

THE HISTORY AND DEVELOPMENT OF THE SCIENCE OF SURGERY

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Introduction

In approaching this subject it should be realized to what extent one could be led in investigating the matter. To really cover the field properly, it would take a much greater length of time than we have to give. Surgery itself as a science had not always been known separately. It is very closely connected with Medicine. Different branches of study are important in order to fully comprehend the extensiveness of the topic. Anatomy is vital, because without it one could not expect to do successful work in surgery. Physiology is necessary to understand the mechanism of the various systems of the body and the importance an organ plays in this function. Pathology is essential in order to be able to recognize disease tissue of the viscera. Bacteriology is important so that one knows the effect of bacteria on organic tissue.

In the early centuries surgery was not regarded as an honored occupation, but it was looked down on. It took time to bring surgery up to the level of a profession. This was due undoubtedly to the type of man that practiced. Of course without the knowledge of the human body it was impossible to perform any serious operations, so that the main thing the "Surgeon" of that time did was trephining, circumcisions, and blood-letting. Gradually as advances were made in medical knowledge, these principles were applied to the human body and we find that the surgeon became a more learned man. Modern developments such as the x-ray and radium have done much to advance surgery.

This paper could not expect to do justice to a subject such as this, because it is known that in order to fully appreciate the

works of an inventor, it is best to go to their own accounts of their experiences. What modern writer with all his ability could really give us an accurate resume of the surgical procedures of Hippocrates? Maybe this is the reason I hesitated in choosing this branch of medicine, because I realize that my ability to set down facts on paper in an interesting and orderly form is not of the best.

In our investigation it has been found that the original inventor or discoverer may not have been an author or lecturer and for this reason the new improvement may have been known much prior to the date that it became a general fact. This last is an important factor in order to constitute true development. We have found that one man has been the first to think of an improvement, but that another has been given the credit. This has caused many disputes and sometimes had taken away from the glory of discovery. It has also been found that advances practically similar have been found in different countries at about the same period entirely unknown to the other party. Because of this, sometimes more than one man has to be given the credit for his part in the advancement made.

With these thoughts in mind let us go back to the dim past.

PREHISTORIC DEVELOPMENT

As has been mentioned, it is necessary to go back to medicine before we come to surgery. When we go back into the very dim past, way before the time of Christ, when man was only first beginning to develop, we find that when a person was suffering from a disease, it was believed that they were in the possession of the devil. They had committed some evil and for this reason were being punished. They had no idea of the functions of the body, and because of this they fell upon the idea of magic as an explanation for the cause of the disease. For example let us take the case of trephining for epileptic fits. They reasoned that the devil was wandering around in the body causing this particular disturbance, so they made holes in the skull to rid that affected person of the demon. What they were doing in reality was relieving the pressure. It has been demonstrated that they performed trephining on live persons and that they were not killed by the process. This has been proven by the finding of skulls with evident trephining, and the subsequent formation of bone that has taken place and smoothed off the edges of the cut. In fact, some of the holes seemed almost entirely filled in, where others appeared to be newer cuts,--showing apparent frequency of the act. Blood-letting was performed for the same reason--to let the devil out.

Whether we go to the Accadians or Scandinavians, the Slavs or Celts, the Romans or Polynesians, we find that under different aspects of space and time, all the phases of folk-medicine and ancient medicine have been essentially the same though they may differ in unimportant details. The main fact is that the use of charms and spells, plant-lore and psychotherapy were used by all races to ward off the effects of supernatural agencies and

that they were performed by practically the same methods.

Mystery, Magic, and Medicine---the same methods of healing in one primitive group were the same in all others. They are still to be found in the fastness of Africa and the remote and uncivilized areas of the world today. Our ancient ancestor may be said regardless of his origin or evolution, to be a savage sunk in animal instinct. He was not having a care-free, abundant life, but was a terror-stricken, ignorant man living in a hostile world. Day by day he had to search for his meager existence, always in danger of stronger men or animals. They had no protection from the elements such as clothing. With conditions such as they were, he was probably not unaware of certain hygienic precautions which were instinctive to lower animal life,--that of a dog licking his wound, hiding when sick, though in constant of starvation or mercy of his enemies, and the hunting of certain plants and grasses when ill.

He tried to seek an explanation, because, though he was ignorant, he was intelligent. This proved his status as a man, because he reasoned in abstract thoughts. Those things which he could not understand, he believed were caused by spirits or ghosts---such was disease. Anything he did successfully was due to his own efforts, but if he failed, then he blamed it on the spirits. This is just an early proof of man's egotism. "The common point of convergence of all medical folk-lore is the notion that spirits or other supernatural agencies are the effecient causes of disease".

Savage amn confused life with motion, so he worshipped the sun, the moon, the stars, and other elements of nature; also serpents, cats, dogs, apes, and oxen. They set up carved statues to represent these objects. At first, he believed that disease was due to the work of an evil spirit or the

spirit itself which had to be honored by offerings and sacrifices. Secondly, he thought disease was caused by his enemy who possessed supernatural powers. He tried to ward this off with the use of charms and sorcery similar to those used by the enemy himself. Thirdly, dreams and nightmares suggested a spirit-world apart from his body which made him think diseases were due to the work of offended spirits of the dead, including men, animals, and plants. These three beliefs were all usually accepted by the savage; we can still find traces of it today in the belief of human sorcery and the displeasure towards death displayed by the peasant and his descendents.

There are two types of magic, white magic which was concerned with the curing of disease, and black magic which was concerned with the causing of disease to an enemy. In order to do this the spirits had to be controlled. Here we find the origin of the first Medicine Men, who were the more shrewd, clever, or perhaps just a little bit queer, and for this reason they were held in esteem, apart from the rest of the tribe. As these tribes increased in size the Medicine Men belonged to a special group which only the very select could join. They had initiation ceremonies with weird dances and chanting.

The basic philosophy of the savage had good logic, but the premises were bad. They had no knowledge of the optic nerve, so when **they** looked in the moirror they thought they were seeing their spirits. If the mirror were broken then their spirits we e injured and it was just to bad for them.

Medicine men used psychotherapy---the influence of mind over body. With this treatment cures were actually affected due to the fact that either the disease was mental or the body had strong recuperative powers. Naturally they thought the treatment was the cause of the cure. We cannot overlook this belief due to the presence of our own modern quackery and fads. In the rural

districts we still find many superstitions such as: a wart being caused by a toad and its being cured by touching them with pebbles or murmuring charms over them. The cures produced by a medicine that was a panacea, probably seemed excellent because, "Nature cures the disease while the remedy amuses the patient". Other superstitions include the effects of such accidental specific factors as color, numbers, solar and lunar influences, magic writings, rings, precious stones, charms connected with the names of saints, the lore of plants, the evil eye, birth, death, the grave, and parts of lower animals. The reason these last were used was because certain animals were considered sacred and had certain virtues. For this reason they were sacrificed and consumed. Some examples of these are:

Lung of a fox-----long-winded animal-----good for consumption

Fat of a bear-----hairy animal----- " " baldness

Lion's heart-----or human heart-----gave courage

Goose grease-----bronchitis

Rattlesnake oil or earthworm oil-----rubbed on skin--
makes athlete
limber.

Toad's skin boiled (does contain similar medicine to digitalis)-----
heart disease and
dropsy

Ground dragon bones-----by Chinese-----children with con-
(We now use calcium in infant tetany) vulsions.

Burnt sponge-----contained iodine-----for goiter.

Many of the treatments and plant concoctions used in that day were useless. They were employed by the Medicine Man in his ritual.

With the growth of knowledge for beneficial plants, there also came to be known various plants that were poisonous. "Practically every substance in the world has been used for medical treatment." The use of the various organs of lower animals was said to be the basis for modern organotherapy, but this is false because it was based merely on religious superstition. It would be too much to go into detail over all the known superstitions. We feel after considering them that probably none had actual curative powers over disease, though people were cured who believed only in them; therefore we must go back to "the healing forces of nature" in physical disease, and where mental conditions are present, i.e. the influence of mind over matter.

Man will go to any end to get back his health. This is a natural instinct. The use of boiling oil, fire, leeches, and the like are examples of this. We still find quackery and superstition present among the most highly educated people. This can only be overcome after great perseverance by the public enlightenment in regards to preventative medicine.

Some believe that the savage makes his first upward trend towards civilization with a small object of chipped flint, but there are others who say that the first instrument was probably not the chipped flint, but a fragment unusually sharpened by accidental flaking. Either way the instrument was used to protect himself, to get and prepare food, and to produce other implements. Though in later years it became more polished and sharper, it still maintained the same shape. It was used in ancient surgery by the Egyptians where we find our first source of knowledge. Human skulls, belonging to the Neolithic or polished Stone Age have been found with portions removed--supposedly an example of early trephining for headaches, epilepsy, and the like. This was an important step in the development of medical science. Un-

til that time the only means for curing disease was by magic exorcism--in the form of a ritual dance, special prayers, fasts, and confession. Superstitious beliefs were very common. This did not exist among the primitives alone, but could also be found in the eleventh and twelfth centuries, and it is believed among the rulers themselves. The date is not known for these skulls, but it probably did not extend to the time of the pyramid builders of the Nile, where circumcisions had become a religious ritual, and an official system of medicine had been started.

We do not find as much concerning surgery as we expected to in the early history of Egypt. It deals more along medical lines. We can find though, clear and unmistakable representations of circumcisions, and possibly surgery of the neck and extremities. We have no cause to make us believe that they went so far as to actually open the body. We are indebted to the engraved pictures on the door posts of a tomb near Memphis, believed to be the earliest pictures of surgical operations, dating back to 2500 B.C. Each physician practiced only along one certain line and no more.

Their clothing was simple and suitable to the subtropic climate. They purged themselves once a month for three days in succession. This is probably one of the reasons why they were considered one of the healthiest races in the world.

Their care of dead bodies proved their knowledge of the antiseptic virtues of extreme dryness, and also of certain chemicals such as nitre and sodium chloride.

Egyptian medicine is important because of its relationship towards Greek medicine, which was destined to go beyond either that of Egypt or the Orient.

For reference to these early times we have to depend

on the six Egyptian Papyri that have been discovered. They are:

Edwin Smith Papyrus----oldest-----surgical subjects-----3000 B.C.

Kohm Papyrus-----Fragmentary--women's diseases-----1800-2000 B.C.

Eber Papyrus-----most ancient book---medical remedies

herbs, mineral waters, and animal parts--1500 B.C.

Hearst Papyrus-----discovered 1899 A.D.-----date and con-
tent similar to Eber Papyrus.

Berlin Medical Papyrus-----quite corrupt-----much later date.

London Medical Papyrus-----British Museum-----no added material
of consequence.

In the discussion of symptoms and treatments in the Smith Papyri we can find a modern note. In the Papyrus Ebers, the word "rephaim" is translated as physician, but it may also be translated as "dresser of wounds" or surgeon. This last was written in 1552 B.C., and contained receipts or prescriptions, many of which were even then considered ancient. It also contained a discussion of the treatment of various diseases that were known at that time.

Although there were medical references in the Bible, it is said that the Jews did not study medicine as a separate profession until the rise of the Alexandrian School, nor did they contribute anything of value to the medical world until after this period. It is evident that in 200 A.D. the rabbi knew about suturing wounds, the freshening up of the edges of a cut to encourage reunion, the use of the uterine sound, the operation for imperforate anus, and the employment of anaesthetic potions, such as Mistletoe wine, to alleviate pain of disease and during an operation. In the "Odyssey", and the "Arabian Nights" there is reference to sleeping draughts, and "drowsy syrups". They were also familiar with artificial teeth, wooden legs, and forms of apparatus for locomotion to enable those who could not use their lower extremities

to get about.

Homer made the first allusion to surgical subjects in Greek literature about 1000 B.C. His works were carefully examined by Malgaigne and Dorembery, and they have proven correct. His descriptions of certain wounds and the like show the knowledge of actual observation and experience. His language is related to that of Hippocrates, and he refers only to the external parts of the body.

Mystery in turn gave way to religion, but there was a period where we found both present. They made invocations to the Gods. In Greece between the fifth and sixth centuries B.C. there were built between fifty and sixty temples to honor Aesculapius, and his two daughters, Hygia and Panacea. Those most renowned were at Rhodes, Cyrene, Cnido, and Cos. The ill applied here for admission. They were given baths of purification in the beneficial waters close to the locations of the temples. Then they were allowed to go in and sleep before the Gods, who were supposed to come down during the night and anoint the afflicted parts. The next morning the priests gave the patients such potions and treatments that knew. If a cure was effected, it was the will of the Gods. If there was no cure, it was just meant to be. The priests themselves would take no responsibility for the cures. For this reason they had no motive to seek the cause of the disease and thereby find a cure or a preventative. This was to come later. The term "medical school" in those days referred not to the actual schools for the teaching of medicine, but indicated a place where medical families had settled.

Lay physicians handed down their knowledge from generation to generation, and in this way made to occupation inheritable. From the Hippocratic Oath we do know that this was true. In order to carry on, if there were no sons in the family, one was adopted.

The school of Cnidos first published their doctrines known as "Cnidian Sentences". the school of Cos did likewise, and their's is known as "Praenotiones Coacae". Hippocrates was the most important contributor to the latter. More of this will be written later.

In the La Tene finds, which dates to about 300 B.C. and referring to a period after the three Ice Ages and the two intermittent glacial periods, there is mention of knives, needles, swords, and lances. In the Gallo-Roman finds in France some time later, there is mention of the beginning of the jointed or articulated surgical instrument like the scissor. With the improvement of implements, such things as tattooing, infibulation, boring holes for ear-rings and nose-rings, external urethrotomy operation, amputations, and lithotomy could be possible. The ancient Hindus performed nearly every major operation.

Let us hesitate for a minute and consider another branch of development, that of Sumerian and Oriental medicine. Astronomy is thought to be the oldest of the sciences, and on it is bases the essence of Sumerian or Acadian medicine. Wars, famine, epidemics, and the future of public or private lives were blamed or determined according to it.

The Babylonians, as have other races studied, believed that disease was caused by the work of demons which infested the earth, water, and air. They had long incantations against them. It was the custom to bring a person who was ill down to the market-place, because they had no physicians. Every passer-by was supposed to stop and inquire the nature of the disease; and if he had had the same illness or knew of one who had, he prescribed the remedies that had been previously used. Later, there developed physicians for each special branch of disease. By this time the medical profession had advanced far enough in esteem to receive remunerations for services

rendered. The prices were fixed by law. Here as in other countries, surgery was the first to take the beginning step in the right direction.

For our principle information of Jewish medicine, we have the Bible and the Talmud. The Bible, of the Old Testament, refers to disease as an expression of the wrath of God. There is no reference that priests acted as physicians. The obstetrical chair and professional midwives are mentioned-i.e.-Rachel of Tamar. We find the use of the chipped flint in the ritual circumcision mentioned in the second book of Exodus. It is the only surgical procedure listed, but there is an indication that they had the knowledge of the roller bandage. In these biblical diseases great efforts were made to prevent them, such as not touching unclean objects, and the purifying after child-birth. The anatomy of the body is referred to only in a few places and then just in a vague manner, because they had no real knowledge of it. Caesarian section, excision of the spleen, amputations, and the operation for imperforate anus of the infant were known, as was also the use of the speculum and the uterine sound.

The ancient Hindus excelled all other races of their time in operative surgery. The Susrata mentioned about one hundred and twenty-one surgical instruments like the: scalpels, lancets, saws, scissors, needles, hooks, probes, directors, sounds, forceps, trocars, catheters, syringes, bougies, and a rectal speculum. They were probably handled and jointed, being sharp, and kept clean by wrapping them in flannel and put in a box.. About the only important surgical procedure they didn't know about was the use of the ligature. To enable the student to become adept at performing operations, they first worked on plants and then dead animal.

Indian medicine almost ceased to be after the conquest of the Mohammedans.

II.

Chinese medicine remained practically stationary. Their knowledge was very limited, and they could not progress, because their religion was against blood-letting and the mutilation of the human body. They did study, practice, and become very adept in the art of massage.

In summarizing Oriental medicine, the important things we received were: the specialization in the matter of medicinal fees by the Babylonians; the medical jurisprudence, public hygiene, and a weekly day of rest from the Jews; and the skill in operative surgery which is still a permanent possession of the Aryan race from the Hindus.

Now that we have a little historical background of the foundation of the science of medicine and surgery, we will attempt to give at least a small amount of the important steps taken in their development up to our modern times.

EMPIRICISM

The next step towards advancement is Empiricism, which is the use of personal experience. It developed along with magic, and now in this period becomes quite important. Examples of this practice are: the scouring of milk buckets because it kept the milk from souring so rapidly, and the use of the castor oil bean. They did not understand the theory of the procedures, but they could see the results so they made use of them. Such is the dog, who, when he doesn't feel well, will eat grass. It is now known that many organic herbs are useful.

We find that the savage, due to experience, gradually learned crude methods of surgery, bone-setting, and herb-doctoring. The women advanced in herb-therapy and midwifery. They soon learned of the poison herbs and the medicinal effect of others in certain diseases. This knowledge of plant-and-poison lore was really the beginning of medicine, the foster-mother of many sciences.

In the natural or physical means for the prevention of disease, the Indians had the advantage over his more civilized brother. He realized the necessity of having his body functioning properly through the elimination of wastes by the skin, the bowels, and kidneys. The necessity was created, because once they became sick it was rather hopeless to get them well again. For their treatments they used the geyser, warm springs, and sweat ovens to produce the desired results.

Empiricism is only mentioned casually among the historic works of medicine so about the source of information was through the various dictionaries. Webster states that an empiric is a member of an ancient sect of physicians who disregarded all theoretical study and based their know-

ledge and practice on experience alone; or one who deviates from the rules of science and regular practice. They are now considered quacks and charlatans. The Standard American Encyclopedia refers to empiric as relating to a person who practices without a regular professional education, relying solely on his experiences and observations. At first it was a respectful designation applied to an ancient sect who sought to derive their entire knowledge from observations and experiments. The trouble or difficulty was that they considered these findings to be the only true method of acquiring knowledge. The first man known to have held these views was Acron of Agregentum in the year 430 B.C., but the sect did not arise until 250 B.C. The assertions of the dogmatics called it into life.

According to the Encyclopedia Britannica, the word empiricism was taken from the Greek words meaning "skilled in experiments". This term applied to a group of physicians who in the time of Celsus and Galen advocated the accurate observation of the phenomena of health and disease in the belief that only by the collection of a vast amount of instances would a true science of medicine be attained. The trouble was that this method was carried to extremes, and it was practiced by those who gave up the real study of ailing bodies, and based their treatment on the rules of the thumb. That is one of the reasons that the modern signification refers to guess work of an untrained quack or charlatan.

The term empirical is applied to treatment that is founded on experience, as opposed to rational, founded on scientific reasoning, so says the Dictionary of Medicine. In a further discussion we find that this practice has its advantages and its disadvantages. If it is aided by accurate knowledge and discrimination, there is often satisfactory results. At the present time, many remedies suggested by experience alone are found to be

in accord with our advanced scientific knowledge. Such examples as the use of mercury for syphilis were used without knowing the real reason. Now it has been determined that the action is due to the control that the medication has over the nutrition of young cellular growths. The usefulness of quinine and many other remedies have been established.

When we cast an eye over the other side of the picture, it isn't quite so nice. Mere empiricism combined with only vague knowledge taints and damages even to this day the treatment of disease. In some cases opium was given to quiet a cough or the colic, without any regard to the cause of either. An expectorant or a purgative would have really been the thing to recommend in each respective case. This type of empiricism in the hands of amateur practitioners is very harmful, because they give for the relief of certain symptoms, things which they supposed had relieved an apparently like condition at some other time, however different the real nature or causes of these symptoms might have been.

HIPPOCRATES

Scientific medicine was born and died. It had its beginning about twenty-three hundred years ago. A complete separation of religion and medicine took place among the ancient Greeks. They decided to use common sense, observation, and logical deduction in their treatment of disease. With the decline of Greece, this very important step was lost, not to be regained for approximately eighteen hundred years.

Hippocrates was one of the first, or the first to introduce this practice of observation of symptoms into play. He left out the Gods, and described disease as an order of nature. He realized that in order to combat it, it had to be studied as were other things of nature. A world of advance was made in this one step from the practice of trephining to let out evil spirits to the study of symptoms and diagnosis of the case. He and his students made careful bedside studies of different maladies and gave us quite accurate descriptions of the symptoms, the diagnosis, and the prognosis. He felt that the careful recording of these symptoms were important, because they are the indication of an underlying condition. It was he who placed the responsibility of the prevention and cure of disease on the shoulders of man where it rightfully belonged. No more could the Gods or the evil spirits be blamed for something they couldn't possibly be held responsible for. He dealt not only with the disease but the patient himself.

Hippocrates says "to know is one thing; merely to believe one knows is another: to know is science, but merely to believe one knows is ignorance". The path he points out to the medical man is one very difficult to travel. It requires a great deal of intellectual honesty, demanding study, hard work, forgetfulness of self, and the welfare of the patient

ever in mind.

Within the century after this development, we can see the beginning of a decline. Rival schools were established. In them, they were more interested in promoting their own dogmas instead of keeping unsullied the teachings of Hippocrates. Three hundred years later, Corinth "the light of Greece" was destroyed. Greek medicine was then taken to Rome, where development was at that point before the time of Hippocrates. Greek medicine took its place, but already it, in itself, had begun deterioration.

There is one other time, in the century just before and the one after the beginning of the Christian Era, that Roman medicine came close to the dignity of that of Hippocrates. For this we can probably give the credit to three men. There was Celsus, who was undoubtedly not a medical man, but a wealthy patron of science and literature. He took the medical knowledge of the day and compiled it in an encyclopedic method. Then there was Dioscorides who was a great Greek army surgeon. He originated a *Materia Medica* that was considered an authority until the seventeenth century. In this work he described about six hundred plants. We find that about ninety of them are still in use. He recorded as an anaesthetic for surgical operation, Mandragora wine. This shows that they realized the necessity for the deadening of pain if surgical procedures were going to be a success. Also there is Aretacus who followed Hippocrates as a clinical observer. It was he who gave us a classical account of pneumonia, tetanus, empyema, the aura of epilepsy, and the earliest accurate accounts of insanity.

Galen was to take his place until the seventeenth century when we find a revival of the teachings of Hippocrates.

Facts concerning the life of "The Father of Medicine" are difficult to find. The reason may be laid to the antiquity of the time.

One author states that Hippocrates might trace his genealogy back to Hercules, but this is opposed to another who traces the lineal descent from Aesculapins: "Aesculapius was the father of Podalirius, who was the father of Hippolochus, who was the father of Sostratus, who was the father of Dardanus, who was the father of Criaamis, who was the father of Cleomytlades, who was the father of Theodorus, who was the father of Sostratus II, who was the father of Theodorus II, who was the father of Sostratus III, who was the father of Nebrus, who was the father of Gnosidicus, who was the father of Hippocrates I, who was the father of Heraclides, who was the father of Hippocrates II, otherwise called the Great Hippocrates". Little reliance should be put on this mythical genealogy, because accurate accounts cannot be found to verify them. We do know that he was real, and that he was a man. This is the important thing in studying a scientific matter. There are three biographies written about Hippocrates, but they are the work of modern authors and consequently are of little value. There is nothing known for certain of the age of Soranus Ephesius. Suidas is a lexicographer and lived in the beginning of the eleventh century. Tzetzes was the third writer, and he flourished in the twelfth century.

There is some discussion about the birth date of Hippocrates. According to Soranus it is about 460 B.C., or the first year of the 80th Olympiad. The data presented by Aulus Gellius, who ought to rank much higher than Soranus of whom nothing is known, has been overlooked in preference to the latter. Aulus Gellius, in his discourse on Greek and Roman chronology claims that Socrates is a contemporary of Hippocrates, but is younger. It is well determined that Socrates' death occurred in 400 B.C. At the time of his death, he was about seventy so that would fix his birth around 470 B.C. This would set Hippocrates' birth back several years from that determined by Soranus. The age at which he died also varies, some saying he was 85, 90, 104,

and even IO9. Even with this uncertainty as to his birth and death, we can reasonably be sure that he practiced his profession with the greatest activity and reputation around the latter part of the fifth century B.C. This was a period of memorable epoch in intellectual development.

We find as some of Hippocrates most famous contem-

pories:	Pericles	Famous statesman
	Aeschylus	
	Sophocles	
	Euripides	Poets
	Arestophanus	
	Pindar	
	Socrates	Philosopher
	Plato	
	Xenophon	His distinguished disciples
	Herodotus	Venerable father of history
	Thucydedes	Young rival
	Phidias	Unrivalled statuary and his pupils

There are also many others too numerous to mention, but they have helped to bring honor and dignity to the human race.

Hippocrates came from a family that had been physicians for generations. Each one had handed down the knowledge they had acquired during their own lifetime. With each succeeding generation there was improvement due to their constant study and travelling from hamlet to hamlet, and country to country. This was their only way of obtaining knowledge from other places, because news travelled slowly. With the wide expansion towards the West in the period just prior to the birth of Hippocrates, military conditions existed, and

military surgery was necessary. The experiences of many physicians were recorded, but not in an orderly fashion.

Hippocrates inheritance from his forefathers was a distinguished position in one of the most eminent hospitals or Temples of Heath. Here he had free access to the treasures of observation that had been collected for generations. He also probably had the opportunity to assist his father in the management of the sick. Thus, he was from youth familiar with the principles of medicine---both the abstract and the concrete. This is one of the greatest advantages that can be had by a student of medicine. He also had the chance to see the good and the bad effect of gymnastic exercises in the of disease, under the supervision of Herodicus, who was the first to try this branch of treatment. The political literature and art of the day were taught to him by the distinguished Gorgias and Democritus. The latter devoted much time and attention to the study of medicine, especially anatomy and physiology.

He was born in Cos and started his practice here. The fact that he was respected by the good and wise of all countries discounts the story that the reason he left his native land was because he was accused of setting fire to the library next to the Temple of Heath in order to enjoy a monopoly of the knowledge that he had extracted from its contents. It is true that he visited Thrace, Delos, Thessaly, and Athen. He probably practiced and taught there. It was during the course of his journeyings that he married. Two of his sons are well known to us, Thessalus, and Draco. It is also possible that he practiced in the court of Macedonia, because Palla and Acanthius of that country are mentioned in his works. It is evident that his son, Thessalus, was the court physician to Archelaus, King of Macedonia, and that Hippocrates IV attended Roxane, the queen of Alexander the Great.

It is highly probable that Hippocrates was at some time connected with the Plague at Athens. We cannot find any contemporary evidence to support this statement, but it is known that the Plague did not die out after one seige, but continues to linger in the country. For this reason, it is believed that in one of the sunsequent attacks he was undoubtedly consulted about the most formidable diseases of the time, especially because of his high rank among the physicians of the day. It is also supported for the reason that (in) many of his works deal with epidemic and endemic diseases.

Another circumstance in his life is vouched for by Soranus, Suidas, and others, but refuted by modern authors, is the refusal of Hippocrates to accept an invitation to pay a professional visit to the country of Persia. Gracian physicians had been held at all times in high repute at the court of Babylon. Therefore, why shouldn't the King of Persia, seeing his country overrun by an unconquerable plague, consult a neighboring people whose superiority in matters of war as well as intellectual development had been learned through sad experience. It is generally believed that the letters said to be written by Hippocrates about this matter are false, but what about the incident itself? Is it not possible? Since the letters date at about the same period as Hippocrates, there is no doubt that the main facts are of an authentic nature.

It is also possible that he gave professional services to Democritus, the philosopher. Otherwise why should he be given the credit by many ancient authors.

In all accounts of his life we find that he spent the best years in Thessaly and Macedonia. The latter part was spent in Thessaly.

He died in Larissa far advanced in age, but as been said before, it is impossible to set the actual age and date. We feel that maybe it is best to judge a man through his works rather than through his life. The education of a man, the esteem with which he is held among his contemporaries, and what he did and wrote to reflect credit on his profession is the way to study an important figure of history. The approbation and the gratitude of a patient is the best testament of a man's public character, and the estimation of his writings by his fellow practitioners indicate his professional character. As a medical author, Hippocrates stands pre-eminently illustrious. The works that he left are his monument. It seems to me that this is a much better way than leaving a statue of stone that can do nothing to help along the cause of humanity. Because he was famous for his work, he was sent for, from distant place, on many occasions.

The soundness of his views, and the practical bent of his genius can be seen in the expression of his opinions regarding the origin of medicine. He states that it was the demands in human life that gave rise to it. Dietetics was originated because of the necessity that man felt for ascertaining properties of vegetable production as an article of food. The art of medicine came into existence after man realized that the system of regimen in a disordered body was not the same as in a healthy body; therefore man felt the need to study what changes of the aliment were proper in disease. He felt that an animal system was as one; consequently, disease was as one. The different types or modifications were due to the peculiarities of the situation. Even with these error, he did have the true spirit of Inductive Philosophy.

He never exempted the apparent results of experience from the strict scrutiny of reason. Being strictly a physician of common sense and experience, he was considered one of the greatest clinical men of all

times. He dissociated medicine from superstitions, systematized the empirical knowledge which had accumulated in Egypt, the schools of Cnidos and Cos, and founded inductive and positive medicine. He is to us what Socrates is to Philosophy. "The basis of his system was a rational experience, and not a blind empiricism, so that the Empirics in after ages have no good grounds for claiming him as belonging to their sect."

It is observed that he gave particular notice to the natural history of disease which included the tendencies towards a favorable or fatal issue. Without this information medicine today would still be only empiric. Leading from this study we find the distinguishing characteristic of the Hippocratic system of medicine--it is prognosis, which is the ability to determine the previous and the present condition of the patient, and an indication of the tendency of the disease from the symptoms that appear.

He established medical deontology which is the science or theory of a duty or moral obligation. This is still valid today. His nobility of soul was proven by his utter contempt for ostentatious charlatanism, and his perfect freedom from all popular superstitions of the time. He always traced diseases to a natural cause. It was either he or one of immediate followers who stated that "Nature is the physician of diseases" His general rule was "to do good, or at least to do no harm". He was responsible for the advancement of the first principles of public health during this period. He also advocated the principle of "*vis mediatrix naturae*", which is expectant therapy tempered by common sense. The theory of Critical Days was accredited to him as was the theory of the Four Humors--the mixture in the right proportions of blood, phlegm, yellow bile, and black bile meant health, while a misproportion meant disease-, but this latter theory was later discounted. He gave us an admirable classical description of various diseases such as: phthisis, puerperal

convulsions, epilepsy, various fevers, and facies Hippocratica. He faithfully reported forty-two cliical cases of which twenty-five had fatal conclusions.

His surgery technique, especially inregards to dislocations of the hip, shoulder, and jaw, remained in some respects unsurpassed until the nineteenth century. He was a bold operator. Fearlessly, and now we think needlessly, he performed trephining of the skull. He opened the chest in empyema and hydrothorax. His great familiarity with dislocations and fractures of all kinds was probably due to his extensive practice, and the accidents which occured at the public games. A statement of Hippocrates concerning the efficiency of fire has caused untold suffering and agony with bad surgery as a result up until almost the beginning of the nineteenth century: "Diseases which are not cured by medicine are cured by iron; those which are not cured by iron are cured by fire; those which are not cured by fire are incurable."

Prior to a discussion of his works we might say that according to Glaen, Hippocrates exercised extreme concisness, precision, and sometimes obscurity due to labored brevity. He avoided all superfluity in discussion, avoided unnecessary repitions, and said only that which was indispensable. "Hippocratic Writings" consist of a large number of treatises. It is certain that they are not all of his hand. Many were the result of his teaching and unfailing efforts. Some belong to an earlier date, probably of the Cnidian school. Then there are some of his own that have been lost to us. In a survey of his "works", the ones on surgery conform much more to modern ideas than do the ones of a medical nature. It is evident that he tried to be honest and truthful in his statements. He outstanding point is that he attempted to put down what he himself knew. As a rule among the early writers, this was rare, particulatly among medical men. He gave attention to the symptoms which indicated the effects that the disease was having on the body such as fever, discharges,

delirium and restlessness. It is considered best to study the works as a whole (except of course, the most spurious), because they have been transmitted and have influenced medical practice and doctrine as such. The number of works vary----Neubur gives a list of fifty-nine. They more or less represent the knowledge and the spirit of the master.

They are too numerous to list separately, but they have been subdivided into the following groups:

I. Generalities-----	8
2. Anatomy and Physiology-----	10
3. Dietetics-----	2
4. General Pathology-----	10
5. Special Pathology-----	8
6. Therapeutics-----	2
7. Surgery-----	8
8. Gynecology, Obstetrics, Pediatrics---	10

The Pythagorean Treatise on Seven is considered pre-Hippocratic. W.H. Roscher dates it in the sixth century B.C. Franz Boll claims that it was written not any earlier than the middle of the fifth century. This latter supposition helps us to understand the apparition of the doctrine of Critical Days to Hippocrates by Galen, but it also discredits him of the Four Humor theory, as it was implied in the treatise. There are also several other treatises that are felt to be before the time of Hippocrates.

The following are probably genuine, but no importance should be attached to the order in which they are presented:

- I. Sacred Diseases--The dealing in a rational way with epilepsy, which was supposed to have been of divine origin. It is now considered a disease of the brain,

These two papers were written by the same author. Perhaps a younger contemporary of Socrates.

not of the heart or diaphragm. This treatise contains much anatomical information.

2. Airs, Waters, and Places---This gives the importance of meteorology, climatology, and astronomy from a medical point-of-view. It explains climatic and geographical influence upon organisms and upon causation and spread of diseases. It is thought to be the first treatise on medical geography. It is one of the first geographical introductions to history. In it we find the first attempt in the classification of races by physical traits.
3. Diet---This dates from the end of the fifth century, and deals with diet and exercise. It presents the first scientific treatment of animals, gives general views on evolution and biology. Some of the views are more speculative than the genuine Hippocrates.
4. Wounds of the Head---The date is about four hundred B.C. It is a very scientific paper giving various descriptions of kinds of skulls (i.e. variation in the sutures). It also presents the theory of fractures by contrecoup.
5. Prognostic---This deals with the prognosis of acute diseases.
6. Regimen in Acute Diseases---Seems to be a supplement of Prognostic. It deals with diseases characterized by high fever, chiefly chest complaints.
7. Epidemics I and III---There are two books here that consist one work. "The most remarkable product of Greek Science."

W.H.S.Jones uses these to define Hippocrates. Considers him the author.

8. Ancient Medicine-- W.H.S.Jones dates this at possibly 430 to 420 B.C. It is a defense of the empirical study of medicine against the "a priori method" (against the use of preliminary axioms).

The following were no doubt written at the same time as the above, but they are certainly of another school.

- I. Nutriments:--Dates at the end of the fifth century. It is distinctly Heraclitean in style and spirit. It illustrates a complicated theory of digestion; and discusses the comparisons in animals and plants with physical facts. We find in chapter forty-eight, the first mention of pulse in Greek literature, but its importance is not realized. Hippocrates' complete disregard for this fact is surprising, because it had previously been mentioned in the Ebers Papyrus.
2. The Art--Written about the end of the fifth century. It is a sophistic treatise written by a non-medical man to justify the existence of medical art.
3. Breaths--It is another sophistic treatise, having a layman as the probably author, proving that air is the prime cause of disease.

A statement from the archeologists research gives a brief summary. "The impression gained from the remains at Kos is that the treatment there was a rational rather than a wonder-working one, such as we find at Epidauros."

No article about Hippocrates should be complete without the oath that is used even today in the medical profession.

THE OATH OF HIPPOCRATES

I swear by Apollo, the physician, and Aesculapius, and Health, and All-heal, and all the gods and goddesses, that, according to my ability and judgement, I will keep this oath and stipulation: to reckon him who taught me this art equally dear to me as my parents, to share my substance with him and relieve his necessities if required; to regard his offsprings as on the same footing with my own brothers, and to teach them this art if they should wish to learn it, without fee or stipulation, and that by precept, lecture and every other mode of instruction, I will impart a knowledge of the art to my own sons and to those of my teachers, and to disciples bound by a stipulation and oath, according to the law of medicine, but to none others.

I will follow that method of treatment which, according to my ability and judgement, I consider for the benefit of my patients, and abstain from whatever is deleterious and mischievous. I will give no deadly medicine to anyone if asked, nor suggest any such counsel; furthermore, I will not give to a woman an instrument to produce abortion.

With purity and holiness I will pass my life and practice my art. I will not cut a person who is suffering with a stone, but will leave this to be done by practitioners of this work. Into whatever houses I enter I will go into them for the benefit of the sick and will abstain from every voluntary act of mischief and corruption; and further from the seduction of females or males, bond or free.

Whatever, in connection with my professional practice, or not in connection with it, I may see or hear in the lives of men which ought not to be spoken abroad, I will not divulge, as reckoning that all should be kept secret.

While I continue to keep this oath unviolated, may it be granted to me to enjoy life and the practice of the art, respected by all men at all times, but should I trespass and violate this oath, may be reverse be my lot.

GALEN

Five hundred years have elapsed since the last chapter.

The next man of importance was Galen, who was destined to influence medicine more than any other man for centuries--until the seventeenth century, when we find a revival of Hippocratic teachings. Galen revered Hippocrates. It has been proven that he followed his teachings and quoted him many times in his own works. There was much activity in politics, and map-workers had plenty to do during this period, but surgical science made no rapid strides.

Claudius Galen was born about 131 A.D. in Pergamus, which is situated on the Caeleis River, on the mainland about one hundred and fifty-five miles north of Cos. He was of Asiatic Greek descent. He is described as being a handsome, vigorous, precocious boy, who was the son of a high-bred, cultivated, and wealthy father, Nicon. This man was a professor of architect, who was devoted to the education of his promising son. Galen studied in the Alexandrian school in its declining years. This place had had a great influence on the science of antiquity. For over one thousand years it had been the Mecca of medicine. The students great accomplishment here was the study and development of anatomy--through dissection. We must remember this because until the time of Vesalius, anatomy made no progress whatsoever. He had the fortune, or misfortune, to be an extraordinarily able man, steeped in Greek culture, and would have nothing to do with humbugs or fools. He declares himself that it was not comfortable to live with him, because he was short-tempered and conceited. In him we find a very different character than the steady, kindly, and gentle-hearted Hippocrates.

It is true that he lived in difficult times, where it was necessary to be ever battling for his own teachings. He hated the super-

ficial, flably-minded, cynical, professional colleagues of Rome where he spent his most productive years. We feel that the history of Galen and his period are intensely interesting, though there are many modern writers who do not think so.

He was given the advantages of the best schools, being a faithful student of the Stoics, the Academics, the Peripatetics, and the Epicureans. His physical health was not robust, but he was active and well-trained; he had an acute mind, a retentive memory, and a just understanding. Many believe that he would have been considered a genius if he had not succeeded Hippocrates. Some authors state, though it should be regarded with caution, that he was an accomplished physician at the age of wighteen, and had written some medical works at the age of twenty-one. It is true that Galen appreciated the contact with the patient and that the study of the organs of the body were essential. There is a distinction arising in the ability to exploit knowledge and the capability to make it available to the public.

Galen lost his father when he was twenty-one. In order to get away, he started treveling; thereby obtaining the best experience that is rated by our educated men of today. First came Smyrna, and Corinth for the lectures, and then he went to Alexandria where he stayed for a year. He had an unusual ambition, and boundless curiosity. Much time was spent in the study of anatomy and physiology, and the branches of pure science. He was also accomplished in letters and arts. Then several places saw him,--Celicia, Palestine, Italy, Thrace, Macedonia, Crete, and Cyprus. He was constantly studying, observing, and comparing. He visited Lemnos, and traveled in Syria. These journeys were all taken on foot where he was seeing and remembering for future reference. After seven years, at the age of twenty-eight, he went back to Pergamus to settle down to teaching, writing, and practicing. Four years later, the charm

of the nations' capital became too strong, and on some small pretense, he moved to Rome. There was to be little peace for him from this time on. He made enemies easily, because of his strong, outspoken character. In the metropolis he found that the profession was debased, that science had practically ceased to be, and that commercialism and quackery were thriving. The Oath of Hippocrates was dead. When all these conditions are considered, it can be seen that Rome was a poor place for an honest man of science.

The situation was too much for just one man to handle, but Galen attempted, though futilely, to bring a little decency back into the fore again. He was ignored by all except the most intelligent and powerful and a virtuous few. It was fortunate that there were more of the powerful than the virtuous. Some of the former were:

Eudemus, a paripatetic philosopher.

Sergius, the praetor of Rome.

Barbarus, an uncle to the Emperor, Lucius Varus.

Severus, the consul, and later the Emperor.

Galen labored and struggled here for five years and then gave up in disgust. He returned to Pergamus, but was recalled shortly by the Emperor, to await him, and to combat the Plague. Thus he spent the remainder of his life in degenerate Italy. Some claim that he was invited to attend Marcus Aurelius in his wars, but he did not go. Both of these men remained in the minds of men for centuries, but recently Galen has lost his position as an authority, and Marcus, the Emperor-Philosopher, has taken a stronger hold.

Galen's death is figured about the year 201 A.D. with his age near the seventy mark. Rome was probably his death place.

For what things do we have to thank this man who is called the greatest physician of antiquity after Hippocrates? He was a product

of Alexandria,—a great man with a notable name. He was an anatomist, surgeon, physician, and philosopher. For the period in which he lived, he knew much. This is evident due to the fact that he was capable of controlling medical thought for almost seventeen hundred years. His methods were founded along the lines of empiricism. Galen, often called the Physician of Rome, astonished his associates in diagnosis, because he seemed to be able to locate the trouble with little or not outside information from the patient or his family. This was due to his keen sense of observation.

Some of the fundamental reasons why he maintained his influence over such a long period was the constant employment of demonstration and his reliance on rational and intelligent evidence. In a broad sense, he might be considered a follower of Hippocrates, but Galen went further than bedside investigation; he practiced and taught that laboratory methods through animal experimentation was important. Thus he acquired the title of our first great Physiologist. "Galen appreciated, as did those other ancients, that physiology is physiology, that diagnosis is diagnosis, and therapeutics, therapeutics, with surgery a branch of therapeutics."

He dissected numerous animals, but very few human bodies. He discovered many new facts in anatomy, physiology, embryology, pathology, therapeutics, and pharmacology. Some of the physiological improvements he made were:

- a. He determined the mechanism of respiration and pulsation.
- b. He determined the function of the kidney.
- c. He determined the function of the cerebrum.
- d. He determined the function of the spinal cord at different levels.

He gave a semi-rational (physiological) interpretation

of dreams and he had some notion of their medical interest.

In experiments he proved:

- a. That arteries contain and carry blood.
- b. That it suffices to divide even a small artery to drain the body of blood in one-half hour.

His most famous discovery was finding the true function of the arteries. It had been previously thought that the vessels contained air, but by the aid of double ligatures, and a subsequent cross-section of the area, it showed that there was congestion of blood. He also noted the difference of arterial and venous blood. He ascribed it to some element of the atmosphere. This point was lost then until Harvey revived it with his demonstration of the circulation of the blood. A fact that Harvey overlooked, but that had been previously been noted by Galen was the presence of a terminal communication between the two sets of vessels---which he named anatomosis. He also studied and described the movements of the heart. There was mention of the foramen ovale and the ductus arteriosus, and their relationship to fetal circulation fourteen hundred years before Botale. To the surgically minded, it is extremely interesting to note that he knew and practiced the art of ligature of the arteries, but he did not use it in tying the arteries after amputations, nor did he use the daring double operation of incision and ligature.

Matters about the nervous system were his favorite subject. He described the brain as the central organ with the cord as an offshoot. The nerves were designed to convey impressions of sensation and motion.

He taught that "the muscles are the instrument of voluntary motion; and we have seen whence the principle of this motion originates, and by what path it travels. It comes from the brain and through the nerves." In his work, he advocated operations of the brain and cord intelligently, with a peculiarly modern note.

He used the trephine less, and employed the gouge and chisel more often. He recognized compression on the cord, properly diagnosed the case, and advised an operation to relieve the pressure when necessary.

He worked to systematize and unify Greek anatomical and medical knowledge and practice. He was a very prolific, clear, and vigorous writer. He strove to establish immediately, medicine at once on an experimental and on a rational basis, but he failed to realize the narrow limitations of the deductive method in the field of biology. Yet,—he was a careful experimenter and observer, It was his immense learning, his intelligence, facility of expression, and his dogmatism that contributed towards maintaining his authority unimpaired until the sixteenth century. His therapy included medications with many vegetable-compounds. This started poly-pharmacy in herb-doctoring. No complete translation of his works can be found.

Sanitation, or the first steps towards it, was an outstanding contribution of this period. In Greece, no provision had been made for sanitary measures, but in Rome we found paved streets, sewers, and aqueducts.

Clean Streets	These three main assets of Public Health had
Pure water	their first practical application, but at the end
Sewage disposal	of the period they fell into disuse until the
	nineteenth and twentieth centuries.

It is true that many of his teachings were erroneous, and that his advice was unsound, but he was centuries ahead of his time. He felt that it was his mission to teach the professors in every branch of medicine. Often his work was visionary, mostly due to the lack of the microscope and a knowledge of chemistry. His assertions were probably guesswork, and his hypothesis untenable, but in his time, his methods and purposes were correct. In

DEVELOPMENT OF THE SIXTEENTH CENTURY

Before we record the findings of the actual sixteenth century, let us go back briefly and see what has happened during the intervening period. Monastic Medicine was the term applied to the time during the Dark Ages, because most of the practices of medicine were essentially in the hands of the priests. One reason for this was because they were the only ones that were able to read and write. The common people were barely anything better than slaves. Their stock did not become degenerate, as was proven by their progeny during the Renaissance. They lacked the inspiration and the free spirit of aggressiveness. The period shows the influence of environment upon the character of men. There was complete submission towards recognized authority such as the Church and the Feudal Lord.

The Arabs preserved the medical science of the Greeks and Romans, though they added their own peculiarities. They admired and applauded clever, subtle logic rather than sound and rugged principles. There is a likely comparison between Greek and Roman architecture---the Grecian column stands clear and simple, while the Arabic filigree is detailed and intricate. Thus they were as men. Therefore, we can see why Galen's theorizing appealed, instead of the rugged principles of Hippocrates. They adopted Galen's theories, poly-pharmacy, and dogmas which became as irrefutable as the basic axioms of geometry.

The Crusades were avenues whereby Arabic medicine was brought back in full force to Europe. It was accepted by a people who were submissive to recognized authority without question. Therefore we have an explanation again, of why Galen's theories were held in repute above Hippocrates. Arabic medicine offered--added stone-lore, a sturdier pharmacy, but they lacked

light in a great wilderness. Their outstanding medical contribution was the writings of Roger of Palermo. He prescribed the use of burst sponge in the treatment of goiters, the use of mercury salves for skin diseases, suturing of the intestine over a tube, but he preached—healing by second intention. A subject which was much discussed until the time of Lister. There were only three men during this Medieval period who advanced that wounds should heal without the formation of pus.

Theodoric, Bishop of Cervia.

Henri de Mondeville.

Paracelsus, a great Swiss of the Early Renaissance.

There were only two men, surgeons, who advanced medicine during this period.

Henri de Mondeville, already mentioned, lived in the thirteenth century. He advocated the healing of wounds by first intention. His influence was not great.

Guy de Chaulic, was a man of rare talents, and a noble character.

Through his example he raised surgery to a more dignified position. He advocated that a knowledge of anatomy was essential to successful surgery. But he was against Theodoric and Mondeville, because he felt that it was necessary to meddle around in wounds using pastes and plasters. His influence was so strong that he retarded the progress of surgery for six centuries.

Little medical progress was made in Europe until the sixteenth century. The intervening period was filled with sterile disputations. Galenic and Arabic-Galenic medicine took its hold on the medical profession to

the point where it was considered a heresy to doubt any of the dogmas.

Pharmacy was the only branch to make any progress, and that was more of a social rather than a professional advancement. It was of great benefit to mankind. Pharmaceutical beliefs led to exploration, which led to the discovery of great countries such as America.

In the fourteenth and fifteenth centuries men began to doubt some of Galen's teachings. The younger students were not satisfied, though it took them many years to actually break through the wall of influence that had been built up by the teachers of Galen's theories. When they did break through, it was like to a flood when a dam breaks. All the bounds of tradition, authority, and superstition were broken. A system of fundamental sciences was built. The structures of the body were studied through dissection of the human body and not from lower animals. With this knowledge the sciences of anatomy and physiology were built. These two branches proved to be the foundation of modern medicine.

It can be seen that there was something needed to set men free from time-worn authority. Two things presented themselves at just about this time. They were gunpowder that ended feudalism, and the printing-press that opened the way for self-education. It can be said that the Renaissance began the year that Constantinople fell before the Turks, and all the wise men fled with their knowledge to their Western brothers. When they came, they brought with them the teachings of Hippocrates and the philosophy of Plato, which was much better than the desiccated diet of Galen and Aristotle for the growth of independence in a country hungry for knowledge. So now we have the beginnings of modern development, when men turned with faltering foot-steps towards the principles that had been left by Hippocrates. As a result of this awakening, in the last seventy-five years, measures which have been most beneficial to man-

kind in many sciences have been demonstrated.

The Renaissance is considered the springtime of our world. It is the period where we find many famous names appearing in all branches of development as men broke away from tradition, rending in two the veil of darkness.

There are many men who have given some contribution towards the progress of medicine, but they are too numerous to mention any but the most important. In the revival, it was first a task of translating and publication which was done by Lenacre, Rebelais, and Roslin.

Paracelsus (1493-1541) was crude, forceful, domineering, and sweeping in the breadth of his conclusions. He started in his work with bullying aggression. The humanist might in time have been able to wear down the walls of tradition, but he proceeded to shatter them. He was a Swiss, being a rather queer type of person with the keenest of intellects, and a coarseness of fiber, which was a peculiar combination. A great deal of his life was spent in wanderings. It was the only means they had to keep up with the progress of the times. This was the life of any university student, or even the professors. Itinerant students of the day were considered vagabonds, begging and stealing for their livelihood. Garrison says that Paracelsus collected his information from all sources, thereby learning a great deal of medical practice and much interesting and unusual knowledge of folk-medicine. Due to the fact that he was keen and well-educated, he was able to overlook the superstitions and uncover the kernel of value in the practice. Being a man of his times, many of his works are shrouded in mysticism so that they are difficult to understand.

He startled many by teaching in the vernacular instead of in Latin, the language of the learned. Worst of all, he taught from his own experiences and common sense instead of from Galen and Avicenna. It has been re-

corded that when he started his teaching at Basil, he burned the works of the two above, and attempted instead, to get his prospective students to revere the works of Hippocrates.

Another factor that he added was the introduction of mineral medications. He substituted mercury, lead, iron, sulphur, and arsenic for Galenic herbs which he claimed were useless. Each faction fought for their own beliefs and undoubtedly both were partially right. Galenic herbs were harmless, but also mainly useless; while the minerals were in certain cases beneficial, but they were also harmful in the large doses that were given at that time.

We have proof that his medical knowledge was sound and practical. He advanced the theory of letting wounds heal by first intention. His greatest contribution was that he preached revolt against dogma and a return to Hippocratic principles. His actions and words were bold, in a period where to stray from the beaten path was heresy--- and the penalty death at the stake. Paracelsus escaped this punishment, and for this reason men began to stir and think independently about various medical affairs. There began a renewed search for scientific facts. One of the first branches to feel the effect was anatomy. In looking over the old drawings of the fifteenth century, we can see that there was a great lack of anatomical knowledge.

Andreas Vesalius (1514-1563) was born December 31, 1514. This was one thousand three hundred and fourteen years after the time of Galen, but the progress made by science could be measured with a foot-rule. The Arabs were about the only forward and active people of the period. Medical science is found among people of this type. Two members of this race, Avicenna and Albucosis are not important for what they originated, but for what they compiled and brought forth of the best teachings of the ancients. They were nec-

essary to Vesalius, at least in a way. He did new and important things. He is one of our landmarks along the path of medical development, because he cast aside worn out tradition. Instead of overthrowing Galen, he appears to be the only true follower for many centuries past. Of course, he improved on Galen, and corrected many of his errors.

Many pass Vesalius by as a surgeon in preference to Pare, but he should be considered as one. He held the chair of Surgery, founded modern anatomical research, and made way for the growth of surgery into a science.

Vesalius was of German descent. He came from a line of physicians and learned men. He was as well-educated as Hippocrates and Galen. This education was given at the University of Louvain. While there, his passion for dissecting was satisfied only with animals/ In 1533, he went to Paris and studied under Sylvius, who merely lectured from Galen. At different times, he would have a barber-surgeon expose certain parts of the body for demonstration. To the young student, it was a futile work, and it said that after about the third time, he impatiently pushed aside the ignorant assistant and showed them himself how it should be done. This was the key-note to his entire life. After three years he went to Vienna. He must have been an outstanding character, because he immediately attracted the attention of the leading men there. In 1537 he was made a Doctor of Medicine at Padua. In this same year, when they founded the Chair of Surgery and Anatomy, he was appointed to the position. The opportunities were wonderful. For five years he was able to work with enormous success. He was popular as a teacher and his classes in dissection became famous. He went far to obtain his knowledge--against the approval of many. The title of our first true anatomist was given him, because he was the first to dissect the body unblinded by the authority of Galen. He recorded what he saw--not what

he was supposed to see. His life was quite different from most of the surgical guild, because he was cultivated at the universities. Thus he appreciated the importance of anatomy and its necessity for successful surgery. He was dignified, straightforward, *sauve*, hot-tempered, and painstakingly thorough in his work. He taught what he knew, and the scientific method of research. Of course, Vesalius made mistakes like the rest. For example,--that the nasal secretion came from the brain. This idea was corrected about onehundred years later.

In 1543, he published his famous book, "De Fabrica Humani Corporis". In it he gave the human body its proper elements,--not those belonging to a dog, monkey, or ox. The response was immediate and violent. It came from within his own profession. Some regarded him with disapproval, and others took this opportunity to abuse him in many ways. In disgust, he burned his manuscripts and accepted the position as private physician to Charles V. After about twenty years or so he made a pilgrimage to Jerusalem for some unspecified reason. On the way back, he received word that his old position at Padua was waiting for him, but he was never to take it, because he sickened and died on the trip. Vesalius's work made a profound impression upon medical science and particularly upon surgery.

Fallopian (1523-1562) for whom the Fallopian Tubes are named went on with the work of Vesalius. Eustachius (1500-1574) compiled his dissections which remained unprinted in the Papal Library for one hundred and sixty-two years. Sylvius (1478-1555) named structure after structure in the body.

The third great man of this period was Ambrose Pare (1510-1590). In his life there was a division in the ranks of the surgeons.

The Church had controlled European learning for some time. Healing was a part of the priest's functions, but the shedding of blood was abhorrent to them, so they practiced only internal medicine, and demonstrated some skill in the treatment of wounds. Therefore, the actual shedding of blood was left to the Jews, the profane and the vulgar. In the monasteries, it was necessary to have a barber to do the tonsure work, also in some of the orders, regular bleeding was a custom so the barbers performed this ceremony. Thus we find the origination of the name "barber-surgeon". In Pare's country, France, this class was held in contempt. Then there was the regular physician, who was educated in a fashion, spoke Latin, the language of the scholars, and were licensed to practice. They were considered the great men at the top. Inbetween these two classes there were the surgeons proper, under the order of St. Cosmo. They were called the "surgeons of the long-robe". There was a great deal of jealousy among the three groups. Each division was in constant conflict with the other. Up until just recently the physician maintained his rank of superiority. There was a gradually leveling of the ranks of the surgeons up the the eighteenth century, when a broader and more scientific basis for surgery was established. It is still possible to find the unlettered and crude work of the barber-surgeon in some countries. His work is to do cupping and certain special treatments. In England, his work was taken over by the Apothecary, and now these duties are being assigned almost entirely to the nurse. In 1731, the Academy of Surgery took the place of the confraternity of St. Cosmo. The great Petit was the first director.

Pare began as a humble "barber-surgeon", and became the greatest medical man in Europe., and he was beloved by all of France. He was not trained, nor was he a great scientist, but he was a practical clinician. He kept his eyes open, and used common sense. He had a great abundance

of experience. He could be equally at home in the crude army camps or in the court where intrigue ruled, that of Catherine de Medici. He was the least strong of the three, but the most loved.

Pare was born in 1510 at Bourg-Hersent. His father was a servant. His brother, Jehan, and his brother-in-law, Gaspard Martin, were barber-surgeons. At the age of nineteen, he became a member of the same group. When he was twenty-three, he went to Paris where the Plague was raging. He found plenty of work there. Almost immediately after his arrival, he was appointed as a resident at the Hotel Dieu, where he spent three years as a pupil, dresser, and operator. Sylvius was the teacher of both Vesalius and Pare. They were destined to meet in later life---possibly at the death-bed of Henry II in 1559. Then he went to the war at Piedmont, under Anne de Montmorceney. He also established a residence in Paris. Thus he had two different streams of life to contend with. It was while he was in the army that he made a great discovery. One day, because of a shortage of oil, he found it necessary to use a soothing potion of egg-yolks, oil of rose, and turpentine on gunpowder lacerations. He found that it worked much better. The patient suffered little pain, and there was no inflammation or swelling in comparison to the fever, pain, inflammation, and swelling evidenced with the boiling oil treatment. He solved the first great surgical problem, (stopping the flow of blood), by making use of a suture. He stated, "I dressed his wounds; God healed them". At the age of thirty-one, he was qualified as a master "barber-surgeon.

Pare received no regular pay for his work, but that which he did was manifold and eccentric, anything from money, [&]jewels, to livestock. He was loved by all, because he was sane, human, resourceful, abounding in common sense, in shrewdness, in natural ability, and he dared to have original opinions. He loved the people, but he did not hate their rulers. He was

loyal, quiet,,and conservative. His personality counted for much. He raised the dignity of surgery, making it tolerable for the actual surgeon.

Pare had eleven publications with an enormous variety of subjects. Some of these are: He dealt rationally with gunshot wounds, and proved that cleanliness and support sufficed for their cure; and he had treatises on anatomy and physiology, head injuries, the Plague, measles, smallpox, and leprosy. There were others that were not strictly professional. He was one of our first great clinical surgeons using careful and exhaustive diagnosis. He spared the knife, but was nimble and dextrous with it. He was skilled as a dresser. Many surgical procedures of today date back to him. The ligature, artificial eyes, massage, truss in hernia, improved operation for hernia, and improvement in his artificial limbs. It was his keen common sense that gave surgery its impetus at the time, and made it a practical art for the next two hundred years when Hunter made it a science. He gave us two great improvements. First, the simple treatment of wounds, and second, the use of the end-ligature in amputation. His life was adventurous and brilliant to the last. He was always in the public eye, and constantly serving in battle, murder and sudden death, and against plague, pestilence, and famine. He died in December 1590, at the age of eighty.

A brief mention should be made of one other man of this period, Girolamo Fracastoro, physician, poet, geologist, and astronomer. In 1530, he published a poem "Syphilidis, sive, Morbi Gallici". In this he gave a name and a description of the malady that was then spreading through Europe.

Just taking these few men as we have, we get an untrue picture of the period, because they were alone and above the crowd. For the most part little progress was made among the group as a whole.

DEVELOPMENT OF THE SEVENTEENTH AND EIGHTEENTH CENTURIES.

In the sixteenth century, scientific investigation was a rare novelty which was undertaken by a very few understanding men, but in the seventeenth century, it became a fad which was patronized and dabbled in by a host of men. For this reason there was a great deal of pseudo-science along with some of the most important contributions given to medical progress. For two sides of the picture, we might compare the work of Harvey on the circulation of the blood, and the support given by the King to Sir Kenelm Digby and his powder of sympathy, which was supposed to heal wounds if garments stained by the blood were dipped into a solution made from the powder. Thus we find that medicine revived, was passing from its childhood into adolescence.

In this stretch of one hundred years, the name of William Harvey (1578-1657) stands out. He graduated from Padua at the age of twenty-four, and sixteen years later, he was appointed Physician Extraordinary to James I, and later to Charles I. He is one of the modern scientists. One would describe him as short and slight, black-haired, red-faced, quick in action, and not the best of practitioners. His discovery of the true circulation of the blood, was the first really important event that had taken place since the time of Galen. The significance lies not in determining the actual flow of blood, but the founding of the science of physiology and the method, a mathematical demonstration, which was later to be used by many in physiological inventions. Ancestry believed that the veins carried the blood, and that the arteries were filled with air. Galen determined that there was no air in them, but he had no idea of what actually happened. In fact, they thought blood to be slow in movement and irregular in direction. After Harvey came to the conclusion that the blood had to flow back to the heart, he went about proving his theory step by

step. At first there was much opposition, but it soon died out, and in its place other men began to find added proof to support Harvey's statements. He centered his attention upon the closely connected systems of circulation and respiration. The greatest question that stopped him and all the others was how the blood got from the arteries to the veins? This could only be speculated upon until the discovery of the microscope. Let us mention briefly some of the men and what they did in connection with this important instrument, because without it medicine and surgery would never have come so far.

Hans and Zachariah Janssen-----Flea glasses-----1590

Anthanasius Kircher-----1st to use a microscope in
disease. Thought he saw living
parasites, but it was probably
red blood corpuscles---1658

Antony van Leewenkoek-----Constructed a special micro-
scope to observe the trans-
parent tail of the ell. 1632-1723/

Jan Swammerdam-----He described red corpuscles and
the internal organs of worms.

Robert Hooke-----He observed minerals and the cell-
ular structure of plants. 1635-1703

Marcello Malpighi-----Founded histology as a science.
He saw capillaries which gave the
final step in Harvey's theory. He
showed the essential vascular
structures of the lungs, and the
minute structure of the air-sacs.

His second problem, why men breathed was not to be answered for one hundred years, but John Mayow did demonstrate that the change in the color of the blood while going through the lungs, as noted by Harvey, was due to exposure to the air.

The focus during the seventeenth century is upon Harvey and the microscope, but other than these two things the period was essentially the same as the sixteenth century. It is true that they had Wilhelm Fabry, "father of German surgery", and the introduction of quinine made from the cinchona bark from South America.

The observation of symptoms was still a very important factor. Sydenham of England, considered the English Hippocrates, did not believe in experiments or theories, but only in observation and experience. Thus he advocated that the only place to learn disease was at the bedside. He claimed that each disease could be distinguished from the other, because they run different courses, but that it was necessary to observe each change. His fame rested on the use of his common sense and keen observation. He described disease with the fidelity of Hippocrates. He prescribed simple treatments that were effective. His methods were seldom attained and never exceeded for the next hundred years.

Galileo Galilei (1564-1642) was the first to describe a variation in the pulse beat. A contemporary, Sanctorius, demonstrated the first clinical thermometer. He also discovered the fact that a certain proportion of food eaten is absorbed and thrown off by "insensible perspiration". Daniel Quare put the second hand on the watch, and Robert James Graves contributed the practice of using it to count the pulse.

The eighteenth century was not to be one of discov-

eries, but it was one of systematization, though there were not enough facts to work upon along the medical line at any rate. It is a period of criticism and sophistication where men were philosophizing.

John Brown advanced the theory that disease was caused by too much bodily excitement or not enough. His respective remedies for the two conditions were opium and alcohol. He died an addict to both of them.

Albrecht Von Haller (1708-1777) was a Swiss, from Bern. He was a brilliant, indefatigable worker, whose labors though not superficial, were not deep or fundamental. He was a Professor of Surgery and Physiology, being a better teacher than practitioner. He is claimed by surgeons as their own.

In childhood he was sickly and precocious. He mastered strange tongues and studied a great deal. At the age of twenty he had his medical degree and had studied as a graduate student. He went back to his hometown, but people shrank from calling him in, so his life as a practitioner was a failure. This did not bother him, because he studied nearly every waking moment that was available. He was much interested in botany, and produced a great work on the Alpine Flora. He was a poet. He wrote books on anatomy and physiology. The outside world recognized him, though his own home did not. In 1736, he was called to the Chair of Medicine, Anatomy, Surgery, and Botany at the University of Gottingen. He worked for seventeen years as a student, investigator, and teacher. At the end of this time he returned to Switzerland, where he devoted his time to mighty works.

We can thank him for a literature and history of surgery; he taught surgeons how to study, and raised the profession from its degraded rank; he demonstrated that surgery was not a mere craft; he showed the necessary union of surgery with a knowledge of anatomy, physiology, and pathology; he explained the mechanics of respiration, the formation of bone, devel-

oped the science of embryology; established the doctrine of muscular irritability, and studied the problems of digestion for which many modern surgeons are thankful. He also studied the nervous system, though here many of his hypotheses were wrong, because he had more difficult conditions to work under than in modern times where great progress has been made.

He suffered much in his life time. There was a mighty soul in a feeble body. When he died, he said, "The artery no longer beats."

The greatest clinician of the eighteenth century was Herman Boerhaave of Leyden. He had a reputation as a consultant all over Europe. Nevertheless he added little to medical practice. He employed the methods of Sydenham, being a better teacher, but he lacked the ability to describe disease. Scientific advancement was at a higher level in other branches than in medicine.

Some of the men who labored during this period, and whose work was valued by subsequent achievement rather than by the influence that it might have had at the time are:

Giovanni Morgagni (1682-1741) correlated disease conditions with the clinical symptoms arising from them, thus founding pathological anatomy at the University of Padua. His teaching that disease grew and was a part of nature was a live, dynamic thing. He did not influence medicine.

Stephen Hales (1677-1761) was a cleric interested in scientific matters. He discovered blood pressure, and measured the arterial pressure with no apparatus, but inserted a tube direct into the vein of the horse which was being used as a subject.

William Smellie (1697-1763) computed the first correct obstet-

ricial measurements of the pelvis.

Leopold Auenbrugger (1722-1809) gave us the art of percussion about the year 1760.

Joseph Priestly (1733-1804) discovered the element, oxygen.

This was the purified product of the air that changed the color of the blood. Thus settling Harvey's question. It is essential to life.

Antoine Laurent Lavoisier (1743-1794) proved that oxygen is used by the body to burn up food. This combustion is the essential phenomenon of life. At the time it was considered of no value. He was killed at the guillotine in 1794 during the Revolution.

Luigi Galvani (1737-1798) put emphasis on the relationship of muscles and nerves, the nature of the nerve impulse, the difference between sensory and motor impulses, and reflex action.

Rene Theophile Hyacinthe Laennec (1781-1826) who himself suffered from Tuberculosis, contributed much towards its diagnosis. He invented the stethoscope in order to listen to the heart.

John Hunter (1728-1793) is the man who is credited with making a science of surgery. Up until this time it had only been a part of the treatment, which made it subordinate to clinical medicine. He supplied not only the knowledge of anatomy and improved technique, but he correlated the surgical procedures with the physiology and pathology of the diseased parts, thus founding the science of experimental and surgical pathology. He did more than most men to raise the dignity of surgery and the surgeon above subordinate ranks. He was still limited to the surface of the body and the extremities,

because he did not dare to open the abdomen. It was done only a very few times until Lister brought forth antiseptis. He dealt mainly with injuries, amputations, surface tumors, and especially aneurisms. One of his motto's was, "Don't think, try; be patient, be accurate."

Hunter was born in Scotland. The world was ready for him. Haller had been a marvelous investigator and teacher, but he was not a practical surgeon, so Hunter was the man.

He came from a robust, good, middle-class stock. He was the youngest of ten. He owed quite a bit to his ancestry. Of his youth all that is known is that he was rugged, not studious, though he was not neglectful or unobservant. His education was very limited, but he was no fool. His older brother, William, had a great deal to do towards his younger brother's success, as well as his own. He was well-educated and turned to the profession of medicine. It was he who gave John a start in his dissecting room in London. The younger boy was uneducated, rude, and had a fierce temper that was to be his downfall in later years. In his youth, his life was not of the best. It is not known where he gained his knowledge of his predecessors. He was a man of his times and was keen about what was going on. He studied under the tuition of William Cheselden, one of the most eminent of men in the older school-- the passing of which later John was to be greatly responsible. The influence of the two Williams was excellent on a young mind. In the next few years he had a variety of teachers. Pott was one, an admirable man and an excellent teacher and surgeon. He was to be of John's rivals and critics. He was entered at Oxford, but being twenty-seven, he was not anxious for this. During all this time, he continued his work as dissector and teacher for William. At the age of thirty-one, he had a breakdown. After which he was considered as a man. He was

an army surgeon, collector, investigator, teacher, writer, practitioner, and at the end a martyr to a fiery temper and a fatal, agonizing disease--Angina Pectoris. He wrote several papers and these were presented to the Royal Society. He dreaded formal class lectures, but those that he did give were published later. His married life was not remarkable, though he must have been quite a trial to his wife, who remained faithful to him to the end. He left her penniless. He made a great deal of money during his life-time, but all this was spent towards his collection of specimens-- the Hunter Museum is still remembered.

He worked from a fundamental viewpoint, and he saw the value of science more clearly than any other man. He made many mistakes as any man would who makes many experiments. He realized that he couldn't accomplish everything in a life time, but he felt that with what he did, his successors could carry on. His experiments were based on deduction from observation. Those things that we contribute to him are: a book on surgical lectures, a treatise on venereal disease that had long been needed by the profession, and the operation of the aneurism. These were only drops from a seething laboratory. He meant to us, the first and the greatest of English-speaking exponents of proper scientific research. He is the father of us all,--physicians, surgeons, and laboratory technicians, for whom he wrought mightily in all fields. He was not loved personally, though he did command respect and admiration. He did not spare himself or others.

The prevention of disease became an important factor. Edward Jenner was one of the outstanding men along this line. He contributed the vaccination in 1796 against smallpox. He was encouraged in his work by John Hunter. Inoculation had not been a popular remedy. In 1770, Captain Cook said that the cure for scurvy was the use of lime water and fresh fruit. John Howard

promoted sanitation in the jail-houses and hospitals in 1786. Industrial trades were considered the cause of various diseases by Ramazzini in 1700. It was found that cholera was due to contaminated water in 1854.

Mathew Ballie in 1794 published "Morbid Anatomy" which was the first connected text on the diseased appearances of the internal organs of the body.

Philippe Pinel did the unheard of thing in 1798 by cutting the chains loose from the mad-men at Bicetre. This was the first humane treatment of the mentally ill. His work actually belongs in the nineteenth century.

At the end of this period, we find that the preeminent medical centers have shifted from Leyden and Paris to Vienna and Edinburgh. The former is important, because it was here that Ignatz Semmelweis (1818-1865) took the first steps in the nineteenth century to control puerperal infection. Edinburgh was the gathering point for Colonial America's most prominent physicians, such as John Morgan, Wm. Shippen Jr., and Benjamin Rush. They were some of the pioneers of our country, but they left no definite contributions to the progress of medical science. Because of the work of a renowned few, the physicians were probably a little better acquainted with anatomy, but on the whole, practical medicine and particularly that of surgery was still at a low level at the end of the eighteenth century. We could still find that Queen Anne and Louis XVI practiced the old superstition of touching for the King's Evil.

Before concluding this chapter let us mention a few of the Americans who, though they did not offer any great contributions, are men to be remembered, because they were daring operators and great clinicians.

John Jones (1729-1791) was born in New York. He is of

the Hunterian Era. He obtained his education in Europe. He was the first American to perform a lithotomy. In 1775 he wrote "Plain, Concise, Practical Remarks on Treatment of Wounds and Fractures."

William Shippen Jr. of Philadelphia (1733----) received a foreign education. John Morgan and he founded the medical department of the College of Philadelphia. He served with distinction as Physician-General to Washington's armies in 1777-1781.

John Warren (1753-1815) was born in Boston. He received his education entirely in America. He was the founder of the Harvard Medical School where he held the Chair of Anatomy and Surgery. He also acted as a hospital-surgeon during the Revolution. In this country, medical schools preceeded the establishment of the hospitals. It was just the opposite in Europe.

Philip Syng Physick (1768-----) was born in Philadelphia, and is considered the Father of American Surgery. He heads the list of the Hunterian Era, being a personal friend and pupil of Hunter. He spent his life working for his friend's principles. In 1794 he was appointed as surgeon in the Pennsylvania Hospital. He contributed little to the advancement of science, but he was famed for his ability as an operator, the tales about him by his pupils, and the compend of his practice. He did improve the technique of the surgeon.

DEVELOPMENT OF THE NINETEENTH CENTURY.

The influence of progress along other lines also has its effect on medical advancement so let us take a look into the outside world. The American Revolution was just over, and the French Revolution was still going. The Industrial Revolution was progressing. The common man felt a new importance, because he was able to labor not only with his hands but with his brain. Thus in medicine, there was a vast difference in what the physician had to offer at the beginning of the nineteenth century and the twentieth century. The character of the men changed little and their aims were as high. There were three things that had to do with this change. First there was an increase in knowledge, and because of this education followed. Then the social situation of medicine changed. It became a social necessity and guiding force in modern civilization.

Practical Preventative medicine was launched in the century to protect the cities, states, countries, and the world from disease. For an example of the radical changes that were taking place, let us compare the inventions of the first part and the last part of the century. There was the stage-coach, sailboats, candles, and filthy cities without sewers as against the railroad, automobiles, steamboats, electric lights, and modern clean cities. The last change was due to medical achievement. In the beginning there was injustice, cruelty, and outrage. There was no Red Cross agreement with belligerents in war-time. There may have been a few scattered cases, but they were rare. At the end there was an International Red Cross Organization.

As life became easier, humanitarian ideas changed. For proof of this we have the work of Pinel. Dorothea Lynde Dix of Boston forced the care of the mentally ill upon the reluctant public. She was re-

sponsible for the founding of over thirty state institutions.

Organization took an important place during these hundred years. Florence Nightingale was not the founder of Nursing, but she brought it up to the level of a profession. Chemistry, physics, and mathematics were utilized in the field of invention.

The beginning of the century was barren of medical progress. There were some characters who added little, but were great because of their personality. They will soon be forgotten, for only those who contributed fundamental principles will be remembered. Deeds not men, illuminate the story. In the first forty years there was a careful observation and classical description of diseases. Many new and useful chemicals were discovered or isolated. The three outstanding events were: the discovery of the stethoscope, the founding of medical statistics in 1835 by Pierre Louis, and the demonstration of cellular structures of plants and animal tissue by Theodor Schwann of Germany in 1839. He determined that the cell is the structural unit of all living things. The "anatomy laws" were formulated at this time to provide bodies for dissection, because Burke and Hare in Scotland had lured inconspicuous people to their place and murdered them for the bodies.

The discovery of practical anaesthesia was the first of the two most important discoveries made during the century. Dioscorides, surgeon to Nero, had used a saporific mixture. The surgeons at the School of Salerno had used a saporific sponge. Opium and alcohol were likewise used, but by the sixteenth century all of these methods had been discontinued as being unsatisfactory. Just before the introduction of ether, hypnotic trances were attempted. They had apparently been successful in the Orient, but not so in the West. Prior to 1846, the words anesthesia and anesthetic were not known. It was discovered three different times in three different places within the space of

four years. In 1842 Crawford Long of Georgia used ether for a minor surgical operation, but the fact was known only locally for several years. In 1843 Horace Wells, a dentist, of Hartford, Connecticut, used nitrous oxide while extracting a tooth. He attempted to interest the Massachusetts General Hospital in its use, but his demonstration was a failure. On October 16, 1846 William Morton, used ether, as suggested by Charles Jackson, with the permission of John Warren. Oliver Wendell Holmes then suggested the names anesthesia and anesthetic. James Simpson tried ether, but he was not satisfied with the results so he found chloroform and used it in his practice of obstetrics. In conclusion, in 1852 Dr. E.R. Squibb first manufactured a pure anesthetic ether by steam. In 1853 he completed his method. Dr. Squibb has set the standard for the manufacture of pure drug products.

In the period 1840-1850, Marion Sims of South Carolina and New York did some famous work on the irreparable vesicovaginal fistula. He established the New York State Hospital for Women. Oliver Wendell Holmes presented before the Boston Society for Medical Improvement a paper "On the Contagiousness of Puerperal Fever" This was proven separately by Semmelweis within five years. They felt that puerperal fever was carried from woman to woman by the unclean hands of the physician.

1850-1860 saw the reorganization of Nursing. Carl Crede of Leipzig invented the manual expression of the placenta, and thirty years later introduced the silver nitrate treatment of the newborn babe.

Between 1860-1870 Julius Cohnheim established the modern conception of the inflammatory process and the formation of pus. Theodor Billroth, Ernst von Bergmann, and William Halsted were all pioneers in the development of surgical technique. The Red Cross was organized by Henri Dunant, a Swiss.

The work of Pasteur and Koch overshadowed all the others from 1870-1880. Weir Mitchell introduced the rest cure. Max Nitze gave us the cystoscope.

Medical development took place during 1880-1890.

1890-1900 found that radium had been discovered by Marie and Pierre Curie, and the x-ray by Wilhelm Konrad Roentgen of Wurzburg. Dr. Spencer Well invented the haemostat, to control bleeding.

Let us mention some of the American men who were prominent during this period. Wright Post of New York was the first surgeon of eminence in the century. He was a daring operator and skilled anatomist. Valentine Mott was an inspiration to students. Emphraim McDowell of Virginia performed an ovariectomy in 1809 and became known as the pioneer ovariectomist. Nathan Smith is famed for the founding of the Dartmouth Medical School, his teaching of clinical medicine, and his exposition on Typhus Fever. He also was an ovariectomist, who dropped the pedicle as no other had done. John Collin Warren of Boston was the leading surgeon of New England for over fifty years. With James Jackson, he founded the Massachusetts General Hospital. He was one of the early presidents of the American Medical Association. He was one of the first that dared to use anesthesia for one of his major operations.

Five years before the introduction of ether, only one hundred and eighty-four were willingly operated on at this hospital. Five years afterwards, four hundred and eighty-seven were performed, and in the year 1898 over three thousand seven hundred operations were performed. W.T.G. Morton established ether as a safe and sure anesthetic in 1846.

Europe educated most of our best men. It was because the best original work came from there, and they had greater experience in the large clinics. The Paris School now became popular during the Napoleonic Era.

Here the men were given an unusual opportunity for study in anatomy and clinical surgery. Edinburgh and London fade into the background, and there rises up a new generation of practitioners. Some of these are: William Gibson who performed two Caesarian Sections on the same person. John Rhea Barton who was a surgeon at the Pennsylvania Hospital specializing in work on bones and joints. George McClellan was a brilliant operator. George W. Norris was a Professor of Clinical Surgery in the University and surgeon at the Pennsylvania Hospital. He was among the best of the surgical writers. Thomas M^ulter did plastic surgery on extensive scars. Daniel Brainard of Western New York founded the Rush Medical College of Chicago. Joseph Pancoast was a Professor of Surgery at Jefferson Medical College and a strong writer on surgery. Francis Maury was the first to perform a gastrotomy in this country. Dr. Hayes Agnew published "Principles and Practices of Surgery" which was famous for over a generation and highly esteemed by practitioners and teachers. J. Kearney Rogers was an able surgeon. Willard Parker was the first to operate for strabismus in this country. Henry J. Bigelow was one of the best products of France. He was a brilliant and meteoric teacher, profound and exhaustive as a writer. Bobbs devised the cholecystostomy. John L. Atlee, Washington L. Atlee, Dunlap, Peaslee, Kimball, and J. Marion Sims placed a sound basis upon the operation of ovariectomy.

The Civil War followed in which the mortality was high, but the record was brilliant. The literature on the medical and surgical history of this period are worthy of study.

Samuel D. Graves borders between the French and German-American influence. Along with Bigelow he made American Surgery respected in Europe. He received the Laureate from Oxford, Cambridge, and Edinburgh. He made a special investigation of abdominal stab wounds, besides many other things. He was one of the few men who have been suitably honored by posterity. In 1897

the American Surgical Association and the Alumni of the Jefferson Medical College erected in the city of Washington, a handsome statue to him in front of the Army Medical Museum.

In 1904 Dennis said, "Surgery as a science made no profound impression upon the world until about a century ago." The foundations had been laid deep long before the beginning of the century. Can we possibly forget Galen, Vesalius, Pare, Harvey, Haler, and the two Hunters. Such men were needed as a basis for the work of the men to come. The great and permanent achievement in surgery was the wide development and the establishment of the scientific method of study.

Joseph Lister considered the commanding figure of the nineteenth century was born thirty-four years after the death of John Hunter. During that period there were other men who contributed towards medical progress. Astley Cooper was the most popular teacher of the time. John Abernethy was an able successor and exponent of Hunter. Benjamin Collins Brodie of a younger generation was a brilliant anatomist and operator. James Syme was a renowned teacher at Edinburgh; author of a text-book on surgery; and the father-in-law of Lister. Fergusson was the leading surgeon in London for many years. Erickson was the author of one of the best known text-books. Sir James Paget's "Lectures on Surgical Pathology" did much to advance the scientific studies that were left incomplete by John Hunter. These are a few of the men who did much for the Scotch and English surgery. They established hospitals and schools, and developed a fine technique from the old style.

The wars on the continent required the skill of great army surgeons. The young students were offered all the help they needed from the government, receiving the best of training with the best of equipment. Some of the more famous are Dominique Jean Larrey who appreciated the value of surgical rest.

Guillaume Dupuytren was a great power in surgery. Jean Civiale was a great genito-urinary surgeon. Alfred Velpeau was probably the most valuable surgical member in the French School in the first of the century. Joseph Malgaigne was the greatest surgical critic and historian known. Many think that Augustin Nelaton was the best surgeon to appear in France. There are many, many others that could be included in this list.

The greatest figure of the century, Joseph Lister was born April 5, 1827 at Upton, Essex County, England. He was not Scotch, but he worked in a Scottish University. Lister followed in his father's footsteps as a wine merchant of London, but he was an earnest student of science throughout his life. He made an important improvement on the microscope. He received his B.A. from University College in 1847. In the same year he started his study of medicine, spending five years at the Medical Faculty of University College and the University College Hospital. He was influenced by Graham and Sharpey. After his graduation he later advised him to spend six weeks at Syme's clinic in Scotland. He went there to take the course, and worked and taught there for twenty-three years. He returned from Scotland as one of the lights of the surgical world.

The mortality of men during the Crimean War was exceedingly large, Hundreds of them were killed outright on the battlefield, but thousands died of surgical complications in the hospitals. Lister did not accept with resignation, as did many of his colleagues. Instead at an early date the problem and its prevention seethed in his brain. From all the stories that are told, the picture is anything but pleasant. Things such as secondary hemorrhage, erysipelas, septicemia, pyemia, and "hospital gangrene" ran rampant. Private practice was not so dangerous, but still the situation was serious. Surgeons had worn the same smock years on end, and had used the waxed ligatures

that were stuck in the assistants coat for his convenience. Whole wards, wings, and even entire hospitals were closed in an attempt to stamp out the dreadful condition.

Throughout Lister's life, he received golden compliments from those about him. His temperament was much different than Hunter's. He was given whole-hearted enthusiasm by his students and close associates while the rest of the world received him with a shrug or violence. His conclusions were stated only after through and careful observation. He then presented them persuasively and persistently to the surgical world. Gradually they had to relent and accept him.

His life was active and full. He gave admirable courses of systematic lectures on surgery. He was an ingenious and able operator. Just prior to 1860 he spent much time on the bacteriological aspects towards antiseptic surgery. Thus, while observing what the rest of the world was doing, he noted the work of Pasteur's intensive study on the cause of fermentation. His research confirmed the theories of Lister that external agents were the cause of infection in open cuts.

While he studied at the University of Glasgow and acted as surgeon to the Royal Infirmary, he felt that besides the air, other things such as clothing, skin, instruments, sponges, ligatures, and the like were also carriers of infection. He had advocated scrupulous cleanliness among operators and dressers including the use of sundry deodorants. Thus he searched for an antidote. He had been impressed by the use of carbolic acid for disinfecting the sewage of Carlisle, so he decided to give it a try.

In 1864 he concluded that in the case of simple fractures, there was no secondary infection. Therefore, he determined to make compound fractures, simple, by excluding the air. He cleansed the wound with pure

carbolic acid, and covered it with lint soaked in the acid.,Then the exudate combined with the acid formed a heavy crust. He also put a tin shield over the dressing to prevent rapid evaporation. Each day he added a little of the acid to keep it well-soaked. If the exudate was not heavy enough, or such that it would not form a scab, then he made his "antispetic paste" by a proper mixture of linseed oil, carbonate of lime, and carbolic acid, and applied this. The treatment proved successful so he began to try it on many other types of wounds. The unhealthiest wards were turned into models of health as a result.

With the introduction of heat, soap and water, nail brushes , alcohol, and a few other chemicals, asepsis took the place of antiseptis. All the inner organs of the body which had only been observed on the autopsy table could now be observed by the surgeon and his pupils under aseptic conditions.

Lister spent the early part of his life acquiring the known knowledge of the medical science, and the rest in creating a situation that launched us upon an era which is truly the most brilliant in the history of surgery.

OUR OWN CENTURY AND THE FUTURE TO COME

What will happen in the rest of this twentieth century no one knows. Maybe many observations that are known and recorded, but whose possibilities have not been perceived will add much to its progress.

In the first few years there have been three definite advances:

The control of syphilis.

1905---- Fritz Schaudenn Of germany discovered the causative parasite.

1906----August von Wasserman developed a diagnostic serum test.

Metchnikoff discovered a specific prophylatic measure.

1910 Paul Ehrlich intoduced the first arsenical preparation.

The rise of organotherapy from ancient times.

Liver extract for pernicious anemia.

Thyroid extract for myxedema

Insulin for diabetes.

The importance of diet in disease. Vitamins have only been known for the past few years so it is still in its infancy.

The rise of medicine from mystery to magic, and from magic to science, which exercises one of the strongest forces in the civilization of human betterment is almost a religion to those who devote their lives to it. Its aim is--longer, healthier lives, with freedom from disease and suffering. Its priests are the physicians, whose ethics never disregard the principles of self-sacrifice to others.

That the future of medicine and surgery is, no one knows, but it has been in the past, that men have stated there could be no more progress just about the time when a great burst of development is near at hand.

The only thing that can be said is that there is no limit to the accomplishments possible.

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