XVI. HISTORY OF SURGERY

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The origin of medicine must have occurred contemporaneous with the beginning of civilization. All phases of folk-medicine and ancient medicine have been alike in tendency differing only in minor details. Whether Assyrian, Celtic or American Indian charms and spells, plant lore and psychotherapy served to stave off the effects of supernatural agencies.

If those purposeful instinctive actions which serve to relieve pain or irritation may be considered as medical, being as they are, manifestations of the healing power of nature, then medicine may be considered to extend beyond the beginning of the human race, and exist as animal medicine.

A dog licks its wounds, hides in holes if sick, or injured, limps on three legs if maimed, tries to destroy irritating parasites, exercises and assumes a definite position when sleeping and seeks certain herbs and grasses when sick. Monkeys attempt to check the flow of blood by application of the paw, and are adept in the extraction of foreign bodies, such as thorns.

These primitive actions of animals were no doubt observed by man, and may be considered to have formed the basis of human medicine. Such actions as rubbing, pressure, limping, moistening wounds, and altering the position to relieve pain are instinctive and are performed daily by adults and children.

The commencement of surgery dates from the time when instruments of daily use were used as a means of healing. These were, in earliest times, flints, thorns, splints of wood, shells, fish bones, teeth and horns. With these articles foreign bodies could be extracted, abcesses opened, scarification and blood letting or venesection performed. Hemorrhage from accidental wounds or the normal periodic process of menstruation possibly suggested blood letting as a means of ridding the body of poisons, and was to become a general practice throughout the ages.

Surgery became a science in recent times, not so much through individual skill or specialization of instruments, as through the introduction of two new factors, anesthesia and antisepsis. Experience of injuries may have originated the idea of operations and surgical dexterity developed with the improvement of instruments during the copper and bronze ages. Treplimed skulls from the neolithic period have been found on the

European continent, in Algiers, North and South America and Mexico. These skulls show well defined trephine holes which proves that the operation had been performed two or three times on the same individual. The indication for trephining may have been headaches or mental disorders. Wounds were dressed with moss or fresh leaves and when poisoned treated by sucking or cauterization. Cupping was performed with horns of animals.

Primitive medicine is inseparable from primitive religious beliefs. Man worshipped the sun, moon, stars, rivers and animals which were later represented by stone images and so began fetish worship. Disease in particular was regarded at first as an evil spirit or the work of such a spirit and to be appeased by sacrifice. Later disease was regarded as something possessed by a human enemy possessing supernatural powers. These he attempted to destroy by spells and sorcery. Nightmares and dreams might have suggested a spirit world apart from his own and disease as a result of the offended spirits of the dead, whether animal, plants or man. With these beliefs came the medicine men and witch doctors. It was only to certain individuals of the tribes that this power was entrusted, through secret knowledge and mystical art of being in touch with the spirit world, finding off demons and communicating the means by which an enraged spirit could be pacified. The "wise women" also appeared about this time and followed herb therapy and midwifery. These women

observed and soon realized that a number of poisons were also remedies under various conditions.

The amulet is the oldest form of preventive medicine, and originated in the blief that the possessions of portions of another body transferred their functions to the possessor and reinforced healing. Demonism constituted the theory and magic the practice, diagnosis and prognosis were derived only from visions and interpretations of dreams or by the consultation of the oracles. Amongst the latter, inspection of the intestines was important and led to a rudimentary anatomical knowledge.

The use of sporific potion for anesthesia is first mentioned in the Bible in the second chapter of Genesis twenty-first verse: "And the Lord God caused a deep sleep to fall upon Adam, and he slept, and he took one of his ribs and closed up the flesh instead thereof." The virtues of opium, mandrake, henbane and hemlock appear to have been well known to the Greeks and Orientals. The use of extreme dryness, smoke and honey as antiseptics was well known to primitive man as well as the use of narcotics and intoxicants such as alcohol, opium, and hashish.

The lesson of the unity of primitive medicine which is a result to the general proposition of the unity of folklore, is that certain beliefs and superstitions have become

ingrained in the human race through space and time and can only be eradicated through public enlightenment by teaching that prevention is better than cure.

The history of medicine is also the history of human infallibility and error. The history of advancement of medical science, however, is the history of discovery of new and important fundamental principles leading to new views of disease, invention of new instruments, procedures and the formulation of public hygienic ideas.

The development of science has never been continuous, depending greatly upon the current theologic beliefs, human indifference, narrow-mindedness, or some accidental circumstance. Yet ever today, it is possible some of our highly intelligent and highly educated persons will continue to believe in supersititions, consult quacks and favor psychotherapy.

Chap. I

ANCIENT AND PRIMITIVE MEDICINE

In the Nile Valley, approximately six thousand years ago, neolithis man first raised himself above his neighbors and initiated the civilization of the Mediterranean basin that was to dominate the world for four thousand years. It has been said that the discovery of copper in Egypt "forged the instrument that raised civilization out of the slough of the Stone Age."[1]

Our knowledge of Ancient Egyptian medicine is derived from inscriptions, from papyrus and from carefully derived studies of mummies found in the pyramids. Only one great physician stands out during this period--Imhotep, whose fame in magic, priest-craft and medicine achieved such a reputation that two thousand years after his death, he became the god of Medicine whom the Greeks identified with Asclepius.

A papyri known as the Ebers Papyrus and wirtten about 1500 B.C. contained many magical formulas, prayers and prescriptions for treatment of diseases. A crude description of the circulation of the blood was recorded which shows that the early physicians had some idea of physiology, Human dissection being forbidden, the organs of animals sacrificed to the gods were closely studied and described.

Egypt's greatest achievement was in the realm of hygiene and preventive medicine, also pharmacy. Cleanliness of person, house, and city was regulated by law. Defaulters were severely punished. The priests set the example in the strictest rules of personal cleanliness. They bathed four times daily, shaved the entire body every fourth day, and wore white clothing. Pork, beans and onions were carefully avoided because flatulence. The prevention of conception and production of abortion was severely punished. Circumcision was practiced as a rite and performed upon boys between the ages of six to ten.

The care of the body is closely interwoven with the use of cosmetics. Formulas have been found for restoring the hair, painting the eyes, mainly for prevention of conjunctivitis, for perfumes, for keeping the skin smooth and improving the complexion. Devices for preserving the teech such as crowns, and gold fillings were developed.

The art of pharmacy had reached a high development. Instructions are given for the making of gargles, salves, snuffs, inhalations, fumigations, plasters and enemata. Opium, castor oil and the salts of copper were freely used. The study of pharmacy led to the development of many chemical discoveries and the beginning of the science of chemistry.

The main importance of Egyptian medicine is the relation to that of Greece. Through the Egyptinas the employment of primitive magic passed into the background and the foundation laid for the sciences of anatomy, pharmacy, medicine and surgery. Magic occasionally appeared, usually in some contest

between priest and physician, so that the inheritance that Greece received was a mixture of scientific facts and primitive magic.

The Babylonians have very little in advancement of medicine except through the science of mathematics and astronomy. The decimal system and weights and measures originated with them. The Zodiac signs were consulted and the prognosis of disease worked out on this basis. Inspection of the viscera of all animals killed in sacrifice was later used. The liver was considered the seat of the soul, and through it's inspection the course of the disease was predicted.

Babylonian civilization tended to separate the priest and the medical profession. The Hammurabi Code, named after its author King Hammurabi, with its "Eye for an eye and tooth for a tooth" restricted the physicians so and imposed such heavy penalties that medicine was definitely retarded through fear.

Through their great achievements in art, literature, science, social organization and codes of law and equity, a basis of real scientific attainment was reached and passed on to the Greeks and Romans.

The principle interest of Hebrew Medicine lies in its remarkable code of hygienic regulation for the prevention of diseases,which is laid down in the book of Leviticus. This contains the strictest orders regarding contact with infectious objects; the most suitable foods to eat; the hygiene of men-

struation; and the prevention of contagious disease. Circumcision is the only operation mentioned inthe Bible, although fractures were treated and roller bandage used.

Definite instructions were given for the diagnosis and prevention of leprosy, gonorrheal and leukorrhea; precise directions for segregation, disinfection by the scraping of walls, or even the destruction of infected houses or the burning of clothing.

In the Talmud, a text of Jewish civil and canonical law more definite information concerning Hebrew medicine is given. This book indicates considerable knowledge of the dura and arachnoid membranes of the brain, aesophegus, larynx and pancreas. The effect of saliva upon food and the movements of the stomach are also noted.

References to surgery include the treatment of wounds by suture, application of wine and oil, and the freshening of cut edges of old wounds to promote union. Venesection,cupping and leeching were common and there is a mention of giving sorporific potions before major operations. Of these, Caesarian section, removal of the spleen, trephining and operation for imperforated anus were known. Also the use of the speculum and uterine sould which was used to locate the source of the blood was known. Fracture and dislocations were treated and crutches and artificial teeth employed.

Very great progress was made in anatomy, physiology

and pharmacy with a beginning in pathology. Surgery was essentially practical and concerned with the inevitable trauma of peace and war and progressed more rapidly than medicine, which remained confused with the supernatural, fromwhich it has not yet completely escaped.

The medicine of the Indians, if it does not equal the best achievements of their race, nearly does so, and owing to its wealth of knowledge, a systemic construction, takes an outstanding part in the history of oriental medicine.

There are three distinct periods existing in the development of Indian medicine: (1) The Vedic, extending from the first migration of the Hindus to about 800 B.C., (2) The Brahmanistic, representing the Indian Middle Ages, and (3) The Arabic, beginning about 1000 A.D.

The Rig Veda written about 1500 B.B. has the greatest influence so far as medical knowledge is concerned. Most ancient Indian medicine has its centre of gravity in the supernatural, however, many fundamental facts concerning anatomy, disease, the action of medicinal plants, and primitive surgical procedures were known. As was true of all primitive peoples the origin of disease was attributed to the supernatural and treatment determined through magic spells and consultation of the gods.

The Brahmanic period distinguished the physicians from the priesthood and left a wealth of scientific literature. Surgery was hindered because of the theological control which forbid human dissection.

One hundred blunt and twenty sharp instruments were mentioned. To the former belonged the pincers, forceps, hooks, tubes, sounds, etc. Among the harp instruments were knives, saws, scissors, trocars, needles, etc. The instruments were made of steel, the manufacture of which the Indians understood from very early times. These were kept in wooden boxes.

Cauterization, especially with potash, and burning was preferred to cutting because disease thus treated was considered cured and would never return.

Various materials such as cotton, wool, silk and linen was used for dressings. Bamboo and pieces of bark furnished the material for splints. Hemorrhage was controlled by cold compresses and herbs. Wounds of the trachea, head and face were suture. All operations were begun and ended with elaborate religious ceremonies. Anesthesia was produced by intoxication.

All these surgical procedures show a firm foundation of knowledge as well as accurate diagnosis and careful after treatment. The most noted work of the Indian surgeon lay in the domains of laporatomy, lithotomy, and plastic surgery.

Suture of the intestines was done by allowing black ants to bite the injured parts and the bodies then torn off leaving the heads embedded. Plastic surgery was widely practiced because cutting off the nose was widely used as a legal punishment.

Indian medicine possessed a treasure of empircal knowledge and technical treatment, but lacked the freedom of individual action essential to the pursuit of real science,

never the less, their medicine found its way east and west through the channels of commerce, especially by the Arabs.

Chinese and Japanese medicine had little effect upon the progress of medicine, mainly because of their isolation policy and refusal to accept the knowledge of other countries.

Chap II

THE GRECIAN PERIOD

The history of medicine in Greece can be divided into three periods: the pre-Hippocratic period, the classic period of Hippocrates, and his school, and the Greco-Roman period during which the preeminance of Rome attracted all that was best of Grecian scientific attainment.

The influence of Greece upon the history of medicne can be said to have started about 600 B.C. and to have ended with the death of Galen in A.D. 200. This span of 800 years is comparable with the period from A.D. 1100 - 1900, and it is readily understood that from many years of gradually increasing knowledge the complete Hippocratic system evolved.

Up to 1000 B.C. the coastline of the Eastern Mediterranean was occupied by the Minoans. These people were creators of a highly organized civilization, and recent excavations show that they were equal to the Egyptians in cultural development.

This cultivated race was over-run by Greek tribes from the north and the campaign of Troy is the story of the struggle between the Minoan people and the northern invaders.

Two Greek tribes were principally responsible for the early development of scientific medicine, the Dorians, who occupied the islands of Crete and Cos and the Iomians, who settled along the western shores of Asia Minor.

These invaders were subject to three powerful influences: the civilization of the submerged Minions and the highly developed systems of Assyria and Egypt, with which they came into contact along their southern borders. Thus, borrowing from all, the early Greeks rapidly outstripped their mentors and became the true founders of Raternal medicine. From Assyria they learned much of mathematics and astronomy; from Egypt, pharmacy, materia medica and a splendid code of ethical conduct. They also inherited the supernatural elements of primitive medicine, which the intelligent and clear thinking Greek scientist soon disregarded.

The Dorians and Ionians soon settled and began consolidating the material which they drew from many lands and also began to develop the Grecian system of medicine. The medical schools of Cos, Endis and Epidaurus were founded. These schools which combined the advantages of hydrotherapy, gymnasia and other physio-therapeutic methods with religion, centered round Asclepius, the god of Medicine, whose insignia of the serpent and staff is the emblem of the medical profession.

At Epidauras, a mountainous district in southern Greece, a school was established that afterwards became onf of the most famous of the Greek Medical Schools.

The temples to Asclepius were located at places suitable in every way for hospital and sanitorium purposes, usually in the vicinity of hot or medicinal springs and remote fromthe

disturbing influences of urban life.

Commingled with their medical work remained many elements of magic and upon arrival to these temples, the patient had to undergo a careful preparation by prayer, sacrifice, purification with baths, massage and inunctions.

During the night the priests visited the patients and gave medical advice to those awake. To those asleep the instructions came as a dream which was interpreted by the priest who then prescribed catharsis, emesis, bleeding, or such remedy as seemed suitable.

After successful treatment a thank offering was given to the god. This usually consisted of a model in silver or gold of the diseased part and a tablet stating the history of the case to hang in the temple. These tablets show that patients affliced with paralyzed limbs, ophthalmic disorders, sword and spear injuries, gastric ulcer, empyema, and vermin infestation were treated in these sanitariums.

In such surroundings and with such opportunities the medical education of Hippocrates began. His clear mind, plenty of ambition and capacity for taking infinite pains, enabled him to take advantage of the clinical material at his disposal to probe deeply and accurately into the origin, course and destiny of disease.

He was born on the isle of Cos in 460 B.C. He received his early education and medical training from his father in the precincts of the Asclepius temple and School of

Cos; later he studied at Athens and then traveled and practiced in Thessely, Thrace and Macedonia.

Hippocrates pre-eminence in the world of medicine is due to three facts.

1. He separated medicine from theology, priest craft and physiology.

2. He reduced the irregular records and vagrant knowledge of the Asclepoids to a systemic science and authentic clinical notation.

3. He gave to all future physicians the highest moral inspiration. It was necessary for Hippocrates to escape from the mystical atmosphere of the semi religious schools of his youth. In this he was assisted by his father, also a physician, but very soon he proved himself an original thinker.

The method of Hippocrates was essentially that of the bedside: it was one of experience rather than experiment. He was the exponent of "tactus eruditus" which is today in danger of being replaced by mechanical aid to diagnosis.

Hippocrates developed the system of thorough case taking. For the first time a carefulsystemic examination of the patient was faithfully recorded, his facial appearance, pulse, temperature and respiration, excreta, sputum, localized symptoms and movements of the body. The elaborate case records we find now in our modern hospitals with the reports from bacteriologists, hematologist and radiologist, are the logical outcome of the work of Hippocrates three and one half centuries before the Christian era.

Hippocrates advocated clean hands and nails and

boiled water for operations, recognizing that wounds should heal without suppuration, and so visualized aseptic methods in surgery.

His description of the facial appearance of a person in danger of death from disease was so accurate that we still call it the "Fauis Hippocrates". He noticed that the shoulder joint is commonly dislocated downwards, and his method of reduction wasthat of modern usage. He also noticed and described congenital dislocations and observed the association of tuberculosis of the lung and curvature of the spine.

Hippocrates wrote many books on all phases of medicine and surgery. Through his influence surgery stood at a very high level. Nowhere more than in this branch could careful observation of nature achieve such triumph, whenever faulty anatomical knowledge did not stand in the way. The anatomical knowledge of the Hippocratists was derived chiefly from dismemberment of animals, experience in slaughtering and sacrifices and from observation of surgical cases. Systemic dissection of the human body was out of the question owing to the religious precepts which strictly enjoined immediate burial, and too, the superstitious horror of the dead which then prevailed. The bodies of savages, traitors and criminals were outside the scope of religious ordinances and were therefore available, as were also accidentally obtained portions of the body.

The diagnosis and treatment of disease and injury

of the osseous system served as a pattern for our modern orthopedic surgery. Also the treatment of wounds in which antisepsis was already recognized and the art of bandaging which knew how to combine usefulness with a regard for appearance.

With admirable courage the surgeons undertook trephoning, thoracentesis, abdominal paracentesis, nephrectomy in abcess of the kidney and such operations like those for hemorrhoids, fistula in ano where either no appreciable loss of blood was caused, or which could be carried out in a bloodless manner. Extripation of large tumors and amputations were performed even though the most important of all haemostatic methods, ligature of the vessels, was still unknown. Means of arresting hemorrhage were in addition to various styptics, elevation and compression, bandage, and sometime, actual cautery.

In the treatment of surgical infections besides purgation, venesection and diet, there were employed such medications as salves, plasters, poultices, cauterization, cupping scarification and a variety of appliances such as splints. Special instructions were given upon the position of the patient, attitude of the physician, duties of the attendants, regulation of light, diet and exercise, correct application of bandages, compresses, splints, etc. Among the instruments used were sponges, cupping instruments, probes, spatulas, hooks, needles, lancets, trephines, cannulae attached to bladders of animals for syringes, rectal specula, punches and dental

forceps. Instead of metal cautery, wooden instruments or sponges soaked in hot oil were used. Enema syringes were animal's bladders filled with quills as nozzles.

It was considered a lack of surgical dexterity if the presence of purulent exudate was not noted in a wound or abscess, or if the presence of stones in the bladder could not be determined after passing a catheter into it; or if, in cutting or burning, one should make a mistake and cut too far or unnecessarily.

Hippocrates, therefore, stands at the confines of two epochs, rooted in the remotest past, yet providing direction and a goal to the immediate present. He still exercises upon mankind a wonderful unbroken power by means of his temperate observations, his far seeing methods, and therapeutic principles, which deprived from nature and opposing no progress, are themselves surpassed.

Hippocrates writings and followers influenced the development until the time of Galen.

Galen was born at Pergamus in A.D. 131. He was the son of an architect, who encouraged him to study medicine. He began his education at a famous medical school in Pergamus, but later took post-graduate studies in Smyrna and Alexandria. Returning home, he was appointed surgeon to the gladiators, but in A. D. 162 he went to Rome, where he rapidly attained to great professional success and fame.

He is considered the greatest of the ancient physicians after Hippocrates. Hippocrates was a devout sincere, seeker of the truth, a careful and minute observer. He faithfully recorded the symptoms presented and attempted to elucidate first principles by surveying the entire clinical picture. He was not influenced by any motive of self-gain.. He calimed no remarkable cures, but was satisfied with the exposition of fundamental facts.

Galen, a hard worker, experimentally and clinically, a great writer, a discoverer of many new things, was officious.

He was successful and a fashionable practitioner, a man of the world, witty and arrogant. For any clinical problem he was always ready with an explanation based upon his conception of physiological function. Having worked out a theory of pathology on the humors, fire, water, earth and air, to which he added his own conception of a spirit penetrating all parts of the body, he argued backwards fromtheory to fact, being ready always to explain everything. This dogmatism had a fatal effect upon medical science as for 1,400 years all problems were referred back to Galen as the last court of appeal, with a resulting stagnation of medical thought and progress.

He was a gay, quick witted, self-confident and efficient physician, enjoying a fashionable practice and royal patronage. His first introduction to court practice was his successful cure of the Emperror Marcus Aurelius of a stomach ache.

In anatomy he was hampered by restrictions upon dissecting and his studies were mainly on apes and pigs although at Alexandria he learnedsomething of human anatomy and osseotology, his limited diesections resulted in many errors in his writings which remained unaltered and accepted until the time of Vesalius.

Unlike Hippocrates he was no upholder of merely passive forms of treatment, but used drugs very freely. Among the most important of his observations and findings are the four classical signs of inflammation--dolor, rubor, calor and temor, the difference between pneumonia and pleurisy, the recognition of various types of tuberculosis of the lungs and its communicability, and the suitability of a dry climate and milk for treatment.

Although restricted as an anatomist, he was the first of the experimental physiologists, and must be recognized as the Father of Research Methods in Medicine.

He just missed discovering the circulation of the blood. Prior to his time the arteries had been thought to contain air; this Galen disproved and showed that, like the veins, they contained blood.

He saw that venous blood was dark and concluded that it was rich and served for the nutrition of the body. He assumed that the products of digestion from the stomach and intestines passed into theliver to be elaborated into rich nutritional blood which was distribued by the vena cava. This constituted a closed venous system, including the right

side of the heart. The left side he considered the center of another system containing bright blood which distributed heat to all parts of the body.

Apart from the work of Galen and the Greek physicians, Rome cannot be credited with any definite advances in scientific medicine, but she may justly claim to have put on an organized basis the provision of hospitals and an effective method of sanitation.

No physician ever dominated medical thought as did Galen. For fifteen hundred years his teaching was to be all and the end of medical science. He was the infallible medical Pope whose teachings were accepted until the Renaissance.. With his death in 200 A.D. the scientific life of Rome and Greece came to an end. The fall of the Roman Empire occurred soon after, and plunged the world into the Dark Ages.

Chap. III

SURGERY AND ANATOMY OF THE RENAISSANCE

Little advance was made in medicine after the fall of the Roman Empire until 1000 A.D. and the beginning of the Middle Ages, because of the constant invasions of war like tribes from the north. Another factor was the influence of Christianity. It was abhorrent for a Christian to believe that man was controlled by a natural law pursuing a relentless course from cradle to the grave. The magnificent system of personal hygiene snd sanitation of the Greeks and Romans was heresy to the Early Christian.

In spite of these drawbacks some medical knowledge survived through the Byzantine School, Salernum, and the Mohammedans in Spain. At Byzantine little opportunity was afforded for scientific studies. Although nothing new was produced the works and teachings of Hippocrates and Galen were compiled and kept alive.

Salernum was the center of medical studies until the Renaissance. About 1066 A.D. there was a conquest of Italy by the Normans, but the efficient rule of these people insured the advancement and extension of scientific studies. The school grew in importance. Opportunities were offered for medical-surgical clinics and dissecting again became common, mainly of pigs, but occasionally of men. A regular course of eight years was established and the teachings influenced by Hippocrates and Galen. It's chief contribution however, was

the extensive transcriptions of Greek manuscripts..

The Arabs in Spain, through their wanderings came in contact with the learning of the East. They did not destroy beyond the necessity of warfare, but absorbed much that they found of the old civilizations and at first the teachings of the Rorean predominated. Some experiments were carried on, but the value of the Arabian influence is their preservation and translation of Greek and Roman civilization. The Sixteenth Century will be carried better in mind if it is considered the century of reformation and the interesting fact noted that so far as medicine is concerned, the reform was limited to anatomy, internal medicine and surgery. The old Greeks, as has already been pointed out, were fairly skilled anatomists, but they rarely studied human anatomy. Their dissections were largely confined to animals. The Alexandrian School created the science of human anatomy, but later Galen chiefly used pigs as the animal that most nearly resembled human beings, and he boldly applied to human anatomy the discovery he made in the dissection of animals.

Human anatomy as a thoroughly rationalized science did not exist until it was established by Andrew Vesalius about the middle of the Sixteenth Century.

Vesalius was born in Brussels, Belgium, 1514, the son of the apothecary to Emporer Charles V. As a boy

he had a passion for dissecting rats, mice, cats and dogs. As a youth he was stimulated by the spirit of independent investigation, and the influence of his teacher, Sylvius, who did much to establish the necessity of human. Sylvius and Vidius in France dissected the bodies of many human beings and established many new facts, but these men were too thoroughly imbued with the authority of Galen to be able to see things written plainly by nature before their very eyes. Vesalius was no respector of authority. From the time he began to study medicine in Paris in 1533, through the period of his professorship of anatomy at the University of Pauda. He discovered more than two hundred errors in the teachings of Galen and was severely critized by medical authorities for so frankly and clearly showing the mistakes and doubting the teachings of the great Galen.

He studied at Louvain and Paris, but finding little scope for originality at either place, he decided to go to Italy where anatomical studies were facilitated by more easily acquired material. He worked in a hospital in Venice, but soon left there and settled at Pauda where he was elected to the Chair of Anatomy and Surgery at the age of twenty-four.

The general public interest in the advancement of science and the influence of enlightened popes had insured the abundant anatomical material that was necessary for Vesalius to carry on his work. He attempted to give an accurate description of all parts of the human body and to illustrate this with excellent drawing, made possible by the contemporary

school of great artists, among whom was Leonardo de Vinci. He and other artists realized that a thorough knowledge of especially that of the bone, muscles and joints, was necessary for the proper portrayal of the human form.

Although there had been many dissections and dissectors prior to Vesalius all were under the influence of Galen. Vesalius himself was educated by strict Galenist, and it was not until he began his work at Pauda that he became the one to drag the idol Galen down.

His career as a professor was noted for three things: its short duration of five years and the influence of his dynamic personality and the creation of the vital science of anatomy. He abandoned the scholastic method and adopted the practical one of personal dissection and demonstration, lecturing to the students with the dissected part in front of him. Prior to his time instructors lectured while an assistant dissected.

During his five years at Pauda he wrote his great book "De Frabria Human Corporis", with its delicate and artistic illustrations. It was printed in Basel in 1543 by Oporinus. In every volume of the book Vesalius criticized and corrected Galen, sometimes in abusive language. The old scholastics bound by tradition, attacked him from every side. Every effort was

made to discredit him no matter how devious or underhanded.

He, like many other great egotistical students, was sensitive to these attacks and threw many valuable manuscripts in the fire and left Pauda to take service to the Emperor Charles V. He married and settled down to life of a court physician, doing no more anatomical work except the preparation of a second edition of the "Fabrica" which was published in 1555.

In 1563 it is reported that he accidently started upon the dissection of a man who was not yet dead, and that in a fit of remorse he undertook a pilgrimage to Jerusalem.

In 1564 he was again offered his old chair at the University of Pauda, which the death of Fallopius had left vacant, but unfortunately illnes overtook him and he died at the early age of 50.

The"Fabrica" consists of seven books: one of astrology, which was so accurate that it could be used as a textbook today, one on the muscles, vascular and nervous systems, abdominal viscera, heart, lungs and brain. These volumes were not only the foundation of the "modern" science of anatomy, but stands as one of the greatest achievements of all times and brought about an improvement in the art and science of surgery. Four hundred years of increasing anatomical endeavor has added so little to the work that Vesalius accomplished in five years. It is also to his credit that anatomical structures are not named after him. The detection of an anatomical detail

overlooked by Vesalius was hailed as a triumph and discoverer's name so became permanently associated.

The best of his books are those dealing with oseotology, myology and neurology, the last being almost entirely new and illustrated by a series of very accurate dissections and cross-sections of the brain. His description and drawing of the abdominal and thoracic viscera repeats some of Galen's errors and his portrayal of the female genitalia are very poor. The illustrations did not present the dissected cadaver, but rather a vivisection of a living man.

His successors have added here a little and there a little, but modern morphology can be regarded as an amplification of the work of this great anatomist of the sixteenth centure.

Surgery was finally reborn during the Sixteenth Century. In 1500 surgery as a science was on a higher plane than internal medicine, but even at that one cannot grow enthusiastic over surgery as it was practiced in the early period of the Renaissance. Su geons were, for the most part, cuppers, leechers, barbers, both attendants and cutters for the stone in the bladder, who also gave enemas, sharpened knives and prepared salves and plasters. Very few surgeons were men of academic attainments and broad vision.

Ambrose Pare changed all this. He was born in one of the French provinces where he worked as a barber's appren-

tice. He went to Paris in 1529 at the age of 20 and served as a dresser in the Hotel Dieu. Soon thereafter he was drafted into the army and served as army surgeon with the troops of Frances I. In common with Vesalius and Panoclesus, who did for internal medicine what Vesalius did for anatomy, he was bold, resourceful man and not easily moved by the shackles of authority and ancient doctrine. He preferred to allow his own common sense full sway, and this quality enabled him to oppose and overthrow the glaring errors of traditional surgery.

He was very popular with the soldiers, for whom he cared with a kindly zeal and great skill, emphasizing always that the duty of a surgeon was to avoid and relieve unnecessary suffering. His value to the nation was considered so great that by royal command, he was the only Protestant to be exempted from the St. Bartholomew's Eve Massacre.

His first great contribution to surgery was discovered by accident. He followed the usual practice of treating gun shot wounds with boiling oil as a cauterizing agent. This intensely painful application was supposed to destroy the poison. On one occasion he ran out of oil and left a number of wounds simply and cleanly dressed, which to his surprise healed more quickly, the patients suffering less than those who received the hot oil treatment. From then on he adopted the simpler treatment of wounds.

He invented many new surgical instruments and artificial limbs. He reintroduced the ligature, it had been used centuries before by the Romans for the stopong of hemorrhage. In his day surgeons stopped the flow of blood with red hot irons which seared the flesh and made a painful would, slow to heal. Pare used pieces of twine to tie shut the ends of bleeding vessels. The surgeon of today uses the method he introduced.

Pare made a most important contribution to anatomy for it was he who popularized for surgeons the anatomy that Vesalius desired. It is unthinkable now for a surgeon to attempt an operation with knowing in exact detail the structure of the body. But in the days of Pare, the surgeon learned as a craftsman, a few simple operations, the trick of doing them was handed on from surgeon to surgeon through a period of apprenticeship. With the knowledge of anatomy a whole new field was opened to the surgeon. His operations no longer needed to be merely the tricks of a trade, but he could now plan operations intelligently and vary them to suit the need.

Pare was equally at home in the strife of the battlefield, turmoil of the camp or the polished court. His unswerving purpose in life was the one that inspires all truly great men, the desire to heal, help and relieve human suffering. Pare was a fighter of tough fiber, and yet he was not ashamed to show gentleness and humility.

Pare was the first man in modern medicine to perform experiments and the first to use the control method. For example a soldier came to him with a badly burned face and on his way to get a healing ointment, an old woman told him to use chopped onions which he did. He did not proclaim it as a cure for burns but waited until another man with both sides of his face badly burned came to him. One side he applied chipped onions while on the other nothing using it as a control. He found the treated side healed more quickly than the untreated, thus proving that the treatment did have some benefit.

Although in surgery Pare does not compare or occupy a position comparable to that of Vesalius in anatomy, he was the first and perhaps the greatest of a group of men, who by applying the new anatomical principles placed surgery upon a higher plane, lifting it from a mere craft, exploited by charlatans to an honorable position upon equality with the physicians. Surgery became respectable.

The organization of the practitioners of surgery underwent many changes during the Sixteenth Century.

In France they had been divided into the "barber surgeon" of the short robe and of the long robe. The short coated barber surgeon was permitted to bleed, cup. leech, extract teeth and give enemas. The long coated surgeon undertook the more serious operations.

In 1500 the barber surgeons were recognized by the Faculty of the Parisian School of Medicine, because of jealousy. In a few years forced the long robed surgeons to also submit to the control of the physicians.

In England the Guild of Barbers obtained a charter from Edward IV in 1462 to form a Company of Barbers. Thirty years later, 1492, the surgeons also obtained a charter, and in 1540 were united in one group. This union remained unbroken until 1745, when the surgeons formed a separate corporation, which has since been replaced by the Royal College of Surgeons, enchartered in 1800.

A Board of Examiners, numbering ten, continue unchanged, and it is this body that pass on applicants for fellowships.

Chap IV

JOHN HUNTER

Pare, as I have said, made surgery a skilled craft. It remained as he had left it for two hundred years, until the eighteenth and nineteenth centuries when a Scotchman, John Hunter, made it a science. He based surgery upon pathology and physiology. At his hand the aim of modern surgery materialized. It was no longer sufficient for the surgeon to know merely anatomy and the tricks of the trade. Instead, he must study physiology--pathology, diagnosis and medicine in general, and in addition learn the operations of surgery. Hunter made surgery a profession.

John Hunter, had only snatches of education. He refused to learn Latin. As a young man failing to do well in various occupations, he was sent from his Scottish Home to London to assist his brother William, ten years his ~~union~~ Senior, a prominent surgeon and teacher of anatomy.

Hunter's father was nearly seventy at the time of his birth. He was the youngest of ten children and the favorite of his father and mother. He grew up impatient of restraint and given to idleness and disobedience. He was fond of games, outspoken, boisterous, impulsive and generous.

Although he hated school, he had a very inquisitive mind and was deeply interested in all the living things he saw, collecting and observing the many specimens he found while rambling in the woods.

History will never recognize William Hunter as a great anatomist, but will always be indebted to him for the part he played in helping his younger brother John to get started. William was a cultivated and charming gentleman, steeped in the best traditions of his profession. He moved in the society of royalty and was physician Extraordinary to the Queen.

John Hunter began his professional career subordinate to his brother, and for some time was known only as a good anatomist, his brother a great anatomist. This was no small handicap to be overcome by the uncouth, sandy-haired Scottish youth who left the farm and rode into London to begin a career of unparalleled industry and scientific investigations and far-reaching discoveries which were to make him one of the most sought after surgeons in London and the first surgeon of England.

After eleven years of strenuous work in the hospital and dissecting room, his health began to fail, and at the age of thirty-two, he left London to become an army surgeon. In his remarks on gun shot wounds, he laid down some fundamental principles often overlooked today. He emphasized the importance of not enlarging wounds, but of leaving them alone unless something absolutely necessary was to be done. By these teachings he proved himself a master surgeon.

After three years in the army he again returned to London. He was now thirty-five and beginning the most pro-

ductive period of his life. He was no longer regarded as merely an anatomist or army surgeon, but as a comparative anatomist or army surgeon, but as a comparative anatomist, biologist, naturalist, pathologist, physiologist, prominent teacher and a truly great surgeon.

He organized a school of anatomy and started collecting and dissecting animals. He was deeply interested in every living thing. He spared neither expense to himself or friends to obtain the animal he desired. As soon as he collected ten guineas, he would purchase some addition to his collection of animals. Animals dying at the Tower of London and the city menageries were obtained by Hunter for dissection and no animal was brought to England during the latter part of his career without his having an opportunity to examine it.

Hunter's collection numbered nearly fourteen thousand specimen. These are explained in ten volumes of manuscripts, notes, drawings and descriptions. He dissected more than five hundred different specimens of animals many of them more than once and left records of 315 dissections. This vast museum cost him more than three hundred and fifty thousand dollars, was bought by the government after his death for seventy five thousand dollars and now forms the famous Hunterian Museum of the Royal College of Surgeons.

He is said to have arisen at four o'clock and

to have gone immediately to the dissecting room where he worked until nine. After breakfast he saw patients in his home, afterwards making hospital rounds until four o'clock, took a nap for an hour then went to his lecture or museum where he worked for hours.

A few of the outstanding discoveries of this dynamic, versatile investigator and surgeon are:

1. The Lacrimal Ducts.
2. Many features of the lymphatic system.
3. The descent of the testes in the fetus.
4. How union of ruptured or severed tendons occurs. He performed tenotomy on dogs, thus laying the foundation of orthopedic surgery.
5. That digestion is also arrested during the process of inflammation in the human body and that over feeding was contra-indicated.

He studied and made contributions on the transplantation of teeth, skin, grafting, growth of the long bones, the arterial supply of the gravid uterus, shock, phlebitis, pyemia, and intussusception, gunshop wounds, and the surgical diseases of the vascular system, head injuries, especially on skull fractures and trephining. He demonstrated for the first time that artificial feedings could be accomplished by passing a flexible tube into the stomach.

His greatest innovation in surgery was the ligation of the popliteal aneurysm by ligation of the femoral

artery high up, thereby introducing and establishing for all time a new principle in surgery which has saved many limbs and lives. This one feat of surgical daring and originality is sufficient to give him undying fame.

Honors at this time began to pour in on Hunter from England and Scotland and all parts of the scientific world. While he was progressive and enthusiastic in his ideas, his colleagues were in a large measure conservative. He never received any encouragement. Some of his contemporaries were indifferent to his doctrines, other envious and jealous and all were openly opposed to him. At that time they could see no value at all in his discoveries on his marvelous collection. Envious of his superior intellect, they grouped themselves in opposing all his efforts for the improvement of science.

He was a frequent sufferer of angina pectoris which developed from an early accidental infection of syphilis. He refused to treat it so that he might study the symptoms. While speaking in behalf of two stduents he was contradicted by one of his colleagues at a Board Meeting of St. George Hospital. This instantly aroused his anger and brought on a fatal attack of angina pectoris. Thus ended the dramatic career of one of the greatest investigators, scientists and surgeons for all time. Those contemporaries who criticised him most have joined the great caravan of fading names, while his name will endure forever.

Today Hunter would be called a propogandist. He

introduced a new spirit, a new method of appraoch to surgical problems, pursying a strictly inductive method of reasoning. He found surgery a handicraft still saturated with theories, magic and mysticism, and carried it far into the realm of general principles and alws. John Hunter elevated surgery to the sole of science, based on physiology and pathology. His permanent position in science is based on the fact that he was the founder of experimental and surgical pathology and a pioneer in comparative physiology and experimental morphology. He has left to all an heritage of achievement and a legacy of wisdom and knowledge which may never be excelled.

His name will live forever not only in the hearts of all surgeons, but in the hearts of all true scientitst. His name will always be associated with those of Pare and Lister as the founders of modern surgery.

CHAP. V

ANESTHESIA

In spite of Hunter, surgery remained handicapped by the lack of anesthesia which made the speed of operating more important than sound technique and the absence of any antiseptic principle to check the ravages of septic infections that rendered every operation dangerous and every hospital liable to epidemics of erysipelas and gangrene.

When these two discoveries were added to the work of John Hunter, surgery entered upon its later phase of rapid and safe development, which has brought within its sphere all regions of the body and made possible the attainments of the twentieth centure.

From earliest times men have tried to overcome the pain of operations. Drugs and alcohol, numbing of flesh and nerves with cold or pressure, and hypnotism were all tried and none was successful. Pain was apparently inevitable, an ordeal not only for the patient, but for the surgeon. In compassion the surgeon attempted to shorten the agony by working with the greatest speed, and when an operation had to be completed in a few seconds, it could not be as carefully and precisely carried through as is the surgery of today.

In 1800 the chemist Humphrey Davy recorded the fact that the inhalation of the gas nitrous oxide procuded unconsciousness and suggested its possible use and advantage in

in surgical operations, but no one used it until nearly fifty years later.

Surgical anesthesia was an American discovery found twice within a few years. The first physician to use an anesthesia for an operation was Crawford Long of Georgia. He used ether to remove a small tumor from the neck of a patient in March of 1842. He suffered no pain, but unfortunately Dr. Long did not publish a report of his success and his discovery remained unknown until the effects of ether had been rediscovered and anesthesia had become an accepted part of surgery.

Ether had been known for many years. Some doctors were aware of the fact that if the vapors were inhaled drunkenness and unconsciousness might follow.

Nitrous oxide again came into use before ether was rediscovered, this time by a dentist, Horace Wells of Hartford, Connecticut. In the forties, lectures were a popular form of entertainment. In 1841 a man named Colton gave a series of lectures on the new discoveries chemistry in which he demonstrated the effects of nitrous oxide. He announced that members of the audience might inhale the gas and enjoy the effects of it. Horace Wells and a friend attended the lecture and the friend volunteered as one of the subjects. Dazed from the gas he became pugnacious and began to grapple with one of the strong men who was hired to protect the audience from the antics of those inhaling the gas. During the fight

the man fell over a bench and hurt his leg. Sobered by the blow he returned to his seat to discover a large gash in his leg. He had experienced no pain, and when Wells questioned him more closely, he insisted that he had not felt the blow.

The next day Wells prepared a bag of nitrous oxide and had one of his own teeth pulled. As he had felt nothing, he was convinced that he had arrived at a long sought goal and went to Bostonto demonstrate the properties of nitrous oxide. Without special apparatus this gas is difficult to administer and the patient whose tooth he extracted revived from the gas before the operation was over, screaming with pain. Wells went home discouraged.

But another dentist named William Morton, a former partner of Wells, continued where he had left off. Morton was also a medical student, and through the suggestion of one of his professors named Jackson, a chemist, suggested that he use ether instead of gas. With this he experimented on himself and the family dog, and finally used ether with success as an anesthetic for the extraction of teeth. He was ready then for a major surgical operation. Dr. Warren, chief surgeon, of the Massachesets General Hospital granted permission and the day was set for October 16, 1846.

The story of that demonstration is one of the classics of medicine. The amphitheater was crowded with incredulous spectators. The patient was brought in.

The surgeon waited, dressed in formal morning clothers--this was in the days before surgeons were white gowns, masks and washed their hands before operating. At the appointed time, Morton turned to start the operation while the skeptical audience smiled. Morton had been delayed in perfecting an apparatus to administer the ether. Morton administed the ether and indicated to Dr. Warner when the patinet was ready. The patient gave no sign of pain--everyone could see that he was breathing and apparently sleeping.

Anesthesia for surgical operations was a reality. Oliver Wendell Holmes coined the word anesthesia to describe the phenomena.

The operating room at the Massachusetts General Hospital where the demonstrations were made, remains unchanged since that day in 1846, a memorial to the blessings of anesthesia. It is an ordinary room of the period with wooden floors, carpet strips, and drab painted walls. A shart contrast to the white tiles and shining metal and scrupulous cleanliness of the modern operating room.

The use of ethyl ether as an anesthesia soon gained the recognition it deserved. Every successful operation under etherization increased the confidence of the profession and the public's faith in Morton's innovation. Three weeks after his first success with anesthesia, Dr. Hayward, another Staff member of the Massachusetts General Hospital, amputated a lower extremity above the knee, the patient remaining

unconscious throughout the operation. The prestage of the Massachusetts General Hospital and the support of such leaders in the medical world as Warner and Hayward account for the rapid headway of surgical anesthesia throughout all civilized countries. Henry Bigelow, considered one of the best surgeons in America at that time did his utmost to encourage Morton. He read a paper dealing with the properties of the new anesthesia before the Academy of Arts and Sciences. In the weeks following Bigelow carried a sample to London and introduced it to European medicine.

Anesthesia was not only the death of pain, but it did away to a considerable extent with shock and by obviating the necessity of great speed in the performance of operations, made the introduction of antiseptic methods possible.

Chap. VI

JOSEPH LISTER AND ASEPTIC SURGERY

In 1854 a young surgeon, an English Quaker, named Joseph Lister, went to Edinburgh... Within the next six years he had risen to the position of professor of surgery in the University of Glascow and embarked upon a career that made him one of the greatest surgeons of all times. The problem that held his attention was infection in wounds. The formation of pus, the development of fever were believed to be due to the state of the weather, and to evil smells in the air, or else were considered inevitable in all wounds resulting from violence. Infection whatever, its cause, made surgery a discouraging task. Lister operated skilfully and cared for his patients carefully; they did well for a day or two and then infection set in. Halfor more died of blood stream infections. A surgical operation in Lister's hospital, or in any other at the time was nearly as dangerous as bubonic plague. What made matters worse was that it seemed to make little difference whether the operation was grave or slight. In either case infection came and the blood poisoning followed.

Lister, studying the problem, observed a curious fact which gave him the clue to his discovery. There were men in the wards with broken legs and arms. They were wounded, but the wound was under the skin. These wounds did not become infected. The air did not reach them, therefore, Lister reasoned, that something inthe air poisoned the wound

and caused infection in the wound.

The next clue came from the work of the French chemist, Louis Pasteur. He had been employed by the wine industry to investigate the diseases of wines. He found that bacteria caused the wines to spoil and developed a process of treating the wine by heat, the process now known as pasteurization.

Reading of Pasteru's discovery, Lister saw a similarity between the putrefaction of wine and the infection of wounds. That something from the air that caused infection in wounds might well be bacteria. If that should be true then he had to prevent the bacteria from entering the wound, or if possible to kill them before they multiplied and spread.

He decided to start experimenting with an infected wound, But first he had to find something to kill the bacteria. He turned to chemical substances and decided upon carbolic acid which was used at that time to prevent unpleasant sewage odors.

A man suffering from a compound fracture was brought to the hospital. Compound fractures are usually infected and in Lister's time, for lack of a way to control the spread of infection, usually necessitated the amputation of the limb.

Lister applied carbolic acid to the wound and built a small tent over it to exclude the air. In spite of all these precautions, infection developed, blood poisoning followed, and the patient died. But Lister persisted. For later cases he washed his instruments in carbolic acid; he dipped his

hands in the antiseptic and sprayed a mist of it in the room. He took every precaution to clean the wound and to keep bacteria from entering it. This time he succeeded, pus did not form, nor did infection and blood poisoning follow.

Soon he was using the spray of carbolic acid in the operating room and carrying out all the operations with the procedure that had succeeded the compound fracture. Infection and fever disappeared. The clean wounds healed quickly and safely. Vastly fewer deaths occurred.

In those early days Lister was convinced that the germs causing infection came from the air. In fact, so strongly did he insist upon the unpleasant spray of carbolic acid in the operating room that other surgeons thought he was trying to introduce a new medicine, and their attention was distracted from the fundamental principle he was advocating--the spread of infection by the use of antiseptics. Lister went his way calmly indifferent to opposition, performing safely operations which other surgeons feared to do, and saving the lives of the patients in his wards.

Reports of his work soon spread to the continent snd foreign surgeons came to visit him and to learn his methods. The Franco-Prussian War broke out and antiseptics were used on the wounded with great success.

Gradually as experience grew, the belief that germs of infection came from the air gave way to the knowledge

that they came from filth ground into wounds, from the unclean hands and instruments of the surgeon and from dirty bandages. So cleanliness--surgical cleanliness, or asepsis--became the dominant idea of surgery. The modern operating room, the scrupulously clean hospital, the white gowned surgeons, are the result of Lister's discovery that infection in wounds is due to the presence of bacteria.

With the new safe surgery, freed from the fear of ever present infection, surgeons for the first time could operate successfully on parts of the body where few had ever dared to operate before, especially the abdomen and joints. A whole new field of surgery was opened up by Lister's discovery. And what is as important, for the first time in history, medicine ahd given a reason for cleanliness, in the home, office and factory as well as in the hospital and operating room. But cleanliness did not wholly replace the use of antiseptics even in the operating room. Instruments could be sterilized with heat, but not the surgeon's hands or the patient's skin. These antiseptics must still be used. There are still wounds from accidents in which bacteria are present, and most people know the necessity of antiseptics in the first aid treatment of even slight injuries.

Lister's researches on materials for ligatures were productive of first class importance. In the earliest days he used silk dipped in wax to which a proportion of carbolic acid

had been added. This proved unsatisfactory and he set about preparing a catgut ligature that would be sterile, absorbent and of adequate tensile strength and pliability. Soon it became routine to ligature bleeding vessels with carbolized catgut; Lister's first important contribution to the treatment of wounds.

The method used to render the gut antiseptic was to steep it in a mixture of five parts of a fixed oil, either olive or linseed, to which had been added one part of carbolic acid, liquified by the addition of five per cent water to the crystals. This emulsion also made it tough and transparent and no longer liable to soften under the action of watery discharges.

Efficient drainage of the wound was realized by Lister to be of the greatest importance in keeping the tissues free from sepsis. He used two chief methods of drainage--the first by means of tubes and the second by means of capillinaty. These tubes were kept in a one to twenty solution of carbolic acid until required for use. His practice was to shorten the drainage tubes at each successive dressing until they became no longer necessary.

Lister experimented with dressings. Beginning with the carbolicacid soaked lint first applied over the compound fracture and following through with various methods until the ideal present-day practice of using plain gauze or wool

rendered aseptic by heating was established.

Lister's pioneer work in the preparation of ligatues, dressings ,and his contributions to general surgery will always be remembered, but his name chiefly deserves remembrance because of the valiant battle he waged against things unclean in the bacteriological sense. In this sphere, his influence on present day surgery has been incalculably great. He was thorough. The rigorous aseptic routine of the modern operating room is but a logical extension of the minute care that Lister employed in excluding pathogenic microbes from wounds. He sowed the seed, we are reaping the harvest.

He died in 1912--two years too soon to see the greatest vindication of his principles of antisepsis made in the World War. Thousands of veterans whoare living today owe their lives to Lister, just as do thousands of men, women and children wounded in accidents or operations.

For many centuries surgery and medicine were so closely associated that no attempt was made to separate them, until the study of human anatomy was well established through the work and writings of Andreus Vesalius. Pare was the first to recognize this valuable aid to surgery and also advocated clean, simple dressings to wounds instead of the barbarous hot oil treatment. Later we find John Hunter adding pathology, diagnosis and a thorough knowledge of anatomy and general medicine to the art of surgical procedures, thus making surgery a science and so raising the standards of the entire profession. No further advance was made until the discovery of anesthesia which opened new fields as well as relieving pain. This enabled the surgeon to use more caution and perfect his technique as speed was no longer quite so necessary. However, in spite of this there was another great drawback to the advancement of surgery whivh made surgeon and patient alike hesitate before resorting to an operation; that was infection and not until the Nineteenth Century and the work of Lord Lister and Louis Pasteur do we find this great danger being eliminated.

Surgery owes much to these men who dared to face so much opposition to their beliefs and continue to carry on their work and experiments. Our modern operating rooms, white gowned surgeons and sterile technic are a direct result of their work. Many advances have been made in the improvement of equipment and in the technics of the operations until surgery has truly become a specialized branch of modern medicine.

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