialization, both in diagnosis and in treatment, has been a very considerable advantage. This trend to specialization has become so marked that at the present time there is a tendency for specialist practitioners to work in teams, each one of a team taking specialized portions of either investigation or treatment. In practice this method of examination and treatment has been found especially feasible in connexion with hospitals to which medical schools are attached. The formation of private clinics for the diagnosis and treatment of the non-charity patient on these lines has not been easy in this country. Many developments, however, are now taking place which will be of great advantage to the successful practice of surgery in the future.

One great difficulty often arises in connexion with the progress of surgery as regards its practical application. This is the inborn desire of the Englishman to have all forms of medical and surgical treatment carried out in his own house. Fortunately public opinion is gradually being educated on this subject, and there is an increasing tendency among educated members of the community of desiring, when ill, to be treated in an institution built and equipped for scientific investigation and treatment.

INFLUENCE OF ASEPSIS AND ANTISEPSIS ON THE CONSTRUCTION OF SURGICAL HOSPITALS.

The general adoption in surgical practice of the principles of asepsis and antiseptics was quickly followed by enormous improvements in the construction of surgical hospitals and operation theatres. In Hunter's day a small room, not specially built to fit it for the purpose, was generally made use of as an operation room. This practice of using any small and otherwise useless room for operations was continued until comparatively recently. In my own student days I well remember, in one of the large special hospitals in London, that the residents' sitting room and dining room were also used as the surgeon's operation and instrument rooms.

The old method of erection of buildings was ill adapted for the practice of asepsis owing to the large number of angles, corners, crevices, wall and ceiling decorations, etc., which formed collectors of dust, dirt, and associated micro-organisms. Since the late eighties of the last century enormous advances have been made in the construction of surgical wards and rooms used for surgical patients, and also operation theatres. In the earlier days of the construction of the modern operation theatre considerable difficulty was experienced by architects and builders in providing absolutely smooth surfaces for floors, walls, and ceilings, which could be readily cleaned without being damaged or destroyed. At the present time the tendency in the construction of surgical operation theatres is to make them as simple as possible, and to have all the sterilization of equipment, instruments, etc., carried out

by superheated steam, or in some cases dry heat produced electrically, in a room adjoining the operation theatre.

In connexion with this subject the accompanying illustrations are of considerable interest, both as regards the operation room, operation table, and the equipment and personnel of the surgeon and his assistants. Fig. 2 is an illustration of an operation being performed in the days of Hunter. Fig. 3 represents the arrangements for an operation in 1820. Fig. 4 represents an operation being performed in the early days of Listerian practice. In it can be seen the carbolic spray which was used for making the atmosphere in the region of the operation aseptic. Fig. 5 is an illustration of an operation being performed under modern aseptic methods.

An illustration of the progress which has been made in ensuring surgical cleanliness and asepsis in an operation is given in Fig. 6; here are shown the lay-out and design of one of the newest and most modern surgical operation theatre units in this country. The main point in connexion with this lay-out is the provision made for avoiding the entrance into the operation theatre of any individual or material which has not been rendered previously as aseptic as possible.

The progress of surgery, especially since the aseptic and antiseptic era, has been greatly assisted and rendered possible by improvements in the education and training of nurses. Without these improvements it would be almost impossible to perform with success a large number of the major operations which are now regularly done in the practice of surgery.

WAR SURGERY.

The great progress in surgery during the late war was due to the utilization, in all aspects, of the discoveries in connexion with (a) immunity and prevention, (b) anaesthesia, (c) asepsis and antiseptics, and (d) x rays. The utilization of these discoveries in the recent great war enabled operations of every magnitude to be carried out in advanced stations and hospitals within a short distance of the firing line. In addition, the improvements in transport, motor and otherwise, contributed greatly to this progress. I have already referred to the preventive inoculation against typhoid and tetanus.

Another important practice developed during the war in connexion with the treatment of recent contaminated wounds, the margins of which were lacerated or contused, was the primary excision of all contaminated and contused tissues, followed by immediate or delayed suture. By the practice of these methods and the advantages of improved transport it was found possible during the war to treat patients at the general military hospitals in London within twenty-four hours after the wounds had been received. In a number of cases of wounds the margins of which had been excised the cavity was packed with gauze soaked in flavine, or after amputation the stumps were treated in a similar way.

A further improvement in war surgery was the recognition of the fact that in many cases of suppurating wounds, or badly lacerated limbs in which an amputation had to be performed, the wounds could be left open and treated by the Carrel-Dakin irrigation method. Free exudation and associated irrigation enabled the wounded surface to become clean, and delayed suture of the wound could be carried out afterwards. As a result of the treatment of war wounds on improved biochemical and biophysical principles the mortality from gunshot wounds and injuries was enormously decreased.

FIG. 6.—"Lay-out" of one of the latest designed operation theatres and accessory rooms.

CONCLUSION.

From the short account which I have been able to give you of the progress of surgery from Hunter's day to ours, it will be seen that the actual technique employed in the performance of surgical operations, and the results which can be obtained thereby, have reached a very high stage of perfection. It does not appear to me that we can expect in the future such great progress to be made in the details of the performance of operations themselves, and the amelioration of the discomforts directly resulting therefrom. In my opinion the main direction of advance of surgery in the future will be along biochemical and biophysical lines, both as regards diagnosis and treatment. If this assumption be correct, it is essential that the medical student and the medical practitioner of the future should pay increased attention to all biochemical and biophysical problems, both in normal and in diseased conditions.

Owing to the length of the curriculum and the multiplicity of subjects which the student of medicine of the present day has to pass through, there is a tendency for parts of the curriculum to be forgotten after the examination in it has been passed. Consequently the application of physiology in the investigation of disease is too often neglected, and a student thereby is encouraged to acquire surgical knowledge—especially diagnosis—in a somewhat empirical manner. At the present time, however, there is a tendency in every modern school of medicine to give courses of "applied physiology and applied anatomy" during the later and clinical part of a student's career.

THEORIES OF SUGGESTION.*

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I.

THE word "suggestion" has been used in educational, scientific, and medical literature in slightly different senses. In the writings of educationists and purely scientific psychologists it has been used to indicate a general kind of influence brought to bear on the mind, an influence which is other than that of logical or rational argument. The mind can be influenced rationally and also irrationally. Rationally, it is influenced, for example, when a child is taught the fifth proposition of Euclid†, in learning to understand the steps one by one in the right sequence and in the right connexion; but the child can be influenced non-rationally, in its learning of this and other school subjects, by virtue of its general mental attitude towards the teacher, by the views on life of its fellow students, even by the beauty or ugliness of the rooms and buildings in which it is taught, by the climate, by the fact of the weather being fine or dull, and in a hundred other ways. These are non-rational, although not necessarily irrational, influences. They may not be contrary to reason, but they are independent of reason so far as the child individually is concerned. We may regard this class of non-rational influence as influence by suggestion.

Again, the child may be misled in his reasoning process and may fall into error. Many of the conditions under which he falls into error can be put under the same heading of suggestion. In a general educational way we may use the term suggestion in a wide sense which covers all non-rational and includes irrational modes of influencing the mind. An individual may be influenced by inanimate objects, by social conditions, or by his fellows, not only non-rationally, but also *unwittingly*—that is, without realizing that he is being influenced. The weather may be depressing, and his fundamental mood may follow suit without his being explicitly aware of the fact; the influence

there is an influence of suggestion. It may be considered a rational influence if he observes in the morning that the weather is bad, and infers from it (on the basis of previous experience) that he will have a bad day and will not be able to work so effectively as usual. But that view is not necessarily a true view; he may be mistaken in it. Even if it is a true view, so that the result is rational, it is not necessarily the work of reason.

The word suggestion in pure psychology has been used in an even wider sense. In Professor G. F. Stout's *Analytic Psychology* there is a chapter headed "Relative Suggestion," but what he is referring to there is the effect of pre-formed associations on the activity of the mind. Certain experiences have been passed through and retained in memory, and if one experience is repeated it tends to call up the memory of another. One experience "suggests" the memory of another experience. Suggestion, then, may work according to the rules of association, either of contiguity or of similarity; that is a very wide use of the term. An officer's gesture may suggest a certain movement to the platoon under his command, and they may spontaneously move accordingly without having received a definite verbal order. The response to the command may be regarded as due to suggestion. It is not necessarily rational—not a form of persuasion, which is the word to use in speaking of the process of influencing a person by rational means. Giving a command or making a request may be, but is not necessarily, a rational method of influence. In its essence a rational method, it may on some particular occasion be either rational or non-rational. It should probably be classed under the general heading of suggestion, taking the word in its widest sense.

From these uses of the term suggestion—a suggestion which involves a non-rational influencing of the mind—we pass to the more medical side of the subject. In psychological medicine the use of suggestion has developed out of the earlier use of hypnotic influence.

I must first emphasize the fact that hypnotism and suggestion are not the same thing. The state of hypnosis is a state of mental dissociation, in which certain interests of the subject's mind may be appealed to while other parts of the mind remain in abeyance. When a person is hypnotized he is more ready to respond to the influence of the hypnotist because the dissociation of his mind prevents him from being able to call upon his reserves—to bring up other considerations. The hypnotic subject receives a command or request from the hypnotist, and his impulse is to respond immediately. Considerations tending towards a different line of action simply do not occur to him; they cannot, because there is a break in the mind. He cannot review the situation and consider alternatives, and certainly does not even begin to consider them. We see that in hypnosis he has become more suggestible, and that his increased suggestibility, or increased readiness to respond to suggestion, is in part the result of mental dissociation.

But the opposite relationship may hold good. Instead of suggestibility following upon the state of hypnosis, we may find a state of hypnosis following upon suggestion. Indeed, this is what generally occurs when a person is hypnotized. The hypnotist suggests to the person that he will become more and more drowsy, more and more lethargic, but that he will continue to hear and understand what the hypnotist says to him, so that through suggestion from the hypnotist dissociation takes place. A person is robbed of the power of controlling his mind as a unitary system.

The procedure in the case of a patient requiring hypnotic treatment is as follows. After a preliminary general examination—that is, a physical examination and a psychological investigation of the conditions under which his illness had set in, which need not take very long, although a detailed psychological examination (autognosis) would require many hours—after this analysis, if the patient is considered suitable for hypnotic treatment, the physician asks him to lie down on a couch, to relax his voluntary muscles,* to fix his gaze on a small mirror or

* A paper read before the Section of Psychiatry, Royal Society of Medicine, on January 10th, 1928, and published by permission of the honorary editors of the Society.

† The name, *pons asinorum*, given to this proposition may exert a suggestive effect upon the child, in one or other of two ways, according to his temperament—namely, discouragement, or as a challenge to a more determined attack.

* The patient may be given detailed instruction in the matter of muscular relaxation. If he directs attention to the small distal muscles of hands and feet he will find that relaxation of them tends to spread to the larger muscles of the arms, legs, etc. Deep and regular breathing also helps relaxation.