

MACEWEN MEMORIAL LECTURE, 1930

**The Dawn and Epic of
Neurology and Surgery**

BY

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The Dawn and Epic of Neurology
And Surgery

We commemorate today the life and labours of Sir William Macewen. I had the privilege of the friendship of this great man. In scholarship he was indebted to regular habits and wide reading. His life was one of unremitting industry, and he possessed the divine gift of judgment. He was of striking and noble presence, his face being finely chiselled. The expression of the countenance revealed a mind characterized by high endeavour, benevolence, tranquil self-reliance, and unconquerable determination. Sir William was a mighty beacon lighting the pathway of Surgery. He adorned with living lustre this proud and ancient land.

In Ecclesiastics ⁽¹⁾ the word ROPHE is translated in our version “Physician.” It means a “Healer.” As the first healers were Surgeons, I substitute the word “Surgeon” in the following beautiful verses.

I recite them in affectionate and hallowed memory of Sir William Macewen –

1. Honour the Surgeon according to thy need of him with the honours due to him: For verily the Lord hath created him.
2. For the Most High cometh healing:
And from the King he shall receive a gift.
3. The skill of the Surgeon shall life up his head:
And in the sight of great men he shall be admired.
4. And He gave men skill,
That they may be glorified in His marvellous works

¹ Chap. Xxxviii. Dr Coweley, Bodleian Library (Private letter) writes, “the word ROPHE means a ‘Healer.

In that fascinating volume, *The Conquest of Civilization*, the author describes the age-long story of man's life on this planet, which we are told covers several hundred thousand years. The story extends from the beginning of man's conquest of the material universe, to the social dreams of Plato, and to the Christian vision of a common Heavenly Father.

“The languages of Greece and Rome were never lost. Those of the early Orient perished, and the ability to read them was lost many centuries ago. Their dramatic recovery opens to us the earlier chapters of the human career. The conquests we owe to the Orient are the invention of alphabetic writing and the discovery of metal.”

A thousand years before the days of Pericles there was a group of gifted men who created at Thebes a grand and imperial city of noble architecture. The same is true of the prehistoric palaces of Crete, Mycenae and Troy.

“The civilization of these famous cities was not characteristic of Greece. The Greek people was a compound of which the necessary constituents had not yet come together”. In the main all classical literature shows that Greek and Pagan were direct opposites. “Greed poetry was a force,” as has been beautifully expressed, “making for the gradual enobling and enriching of the content of life, or some movement towards the attainment of that ‘Chief End of Man,’ which is, according to the magnificent definition of the document known in Scotland as the ‘Shorter Catechism,’ to glorify God and to enjoy Him for ever.”

The search in recent years for their earliest home of civilization appears to point to Egypt and the Near East. In this quest it is difficult to exclude the Middle East, the land of the two rivers. Perhaps when we now more about the Orient opinion may change.

Mesopotamia is the site of the Scriptural account of the origin of man, and has been described as “the nursery” if not the cradle of all culture.” Babylon, “The glory of the Kingdoms, the beauty of the Chaldees Excellency,” and Nineveh, “the exceeding great city,” represent a phase, not the beginning, of intellectual development.

The inter-penetration of Egypt and Greece with the ancient civilizations of Asia Minor, Assyria, Mesopotamia and Babylonia, along the “fertile crescent” led to mutual art and other influences.

A sword of iron was sent as a gift by the Hittite King to the King of Egypt – 1300 B.C. The intercourse too between Egypt and Crete influenced Minoan culture, and in this way Egyptian Art reached the mainland of Greece (Mycenae) and Asia Minor (Troy).

Great architecture has been before now the beginning of greatness into their arts. In ancient Egypt the art of the sculptor, the painter and the architect reached a very high level; but in Greece during the Classical period the beauty of sculpture and of building has never been surpassed.

What is the relation between beauty and goodness? “Those who have produced the most enduring work were men of great intellect as well as of deep feeling. One of the

best examples is Leonardo da Vinci. With him, as with others of the Immortals, there was always a balance between the two sides of his nature. It is rare to find a satisfactory work of art to which we can assign its edification. Milton does not really justify God's ways to man, but we perhaps care more for Him than those who thought he did. Dr Johnson said that Shakespeare "seems to write without any moral purpose" and "is not always careful to show in the virtuous a disapprobation of the wicked." The highest art then does not aim at edification, or, if it does so at all, it does so only in an indirect manner.

Professor Breasted traces the earliest civilization of man to the land of Egypt. It would be presumptuous for an amateur like myself in this subject to contest his conclusions. The magnificent brachiocephalic heads and faces depicted by the sculptors Phidias and Praxiteles belong to a different race and a nobler people than do the dolichocephalic heads and semitic countenances of the Egyptians, as typically represented in the head and face of Tutankhamen. But there is a more important aspect of this question. The "inner light" of the immortal Greeks of the age of Pericles is of a quality, as far as I know, unknown in Egypt. It is the "inner light" of the mind and heart, not the material grandeur of palaces and temples, which is the supreme legacy left to mankind by the Greeks. The moral perfection of the teaching of Hippocrates is a beacon light in every age to the pilgrim student of Medicine and Surgery.

Is Greek civilization indebted in any way to the people of Palestine? Did the first stirring of the waters of noble thought and sublime aspiration among the Hebrews influence the minds of the Greeks? Three hundred years after the time of Homer, and 100 years before the days of Pericles, the great Hebrew prophets, Amos (750 BC), Isaiah (700 BC), and Jeremiah (590 BC), preached to their fellow countrymen that “righteousness exalteth a nation, but sin is a reproach to any people.”

We are as yet only on the borderland of knowledge with regard to the ancient Orient, and strangely little has been discovered concerning the surgery practised amongst those ancient peoples. We know much of the triumphs of Greek surgery; but we do not know how, when, or if the Orient contributed to this knowledge.

If one was inclined to arraign the findings of those who have described the slow unfolding of the life of man from the most ancient times, it would be to mention the little importance attached to the gradual ascent of medical and surgical knowledge.

“The first man Adam was made a living soul.”

Man appears at last, His long triumphant march begins. The earliest effort to relieve pain and suffering, the dawn of service and of sacrifice, was a moral advance as momentous as any material gain secured by the discovery of metal. It was a gleam of a great tide of light amid the encircling gloom. It gave to the first Adam, amidst his hunting and fighting, a glimpse of the quickening spirit of that last Adam, who came to heal and to save. It was a prophecy of a day which was to come, when steel, so long the enemy of life, should become in the surgeon’s hands the enemy of death.

Surgery is the oldest branch of the healing art, for injuries must have been common events in the lives of our most remote ancestors; it is indeed coeval with man himself. The poetic fancy of the late Dr Weir Mitchell, a great American poet, physician and philosopher, describes the dawn of surgery:

“The Hunt is o’er – the stone-armed spears have won,
Dead on the hill-side lies the mastadon,
Unmoved the warriors, their wounded leave,
The world is young, and has not learned to grieve.

But one gentler sharer or the fray
Waits in the twilight of the westering day,
Where, ‘neath his gaze, a cave-man, hair, grim,
Groans out the anguish of his mangled limb.

Caught in the net of thought the watcher kneels,
With tender doubt, the tortured member feels,
And first of men a healing thought to know,
He finds his hand can check the Life’s blood flow.”

PREHISTORIC TREPHINING

As a tribe evolved into a nation, some empirical knowledge of the effects of injuries and some skill of their treatment must have arisen, to be handed down by tradition to succeeding generations. No written record of this early tribal surgery has reached us, but the evidence of the ancient skulls shows that trepanning was practised in prehistoric times. The operative cranial openings are frequently to be found over the site of the representation of movement on the cerebral cortex.

It is of surprising interest to note that thousands of years before trephining was deliberately employed for the treatment of organic diseases of the brain a decompressive craniectomy was performed in many parts of the world as a therapeutic measure:

1. For pains in the head
2. For fits.
3. For insanity (the Biblical disease possessed of the devil), and
4. For fracture of the skull.

GREECE

Greek surgery is the earliest of which we have a definite record. The operation of trepanning in the time of Hippocrates seems to have been carried out in an admirable manner. The use of wine and honey in the treatment of wounds was conducive to the success of operations.

In my early days history commenced with Homer. Today the origins of Greek civilization go back at least to 3000-4000 B.C. The Minoan culture of Crete goes back to Neolithic man; the excavations already made life over neolithic strata which are of a date at least 9000 B.C. It is possible that the more perfect methods of trepanning practised by the Hippocratic surgeons had a direct and continuous descent from the primitive operations of the Stone Age.

Homer does not give us the first struggle of a rising Hellas but rather an epitome of the wonderful pre-Homeric Greece. The centuries following Homeric times seem to be an interval of medievalism standing between the time of the ancient splendour and the birth of the classical period. There is a rhythm in human affairs, an alternation of efflorescence, decay, and efflorescence again. We know nothing as yet of the surgeons of the Grad Age in Crete and in Mycenae.

AESCULAPIUS

The history of Greek surgery commences with the Story of Aesculapius. This story has some facts for a basis. It dates from 1250 B.C. From Aesculapius to Hippocrates there was probably a continuous tradition of surgical knowledge. After his death Aesculapius was worshipped as a divinity all over Greece. His temples, built for the most part on wooded mountain slopes near mineral springs, became popular sanatoria.

Among the Hebrews at a later date it seems to have been the custom for the sick to be brought to the Temple and the synagogues, near some of which were springs of healing waters. In the Scriptures, for example, we read of the pool of Bethesda and that of Suiloam where miracles of healing occurred.

HOMER AND HIPPOCRATES

Homer lived about 900 B.C. Homeric surgery is chiefly descriptive of the treatment of wounds, those e.g. of the heart are well described. About four centuries after Homer, Hippocrates lived and worked. He was born at Cos. He travelled widely and taught and practised at Athens. The prophecy of Daniel, "Many shall run to and fro, and knowledge shall be increased," was little more than fifty years old at the time of his birth. He lived in a great age and had for his contemporaries Pericles, the famous statesman; the poets Aeschylus, Sophocles, Aristophanes and Pindar; the philosopher Socrates, and his disciples Plato and Xenophon; the father of history, Herodotus, and his rival Thucydides; the sculptor Phidias, and many other distinguished men.

Philosophy, poetry, literature and sculpture found in these great minds their most perfect exponents. The father of medicine was therefore the worthy product of his remarkable age. The genius which culminated in the Golden Age of Greece could hardly have left medicine without her Hippocrates; the harmony otherwise would have been incomplete. The philosopher, Aristotle, was of the next generation.

At this period other regions of the earth were remarkable for moral and intellectual development; for the religions of Confucius, Gotama Buddha and Zoroaster were flourishing during the Hippocratic era.

The Hippocratic writers remain patient observers of fact, sceptical of the marvellous, eager always to generalize from actual experience; calm, faithful, effective servants of the sick. The glimpse that we have of Hippocrates is very dim and distant, yet we cannot exaggerate the influence on the course of medicine, and the value for physicians of all time of the traditional picture that was early formed of him, and that may indeed well be informed again from the works bearing his name. In beauty and dignity that figure is beyond praise. Hippocrates will ever remain the type of the perfect physician. It is a figure of character and virtue, which has had an ethical value to the medicine-men of all ages, comparable only to the influence exerted on their followers by the founders of the great religions.

Hippocrates' knowledge of injuries of the head was very complete, and his method of performing a craniectomy was much like that employed at the present time. In some cases he recommended operation in order to "slacken the tightness of the head." He recognised that a blow on one side of the head was sometimes followed by convulsions or paralysis of the opposite side.

Hippocrates recommended the use of the trephine as a cure for incipient blindness without evident disease of the eye. Thus he may have seen and relieved optic neuritis. Operation is also suggested for certain acute conditions, probably meningitis. The seed dropped by Hippocrates did not germinate in regard to the treatment of

amaurosis without visible ocular disease, and in regard to meningitis, till our own time some forty years ago.

The lasting service rendered by Persia was in giving a home to Greek medicine and surgery. The knowledge thus preserved was passed on to the all-conquering Arabs.

THE ALEXANDRIANS – CELSUS

When Greece lost her intellectual supremacy and independence, the centre of literature, philosophy and science was shifted to Alexandria. After Alexander's death, Alexandria with the Egyptian portion of his empire fell to Ptolemy Soter (323 B.C). Under this monarch the famous school was founded where anatomy was systemically studied. Our only important source of information concerning the surgery of the Alexandrian period is Celsus (A.D. 30), who lived in the reign of Tiberius. The Imperium Romanum is more noted for military science, civil engineering and law than for the healing art. Greek surgeons were of repute, however, in ancient Rome. The Greek spirit made for culture; the Roman for the unfolding of strength. From Celsus we infer that the brilliant anatomy of Alexandria made for good practice in surgery and for advance in surgical diagnosis. He described the operation of trephining and expressed the opinion that in some cases it must be done even when there is not fracture of the skull.

GALEN

Galen (A.D. 150) owed much to his knowledge of the Hippocratic writings and to the human anatomy taught in the Alexandrian Schools. As far as we know, he was the first experimental neurologist.

The knowledge collected in the Alexandrian Schools was in great part lost, in the burning of the Alexandrian libraries, in the burning of the Royal library of Tripoli, and in the wars and tumults in the early centuries after Christ. From the date when the learning of Alexandria was lost till the rise of the famous sixteenth-century school of anatomists, a period of 1000 years passed by during which the spirit of man was content without anatomical or physiological enquiry.

THE ARABS

Such Greek surgical learning as survived the general wreck of knowledge was preserved by the Arabs, and in Europe in the monasteries. The wonderful conquests of the Arabs were followed by an intellectual activity hardly less wonderful. "A Byzantine Emperor was astounded to find that the right of collecting Greek manuscripts was among the terms dictated by a victorious barbarian. The Caliphs, by purchase, conquest and exchange, possessed themselves of countless precious manuscripts, which they caused to be translated. Of the books enumerated in the Index (A.D. 987) it is not an exaggeration to say that not one in a thousand now exists. The Mongols, "that detestable nation of Satan, "poured forth like devils from Tartarus and did their work only too thoroughly." The destruction of the Arabic

collection of manuscripts in the Library of Wisdom at Baghdad (A.D. 1258) can only be likened to the burning of the libraries of Tripoli and Alexandria.

“The teachings of the most eminent physicians of ancient Greece, notably Hippocrates, Galen, Oribasius, Rufus of Ephesus and Paul of Aegina, by the diligence and learning of the great translators were rendered accessible to the Muslim world.”

“It was in the middle of the eighth century of our era, and through the then newly-founded city of Baghdad, that the great stream of Greek and other ancient learning began to pour into the Mohammedan world, and re-clothe itself in an Arabian dress.”
“The philosophers of Constantinople were amazed by the appearance of Muslim writers, whom they styled with reluctant admiration ‘learned savages,’ whilst the cultured Christians soon came to look upon the wisdom of the Saracens as something more than human. It was the people (the Arabs) who now took from the hands of unworthy successors of Galen, Celsus and Hippocrates the flickering torch of Greek medicine. They failed to restore its ancient splendour, but they at least prevented its extinction, and they handed it back after five centuries, burning more brightly than before.

During the Golden Age of Arabian learning, between A.D. 750 and A.D. 850, the Mohammedan Empire extended from Baghdad on the Euphrates to Andalusia in Spain on the banks of the Guadalquivir. In all the great cities occupied by the Arabs, hospitals were founded. A patient leaving the hospital at Cairo was presented with a piece of gold. Our whole population would be crowding into the hospitals if that custom now obtained.

MEDIEVAL EUROPEAN MEDICINE AND SURGERY

“Civilization, if we look only to Europe, its chief seat, has grown continuously like a tree since the beginning of history, but with one bad break, the centuries which followed the destruction of the West Roman Empire. It took a long time to make good the losses suffered in that period of barbarism. The legacy of Greece, except for some parts of it which were irretrievably lost, was taken up again at the Renaissance, and has been at work amongst us ever since, inspiring the love of clear thinking, intellectual liberty boundless curiosity, and a certain sanity of outlook, which hitherto have not been found except in civilizations which have drunk from Greek sources.

In our own country and in other parts of Europe such learning as survived was preserved in the monasteries. Benedict, the Saint of Subiaco, founded the monastery of Monte Cassino in 540, and from this the Medical School of Salerno is said to have originated. Constantine Africanus was the first to make known to Western Europe the learning of the Arabs through the medium of the Latin tongue.

In the thirteenth, fourteenth and fifteenth centuries the operation of trephining appears to have come again into vogue. Guy de Chauliac, 1363; Pare, 1516, Andreas a Cruce, 1573, and many others, published works with illustrations crude and dreadful as compared with the Hippocratic method.

In the thirteenth century two Continental surgeons, Theodoric and Henri de Mondeville, lived and worked. They were forerunners of the great Lister. What was Theodoric's message? He wrote; "For it is not necessary as Roger and Roland have written, as many of their pupils teach, and as all modern surgeons profess, that pus should be generated in wounds. No error can be greater than this. Such a practice indeed is to hinder nature, to prolong the disease, and to prevent conglutination and consolidation of the wound". (Book ii. C 27.). In principle, what more did the great Lister say than this?

Wine was used as a dressing; oils and salves were rejected.

Henri de Mondeville wrote: "If treated on Theodoric's and my instructions, every simple wound will heal without any notable quantity of pus. Many more surgeons know how to cause supuration than how to heal a wound." Henri de Mondeville made a hard fight for the new principle, but the advocates of suppuration won all along the line. It was 600 years before the wound doctrine of Theodoric and Henri de Mondeville became current practice.

THE REVIVAL OF ANATOMY AND FURTHER ADVANCES IN KNOWLEDGE

In the sixteenth century the great anatomist surgeons, Vesalius, Fallopius, Eustachius, Paracelsus and Fabricius Hildanus lived and worked. In the seventeenth and early part of the eighteenth century many great men lived: Willis, Sylvius, Valsalva, Morgagni, Jean Louis Petit and Pervival Pott. In the period lasting from the thirteenth to the middle of the nineteenth century no striking improvement occurred or could have been expected to take place in the practice of surgery; but certain great discoveries and re-discoveries, such as the circulation of blood, and the use of the ligature for the arrest of bleeding, were made, and the knowledge of human anatomy and gross morbid anatomy was also greatly extended.

THE ZENITH OF PRE-LISTERIAN SURGERY

During the first seventy years of the last century the art of the practical or pre-Listerian surgeon reached its zenith. I may mention a few names – Guthrie, who gained great experience during the Peninsular War; Baron Larrey, the great Surgeon of Napoleon's armies, Astley Cooper, who first tied the abdominal aorta; Dupuytren, the great Paris surgeon; Cheselden, who cut fifty men for stone without a fatality; Brodie, Syme, and that master of his craft, Fergusson. The great morbid anatomists, Auvert, Cruveilhier, Bright, Lebert, Hooper and Carswell lived through the same period, and each has left us volumes of beautiful illustrations of disease. On the sure foundation laid by such patient pathological investigations, the more perfect clinical diagnosis of the present day has been built up, and advances in surgery have in great measure been made possible.

Baron Larrey and Guthrie were military surgeons with an unrivalled experience of the wounds of war. They worked very hard and both were often exposed to danger on the battlefield. They laid down and practised the principles of the treatment of gunshot

wounds which were, in many phases of surgical work during the Great War, a sure guide.

Guthrie was an historian of the battles and of the surgery of the Peninsular War. He served also in Egypt and attended many wounded after the Battle of Waterloo.

Guthrie had perhaps more of a scientific bent of mind than Larrey. He writes: "Surgery is never stationary, and the surgery of the present day must contrive to show that surgery is as much a science as an art."

The wonderful story of the opening of a brain abscess by Dupuytren given in one of his lectures is part of the history of surgery. He writes: "In certain cases of deeply-seated collections we must incise the dura mater and arachnoid, and the brain itself and by this bold proceeding patients have been saved," and again, "I incised the dura mater; nothing came out; I thrust a bistoury cautiously into the brain and there welled up immediately a flood of pus. That very night all the symptoms disappeared, and the patient recovered."

THE EPIC OF NEUROLOGY

Before 1880 the Surgery of the Brain and Spinal Cord as a science did not exist. A real knowledge of the physiology and of the anatomy of the central nervous system was lacking. It was not enough, for example, to know that the syndrome of headache, vomiting and choked disc probably indicated the presence of a brain tumour; or that the Brown-Sequard syndrome consisted in motor paralysis on the ipsilateral side, which dissociated anaesthesia on the contralateral side.

When I was elected to the staff of the National Hospital, Queen Square, in 1890, I came into contact with several remarkable men; and for the first time had the privilege of personal acquaintance with Hughlings Jackson and David Ferrier, both of whom had taken a leading share in the rise of the Epic of Neurology.

Hughlings Jackson was a clinician and philosopher with a mind endowed with Hippocratic insight and wisdom. David Ferrier was a clinician and experimentalist; the results of his experiments prepared the ground for the immense progress attained in the coming years. This progress was sided by the routine employment of certain instruments of precision and by other means, some of which may be noted:

1. *Clinical Examinations:* Already in 1890 most careful and repeated clinical examinations were made and recorded. Clinical examination, with its many adjuncts, is still the most important means at our disposal for recognising the slow ingravescent advance of a case of cerebral disease, and of making an accurate localising diagnosis and prognosis. Several observers described *reflexes* which are now investigated in the routine examination of cerebral and spinal cord cases. It is well to remember that a sign or symptom not observed, is not a sign or symptom not present.

2. *The Ophthalmoscope.* In 1847 Babbage, a mathematician, demonstrated to Wharton Jones that the interior of the eye could be seen by means of a small mirror from the centre of which a small portion of the silvering had been removed. In 1848 Helmholtz, a military surgeon, not an ophthalmologist, devised the first ophthalmoscope. In 1860 von Graefe pointed out that blindness when occurring in a case of cerebral tumour was not, like the palsy, the direct effect of the lesion, but the secondary result of the optic neuritis. When I entered St Thomas's Hospital in 1875, Liebreich was ophthalmic surgeon and the ophthalmoscope in use was Liebreich's. Liebreich was an artist, musician, and ophthalmic surgeon. It was commonly reported among the students that he had a flair for performing the operation for cataract by moonlight. Hughlings Jackson, in 1863, 1865 and 1866 published four papers on "Defects of sight in diseases of the nervous system." These papers are of surpassing interest in that they set forth the slow unravelling of the truth with regard to the nature and cause of optic neuritis of intracranial origin. He urged that routine ophthalmoscopic examination should be made in all cases of severe cerebral disease, whether the patient complained of defect of sight or not. He described the association of headache, vomiting and optic neuritis in cases of cerebral tumour, and laid great stress in the fact that the chief disease in a cerebral case, in which anaurosis is a symptom, rarely involves the optic nervous system. "It is just as important," he adds, "to determine whether a patient's blindness depends on choroiditis, apoplexy of retina, or neuritis; as whether his bad talking depends on incoherence, defect of the faculty of language, or paralysis of the tongue." Since the time of von Graefe and Hughlings Jackson the ophthalmoscope has undergone innumerable modification and improvements. It is now an instrument of precision in universal use.

3. *The Perimeter.* It was von Graefe who was the first to recognise the value of the study of central field defects on a flat surface. The perimeter in its modern dress determines with accuracy the visual powers of different parts of the retina. In the *Lancet* of 6th July 1872, Brudenell Carter, ophthalmic surgeon of St George's Hospital, described an improved perimeter for measuring the field of vision. He remarks that the early attempts for measuring the field of vision were rude and primitive, and narrates the efforts of Professor Donders and of Forster of Breslau to improve the instrument. Donders pointed out that the central fixing point was nearer the eye than any lateral portion of the surface – Forster obviated this defect by attaching to the pillar a semicircular iron bar. It is not possible to overstate the gain won by the routine use of the perimeter. The observation, for example, of the progressive changes in the fields in patients with pituitary, occipital lobe, and temporal lobe tumours, furnishes a sign that is pathognomonic of the site of disease.

4. *X-Ray Photography* has also been a fruitful aid to the neurological surgeon. Dr W W Keen in 1905 employed this method of examination

and discovered an intracranial clot. In 1933 Lockett saw air in the ventricles in a case of fracture of the skull, and in 1918-1919 Dandy used ventriculography in the study of cases of hydrocephalus and brain tumour. In 1925 Naffziger demonstrated the “pineal shift” as a method of locating certain supra-tentorial tumours.

5. *Transfusion of blood* before, during and after operation. Infusion of a 6 per cent, solution of gum acacia. Cushing in a paper in the *Annals of Surgery*, 1916, on “Haemostasis in brain Operations,” refers to the employment of Horsley’s wax, living muscle pledgets and silver clips. Horsley published in the *Brit. Med. Journal*, July 1914, a note on “Haemostasis by the application of living tissue.” It would seem that Cushing and Horsley discovered independently the value of muscle pledgets. Vaughan, in 1907 – *Journal of American Medical Association* – recommended the use of minute fragments of soft tissue to arrest bleeding.
6. *Lumbar Puncture* was first done by Quincke in 1891, and for meningitis serosa in 1893. The circulation of the cerebro-spinal fluid during the last twenty years has been intensively studied, and the knowledge thus gained has led to much therapeutic advance. For example – the discovery by Weed that the intravenous injection of hypertonic saline caused a prompt diminution in brain volume was at once adopted as a means of lowering intracranial tension in desperate cases. Again, a decompression operation was not directly performed for the relief of optic neuritis prior to 1890. The subsidence of the swelling of the disc, following operation for brain tumour, was noted, especially after a large escape of cerebro-spinal fluid occurred when the craniectomy had been done in the cerebella region. It was James Taylor who contributed the first paper “on optic neuritis in its relation to intracranial tumour and trephining” in 1894. From this date decompression became a recognised operation for the relief of choked disc and optic neuritis, in order to prevent atrophy and blindness. Cistern puncture has been used for diagnostic and therapeutic purposes, and later there has come the introduction of lipiodol.
7. *The Study of the Ductless Glands and of their Secretions* has been of the greatest importance to neurology. The pituitary body is perhaps the most important of these from the point of view of surgery.

Sir E Sharpey Schafer’s Lane lectures, 1913, give a wonderful record of present knowledge in this department of science. Dr Halsted’s papers on the surgery of the thyroid, parathyroid and thymus glands, published in *Surgical Papers* in 1926, are for ever valuable. Cushing’s Cameron lecture on “the pituitary gland as now known” in 1925 is a perfect exposition of the subject in the author’s inimitable style.

8. The demonstration of the *Segmental Distribution of the Sensory Roots* of the cranial and spinal nerves was a wonderful aid in the localisation of injuries and tumours.

Turk (1856) first detected a segmental arrangement in the cutaneous area supplied by the sensory roots. My knowledge was chiefly gleaned from the experiments of Herrington (*Proc. Royal Society, 1892*) and late papers), some of which I witnessed, and the researches of Henry Head. In Luciani's *Physiology*, vol. Iii. P.301, a full description of the slow ingravescence of truth in the subject is found. The first meningeal spinal tumour was removed by Horsley in 1888. Spiller in 1911 suggested that in some cases relief from suffering might be attained by cutting that part of the anterolateral column of the spinal column which conveys impulses provocative of pain. The knowledge of the true significance of the nerve tracts in the spinal cord was thus put to the humanitarian purpose of relieving pain, and the study of anatomy on the right lines is seen to raise the standard of the science and practice of surgery.

9. Recently two surgical instruments of great ingenuity and usefulness have been invented. (1) The *Souttar instrument for performing a craniectomy* with speed and gentleness; and (2) the *Bovie-Cushing electrical instrument* for removing neoplasms of the brain; but it clearly may be employed with advantage in other regions of the body. The Bovie loop is a bloodless method of dealing with vascular tumours. The loop acts by dehydration of the tissues and not by burning.
10. *Cerebral Localisation.* David Ferrier recreated the science of experimental neurology lost to mankind since the days of Galen. His first paper was published in 1873, but it was not till the meeting of the International Congress in 1881 that the doctrine of cerebral localisation was generally accepted. Hippocrates knew that contralateral paralysis was caused by injury of the cerebrum. Larrey was the first to note ipsilateral paralysis in injury of the cerebellar hemisphere. There are many clinical cases in early literature which pointed to localisation of function:

Peter de la Marchettis in 1665 and Moulins in 1677 each operated successfully on a meningocortical abscess causing headache and epilepsy. Morant, in 1752, operated with success on a monk, aged 51 years, for temporo-sphenoidal abscess. *Baron Larrey* and *Astley Cooper* relate cases of traumatic epilepsy cured by operation. Cruveilhier in 1829 diagnosed a tumour of the right frontal lobe. The symptoms noted were: frontal headache, weakness of the left leg, slow speech, mental enfeeblement and involuntary micturition. Heyman in 1831 successfully removed a tuberculous tumour which was causing tremor and weakness of the contralateral hand, and epileptic fits. In 1862 Broca showed at the Anthropological Society of Paris the brain of a man who for twenty-one years had lost the faculty of speaking. There was softening of the third left frontal convolution. Fritsch and Hitzig in 1870 marked out certain centres in the brain by means of electrical stimulation, but Ferrier soon left this work far behind by precisely charting certain centres for movements and special sense.

Following on Ferrier's demonstration of the truth of the doctrine of cerebral localisation in 1881, a great activity in experimental work designed to elucidate the anatomy and physiology of the central nervous system was carried out. The names of Horsley, Schafer, Sherrington, Beever, Spencer, Gotch and Mott naturally occur to the mind in this connection. Time will not allow me to give even the scantiest reference to the great volume of clinical and experimental research on the brain and spinal cord which since that date has continued in an ever widening and fruitful stream. A few other names, however, must not be omitted: Charcot, Pierre Marie, Langley, Gaskell, Dejerine, Gowers, Alexander Bruce, Byrom Bramwell, James MacKenzie, Howard Tooth, Charles Mills, Henry Head, Oppenheim, Krause, Spiller, Archibald Young, Stopford, Weisenberg, Elsberg, Dana and Starr. Also the great microscopists Golgi, Ramon y Cajal, Bielchowski and Weigert.

Ferrier in 1883 said "that up to that time cerebral localisation had been absorbed like latent heat by medical science itself, as distinct from medical and surgical practice, but that the unfailing safety of experiments on animals made it clear that similar results would soon be achieved on man himself." Godlee removed a brain tumour in 1884, but the early pioneers in this department of surgery were Macewen, Horsley, Keen and Ernst von Bergmann. Some ten years later the profession began to be attracted by the contributions of Harvey Cushing and Charles Frazier to the physiology and surgery of the nervous system. During the last twenty years an increasing number of brilliant younger scientists, physicians and surgeons have devoted themselves to the study and operative treatment of diseases of the nervous system. The present progress and the future of neurology are in their sure care. Some I have the privilege of calling friends and colleagues. A few names may be mentioned:

Wilfred Trotter Percy Sargent, Gordon Holms, James Collier, Purves Stewart, Aldren Turner, Armour, Hugh Cairns, Greenfield, Bathe Rawling, Walshe, Riddoch, Julian Taylor and Symonds of London. Aidson, Craig and Learmouth of the Mayo Clinic, Rochester, Minnesota. Jefferson of Manchester, McConnell of Dublin, Dott of Edinburgh, Forster of Bteslau, De Martel of Paris, Penfield of Montreal, Martin of Brussels, Bronwer of Amsterdam, Naffziger of San Francisco, Grant of Philadelphia, Bailey of Chicago, Harvey of Yale University, Dandy of Baltimore and Horrax of Boston. A list of the important papers on the physiology and surgery of the nervous system printed during my surgical life cannot be given. The number is too great. Sherrington's contributions alone number over 150. The risk of drawing attention to a few classical papers is that others equally important may be omitted. The references in Brain and Strauss's "Recent Advances in Neurology" are so full that the attempt to make a new list is unnecessary.

The one certain thing of the future is that the neurological surgeon must be a trained physiologist before he begins to operate on the nervous system of man. The physiology of my early surgical days is being replaced by the sciences of bio-chemistry and bio-physics. The intensive study of the living cells of tumours, as recommended long years ago by Sir James Paget, has already been of striking service in diagnosis and prognosis. Witness the grand labours of the Cushing group concerning the cells of the Gliomas. Cushing quotes the case of the wife of a physician from whose cerebrum he removed what was thought to be a highly malignant glioma. The microscopic report showed it to be a protoplasmic astrocytoma. The prognosis was completely unaltered.

Again, the modern method of tissue culture may prove of service in differentiating malignant, locally malignant and benign neoplasms, and perhaps in other at present unknown ways it may be useful to the surgeon.

It is not sufficient nowadays for a surgeon to be content to perform neurological operations on patients as a part of his work as a general surgeon. No advances can be won by this plan. The science and art of neurological surgery demands the whole life of the surgeon; all his mental and physical energy. A teaching hospital or a university which does not provide a surgical neurological department, self-contained, adequately staffed, and complete with laboratories and research rooms, neglects a splendid opportunity, and fails to provide for the relief and cure of many of the most dreadful diseases to which mankind is heir.

Galen and Harvey were John Hunter's forerunners in the use of the experimental method; but, unlike Hunter, neither left behind, when they passed into the silent world, a great band of pupils and followers to keep alight the fire of experimental research.

John Hunter (1728-1793) was a physiologist, a philosopher and a surgeon. "He was the greatest man in the combined character of physiologist and surgeon that the whole annals of medicine can furnish." This sentence was published in 1835. Hunter awoke to the minds of his pupils a desire to explore the old ground and to unearth truths long concealed by the new experimental method. "There was a spirit of adventure, like that which animated the Elizabethan explorers, the ambition of the human intellect to extend its range of vision and of knowledge. To Hunter belongs the credit of re-discovery of this new world. It was he who lighted the torch. His pupils, like Astley Cooper, were those who first carried it forward in the race, kept it alight, and then passed it on, not only undiminished, but burning with a brighter flame."

Is there anyone in the world of surgery today on whom it may be affirmed that the mantle of John Hunter has fallen? The answer is "Yes". *Harvey Cushing*, in the domain of neurological surgery, is a

physiologist, philosopher and surgeon. He has been a life-long exponent of the experimental method. He and his associates have extended the range of vision and of knowledge in the sciences of physiology, pathology and surgery. His pupils and followers are spreading widely over the world. They are keeping alight the torch of research and practice which they learned in the laboratories and clinics of their chief – *Harvey Cushing*.

It is to the experimental method no less than to the discoveries of anaesthesia and of the microbic origin of disease that surgery and medicine owe so much.

Sir Ronald Ross's demonstration that the mosquito was an essential link in the cycle of the "million-murdering" malaria was of untold value to the human race. The following are the lines which Ross wrote on the evening of the day of his great discovery;

"This day relenting God
Hath placed within my hand
A wondrous thing: and God
Be praised – At His command.

Seeking His secret deeds,
With tears and toiling breath,
I find thy cunning seeds,
O million-murdering Death.

I know this little thing,
A myriad of men will save,
O Death, where is thy sting?
Thy victory, O grave?"

THE EPIC OF SURGERY

When I entered St Thomas's Hospital as a student in 1875 nearly all operations, and they were few in number, were followed by suppuration, cellulitis, erysipelas, septicaemia, or pyaemia. I remember the case of a young man with a varicose infra-patellar vein. It was removed. He was dead in thirty hours. The same marine sponges were used at the operation as had been employed previously in a septic bone case. It was just before this time that some hospitals on the Continent were closed because hospital gangrene and death followed every operative intervention.

The Hotel Dieu of Paris dates from A.D. 650. It was first administered by twelve citizens of Paris under the direction of the Bishop. Every Canon who died or changed his residence was required to give his bed for the use of the sick. Like all other hospitals, it became a hotbed of sepsis, and it was remarked that the inscription over its doors, "This is

the house of God and the gate of Heaven,” was more literally true than its founders appreciated. The evils resulting from want of air space, and accumulation of buildings, made themselves felt, so that, on the occasion of a fire, it was said “let the hospital burn and save the sick.”

Milton’s terrible description of a lazar-house was in large measure still true, especially at some places on the Continent.

“Despair
Ended the sick, busiest from couch to couch;
And over them triumphant Death his dart
Shook, but delayed to strike, though oft invoc’d
With vows, as their chief good and final hope.”

Those who have recently joined the profession cannot in any way realise the paralysis of surgery sixty years ago in the presence of sepsis, tetanus, hospital gangrene and other wound diseases for which there was as yet no means of prevention and no remedy.

I have lived through the most glorious period in the history of science and art of JJJd in t-3.47 Tve12a EM(dcd ov5)7(r)-16(y)20o2(f)-6(a)na(c)4(e)sthixend thi

The science and art of neurology and surgery have in my lifetime achieved what in my student days would have been looked upon as the most magnificent promises of impossibility.

“The source of all good is like an inexhaustible river.” The surgeon may, therefore, garrison his mind with the assurance of a glorious time for his art and science.

“I see my way as birds their trackless way.
In some time, His good time, I shall arrive:
He guides me and the bird. In His good time!”

