History of Medicine and Development in Laboratory Sciences

Theses for Seminar in Nursing

Lucille B. Dunn
University of Oregon
Nursing Department
July 30, 1937

BIBLIOGRAPHY

"Preventive Medicine" Milton J. Rosenau

NewYork and London-- D. Appleton & Company 1926

"A Short History of Medicine" Charles Singer

New York & Oxford University Press-- American Branch 1928

"The Peaks of Medical History" Charles L. Dana

New York Paul B. Hoeber Inc. 1926

"Medicine-- An Historical Outline" M. G. Seelig M. D.

The Williams & Wilkins Company Baltimore Md. 1931

"The Dawn of Modern Medicine" Albert H. Buck BA. MD.

New Haven, Yale University Press

London, Humphrey Press

Oxford University Press

Yale University Press 1920

"Bacteriology" H. W. Conn,PHD. & Harold J. Conn, PHD.

The Willia ms & Wilkins Company Baltimore Md. 1923

Some other references were read, but the material was used only for general knowledge.

History of Medicine & Development in Laboratory Sciences

The subject which I have chosen for my theses in one which covers a vast field of knowledge. In order to have a glimpse of this great work which will be little more than outline in this short paper, we will go back to the very beginning of medicine.

Medicine has originated and developed out of superstition. Much of the history that we have of medicine is taken from folklore which has been handed down through generations of families. These peoples believed that any of the upheav a ls of nature were omens showing the anger of the gods. Disease was also considered an omen of ill will. They had many such ideas, mostly suited to the particular beliefs of a group of primitives. Later, when methods of writing were found these tales were preserved and we ha ve some of these today: i.e. the Egyptians inscriptions in stone and those of the Greeks. We have the papyrus of the Egytia ns too. A fter the Egyptian era we find the Grecian and then the Roman period which is followed by dark centuries until the Renaissance which ushers in the beginning of modern medicine.

These writings not only give us the folklore but also many true incidents of disease, and the treatment of them.

Throughout this paper we will read the names of such men as Aescupaleus, Hippocrates, Galen, Vesalius, Paracelseis, William Harvey, Jenner, Pasteur, Lister, Semmelweiss, and many others. I shall try then in a small way to give you an idea of the work of these men and what it stands for today.

The Egyptians and Assyro-Babylonians were the oldest cultivations of medicine. Egyptians preserved their knowledge in encyclopedias, inscribed in hieratic script on papyri. Some of the papyri have been discovered and published with translations, so now we have an idea of their medical knowledge.

Medicine was practised by the priests who kept it within the boundaries of their own kind. They developed specialists who cared for only the eye, ear, teeth, a nd all other parts of the body. They practised chemistry and pharmacy and had a fairly la rge Materia Medica. However, their knowledge was neither accurate nore extensive.

Dissection was considered a sacrilege. Knowledge of anatomy was gained only through embalming.

The text of the Ebers Papyrus is well arranged. It has reproductions of prescriptions and accounts of parasitic infections. There is a paragraph on fatty tumors and their treatment. Also a pediatric secretion.

Cunieform inscriptions on baked clay tablets are the sources of the Assyro-Babylonian medicine. These ha ve been found near Nineveh and in other places.

Demons were considered the cause of diseases. The treatment consisted of incantations against them. These were used to prevent infection of liver, fetal monstrosities, considered birth omens. Prognosis was taken from astrological signs and they sometimes administered potions as a crude therapy, which often consisted of filthy ingredients. Despite these practices they had a code of medical ethics with regulation of fees .

Chines e medicine until recent times has been stationary. For four thousand years they followed the aphorisms of Hoang-to who died in 2600 B.C.

Progress in ancient India was very slow. They have since attained remarkable skill in surgery and have some well written treatis es on infant nutrition and also in other branches.

Like the Egyptians the practice of Grecian was in the hands of the priests. They called to their aid such Gods as Appollo, Minerva, Orpheus, and Chúan. Aesculapius, the father of Hygeia and Penaces, was the ruling god of medicine. He was the patron saint of the healing art. Temples were built in his honor. They were called Asclepiea and medicine was practised in them by Aesculapius and his followers. But even with all his knowledge Aesculapius is supposed to have been enveloped by flames by the jealous god Jeus, when he restored Hoppolytus to life. Today it is not known wh whether he was a myth or not, but he actually existed around the year 1200B.C. Today his portrait is used as a symbol of medicine. He is pictured as a kindly old man in Grecian robes who carries a staff with serpents entwined around it.

Gra dually the knowledge and skill of the priests became known to to the laity. Along with this change schools of natural philosophy opened and were established by Anaximander, Anaximenes, Thrales, and Heracletus. As a result of these schools the sciences of physics, physiology, embryology and zoology were established about 500 B.C.

Since the sick could not go to the temples, the travelling physicians developed and they established out-patient clinics and instituites which today correspond to our present day hospitals and clinics. As development continued physicians became classified as nulitory doctors, general practitioners, midwives, and special medical attendants at the athletic games a nd contests.

Because of the great demand for knowledge many schools were established among them Kos, Knidas and Rhodus.

The most prominent character in medical history was Hippocrated, the Father of Medicine, graduated from Kos. He has the honor of being the first to rationalize medicine, to cadify medical knowledge, and to establish the art of healing as an endeavor of high ethics and spiritualism.

He was born on the island of Kos around 460 B.C. and later graduated from its medical school. He travelled extensively and practised medicine in several cities; he remained in Athens for some time. He died in his eighties about 370 B.C.

He is the one who firmly established the principle that the knowledge of disease rests primarily upon the careful observation and notation of symptoms. Dr. Seelig says, "His principles of clinical analysis which constitute the foundation of what we call bedside method, are all the more remarkable to contemplate if we bear in mind that curiously enough, Hippocrates wa s not thoroughly familiar with the significance of pulse variations, and had at his command not even the simplest of those instruments of measurement and precision that are indispensable to the present day clinician. The true writings of Hippocrates contain the books, "Aphorisms"; the treatises "On Prognosis, On Epidemics, On Diet in Acute Diseases, on Wounds of the Head, on Dislocations, on Fractures, a nd on Ulcers, on Air, water and on Sacrel Diseases." There are many other writings supposedly Hippocrates, but today are believed to be false.

The Hippocratic Oath, considered the earliest and most impressive document in medical ethics is generally considered to have been written by one of the A s clepiads to use ans an oath in the ancient temples and not by Hippocrates.

The Aphorisms a re short comments on disease similar to notes taken at the bedside endeavoring to establish a true relationship between generals and particulars, accidentals and essentials. His work "On Prognostics" was an effor to perfect the art of p prognosis. He instituted for the first time, systematic and thoroughe examination of all the evidences of disease; general nutrition; facies, temperature, respiration, excreta, sputum, localized pains, and movements of the body. "On Epidemics" deals with epidemics affecting large groups of people in a locality; it also contains histories of surgical cases, some anatomical discriptions, empirial remedies, and some philosophical specula tions. "On Diet" in Acute Diseases treats two important topics.: (1) The proper differentation of diseases, one from another, and (2) Therapeutics, or rules by which the regimen in acute diseases ought to be regulated. "On Airs, Water and Places" is considered the first written work on the subjects of medical geography, climatology, and anthropology.

There is sufficient evidence prevalent today to establish Hippocrates as a first class surgical clinician. His descriptions on fractures and dislocations are very accurate and thoroughly modern. Dr. Seely's book, "Medicine--An Historical Outline" follows: "He practised forcible reduction of spinal curvature, recommended the irrigation of wounds, recognized the aseptic advantages of dry dressings, the significance of rest and immobilization, the salient features of suppration, the importance of primary wound healing, and the necessity of using only pure or boiled water. In describing an operating room he stressed the importance of good illumination, the presence of capable assistants and the proper posture of the patient."

Hippocrates was not all wisdom and practicality. He was at times a true theoretician. He preached the doctrine of the four elements as the fundamentals in all bodies--the human body too. These elements were warmth, cold, moisture, and dryness. In the human body the blood represented warmth, mucus-cold, yellow bile-dryness, and black bile-moisture. All disease was related to some error in the humors. (Humor means animal fluid.) Our present day "God Bless You" to a person who sneezes, is a result of the fallacy of the Hippocratean doctrine of humors.

Another theory of Hippocrates assumed that all diseases passed through three stages; (1) the raw stage or state apepsis (2) the cooked or ripened state or state of pepsis (3) and finally the stage of crisis, that he theorized freely, is a fact; but in his practice in his analysis of disease phenomena, and in his establishment of the indication for treatment, he turned his back on all theories, including his own, and trusted only demonstrable facts. He established the pinnacle of Greek medicine and lived at the time when Greece was in flower.

After the death of Hippocrates the two great philosophers Plato and Aristotle were the leaders of Greek thought.

Alexander the Great, a pupil of Aristotle was enthuisiastic over medicine. He founded the city of Alexandria in Egypt around the middle of the 4th C. B.C. Here he built a medical school.

Everything that was best in Greek medicine was transplanted to Alexandria. Here they grew and developed. Alexander constructed an excellent library and fully equipped it. Autopsies were performed, and as a result were the sciences of anatomy and physiology developed to a great degree. Exasistratus and Heraphilus were excellent clinicians. They contributed to anatomy and physiology and established several facts, among them; that the brain was the center of the nervous system, that there was a difference between veins and arteries, that the intestine was made up of various segments, that the testicle was the depot of the semen, that there was a system of chyle vessels and numerous other fundamentally significant details. The influence of the Alexandrian school lasted over a period of three hundred years, into the second century after Christ.

It was indeed a great school. but gradually it became exploited and there was influx of people who were more interested in creating an illusion of greatness rather than improving the sciences and arts.

With the rise of the Roman Empire, naturally there was an interest taken in all things educational. Much of the work was done by men from other citi.s. There was an gradual inflow of students and professors from Greece, and Egypt and other educational centers.

In 125 B.C. Asklepiades, a physician from Asia Minor settled in Rome, thus starting there the nucleus of Greek medical thought. He was tactful and resourceful individual and combined with these attributes the qualities of an astute clinician.

He really held theories which overthrew the whole structure of Hippocratic doctrine. He had a group of followers called Method-. ists who tried to make definite fixed methods of intrepreting and treating disease out of these leader's notions.

Another group of men were called the Encyclopredists. They collected material and classified all medical knowledge in a way comparable to our present encyclopeadios. One of the most famous of these was Celsus who wrote on all branches of science.

Celsus did much to clarify medical knowledge but his work did not last for very long.

Other schools developed which mixed up the knowledge of those before them. However the schools of Eclectic did clear away some of the chaos and prepared the way for the greatest medical man since Hippocrates.

Claudius Galen was born in Perganas in 130 A.D. He was well schooled in philosophy, mathematics, and science and studied medicine at Smyrna. He practiced in his home town and then in Rome for awhile. He was principally a student, so he spent most of his time travelling and studying. He is supposed to have written five hundred treatisis, but we have only a hundred and eighty of these. One fifth of these are comments on Hippocratic doctrine and practice. Galen was a conceited man and loved to dwell on his own wisdom and skill. He emphasized his own cures and believed it was impossible for a person less wise than himself to accomplish such results. He covered every possible medical field in his efforts.

Galen was an experimenter in anatomy and his descriptions of nucular and osseous systems are excellent. His discriptions and dissections of the brain are fairly adequate; his knowledge of physilogy was very incomplete, although his experiments on the brain cord and gastro-intestinal tract were far in advance of his time; he knew nothing of circulation but recorded data on pulse indicative of the most pains taking observation. In pa thology he clung to Hippocrates humoral idea and his clinical descriptions were also cast in the Hippocratian mold.

Galen's importance lies in the fact that he restored Hippocratean ideas and he did so in such a forcible fashion as to immortalize Greek medicine into history for a 1000 years and to establish his own authority so as to resist the downfall of Rome until the renaissance of learning ten centuries later.

After the fall of the Roman Empire there was a gradual decline of all things educational.

We must not think that this happened at once, but over a period of years, neither must we believe that the spark of interest flickered out. It merely died low.

Throughout this period known as the Dark Ages this spark of truth was kept alive by men who were as interested as those before them, but had to deal with such a chaos on the outside that their work was not known until the Renaissance. Most of these men were cloistered in monasteries, where they made beautiful copies of the books and articles containing the knowledge of all the arts and sciences, thus preserving them for us today. This period lasted from about the sixth to the 16th century.

During this time, the Arabs did their part in keeping learning alive. They appropriated Greek science, philosophy and literature. They founded schools and later their science, philosophy and literature, filtered back into Europe with the spices, silks and riches of the Indies.

Dr. Seelig believes that these years we call "Dark Ages" were merely fallow years during which the human mind became fertile soil for the growth of the new learning that was to replace the long period of sterility.

Probably the first medical school to be founded, which began the renewal of culture is that at Salerno in Italy. We know that it was established as early as 800 A.D. and that it was the first medical school to relieve "the dreary stagnation of the Middle Ages, with something of the invigorating freshness of the sea," Garrison.

There is an unconfirmed belief that the school was founded by the efforts of a rabbi, an Arabian Schola r, a Greek pontiff, and a Christian physician.

Salerno was considered a health resort, there it was comparatively easy to arouse an interest in medicine in this center. It is believed that men as well as women matriculated there and medicine was taught as an independent branch of science. Later, departments of Jurisprudence, Philosophy and Religion were added to the Arabian Academies.

The reason for out interest in Salerno just at this time is that it was the incentive for the establishment of universities in other centers.

Some of those founded were Paris in 110, Bolgna in 1158, Oxford in 1167, Montpellier in 1181, Padua in 1222, Prague in 1348, Vienna in 1365 and Heidelberg in 1386.

The text books of these medical centers were those of Hippocrates and Galen, Avicenna and Rhazes, but furthermore there was active work in the schools themselves. Anatomy was restricted mostly to the dissection of swines. Surgery which had advanced under Hippocrates and Galen was for the most part discarded. The use of cautery, salves, plasters, and drugs took its place.

Arabs were afraid of the use of the knife. Pharmacology was of the prides of the Arabs and they enlarged the knowledge of drugs to a great extent. Though anatomy and physiology was neglected they compensated by intense study in symptomatology, dietetics treatment and materia medica. Much stress was laid on the cultivation by the physician of what we now call "the bedside manner."

With the founding of new universities there began a process of classification of all the false theories. The scholars were busy gathering the important treatises on medicine. These men were known as Collectors. There was also a group of Concilators who were trying to clear up the medico-phylosophical discussions.

Also we have the Concordants who wrote a resume of the facts of medicine that could be subscribed to as standard. None of this work was original but it was a stepping stone toward the dawn of Modern medicine.

We have many men who worked during this period each contributing his share. At the end of the 15th century, everything was beginning to look better. But not until this time men like Bacon, Arnold of Villanova, Petrarch, and Guy de Chauliac had scarcely pierced ranks of pathfinders.

At the dawn of the 16th century science was beginning to show signs of developing into something similar to what we have today. This happened through the rebirth of independent authority resting on observation, experiment, and national thought.

Factors which helped this reestablishment were the great epidemics of the 15th century, the discovery of gun powder in 1450, America in 1492, the new sea route to India by Vasco de Gama in 1498, the revolt of Luther and the birth of Protestanism, the new Copernican theory of astronomy, the fa ll of Constantinople in 1453, a nd the discovery of printing in the late 15th century. Printing, of course, was a remarkable addition to all learning because of the ease with which written works could be spread.

There us a general agreement that the beginning of modern medicine was ushered in with the 16th century.

Divisions in medicine became differentiated into Anatomy, physiology, pathology, medicine, surgery, obstetrics, aphthalmology and many others.

The men who established the study of botany were responsible for untangling pharmacology from its web of alchemy. They established the custom of visiting new lands and collecting specimens, and most important, the principle of independent observation.

Around this time the science of anatomy readily developed. Andrea Vesalius was one of the foremost anatomists and has the title of Father of Anatomy.

Vesalius was a German who lived from 1514 to 1564. As a small boy he showed his talent by his passion for dissecting mice, rats, cats, and dogs. He began to stury medicine in Paris in 1533 under Jacques Sylvius; there he concentrated on anatomy. He dissected with unflagging interest and discovered numerous errors in the accepted teachings of Galen. Through his many discoveries in his dissections he accomplished the downfall of Galenic anatomy. He received his degree in medicine at Padua in 1537 and was immediately made Professor of Surgery there. He taught surgery and anatomy while continuing his own efforts. He disclosed more than 200 errors in the supposedly authentic Galenic teachings.

In his 29th year Vesalius decided to publish his findings. They were published in Basel in 1543 by Oparinus in the form of a larger and smaller textbook of anatomy. They brought him much glory but also created much fury because of the dethroning of Galen. A s a result of this he was obliged to leave Padua. After some travelling he settled in Brussels as body physician to the Emperor Charles V. Of course he continued in the court physician under Philip II, when the court was moved to Spain. There, certain members of royalty tried to take his position. They eventually succeeded and Vesalius lost favor with the Emperor. It is generally believed that he then made a pilgrimage, supposedly of penance to Jeurusalem,leaving Spain in 1564, never to be heard of again.

Only two of Vesalius' works contributed toward his preeminence as an anatomist. The larger one a textbook for specialists and the smaller is a short work for students. The larger volume is illustrated with 300 wonderful woodcuts, made by Johann Kalkor, a pupil of the great Titian.

Vesalius' work disclosed many new points in the structure of the human body, but of course he made some errors which only proves that he was human.

Naturally there was great opposition to such a brilliant man, but he must have had great joy in the fact that many sincere scholars received his work with unqualified approval.

Many another anatomist followed Vesalius such as Gabriele,Falliopo.

Each in turn contributed to the newly awakening fund of knowledge.

The step from anatomy to physiology is a short one; the study of function logically associating itself with the study of form. However, Greek medicine had not gone far in physiology and the minds of men had not as yet deveoped in experimental methods. For the same reasons pathological anatomy a lso lagged--the microscope had not been invented. The chief results of numerous dissections were the descriptions of various stones that were found in the kidney, bladder, gall bladder, lung, brain and salivary apparatus. Abscess of the heart, ulcer of the stomach, urethral ulcers after gonorrhea were most of the gross pathological conditions that were seen by 16th century investigators.

Medicine advanced in the 16th century in all its branches,and experimental work was becoming more the source of knowledge.

In the 17th century most scientific activity manifested itself in England and Italy.

The most illustrious medical man of the 17th century was William Harvey. The inspiration he furnished by his use of the experimental method and by his keen and incisive practice of inductive thought, constitutes one of the important supports on which rest the scientific accomplishments of modern medicine.

Harvey was born in Folkestone April 2, 1578. He studied medicine in Cambridge and in Pudua. He was made Professor of anatomy in the College of Physicians and attending physician to St. Bartholomew's Hospital after his return to London from Padua. He practised medicine half heartedly and after the civil war he worked in retirement for five years until his death in 1657.

The storm of protest after his announcement of the discovery of circulation cost him practically his entire practice which he willingly gave up/

The discovery of circulation is unquestionably Harvey's, although Galen, da Vinci, Servetus, Cesalpinus, Colombus and several others had at some time or other hinted at the existence of the circulation of the blood. "But Harvey it was who, following the closest knit inductive reasoning, based on clear cut experimentation and guided by the indispensable factor of healthful imagination proved, step by step, that the heart was the central pump that forced the blood in a circulating current." He worked for seventeen years in experimentation before he published in 1628 the famous "Exercitatio Anatomica de matu cordis et sangumis in animalibus" and thus his thesis withstood all onslaughts.

Harvey did not know of the existence of the capillary circulation existing between the arterial and venous system nor did he explain correctly the changes occurring in the blood when it passed through the lungs, neither did he know anything of the lymph circulation as a part of the general circulation; but the fact remains that his discovery was the starting point of modern physiology.

The capillary circulation was discovered by Malphigi in 1660.

Following the birth of physiology was the complete reform of embryology. Harvey was responsible for this factor also. In his works "Exercitationes de generationibus animalium," he announced the famous doctrine of omne virum ex ovo, and thus established the basis of modern embryology.

Harvey's work on generation inspired many other such as Nathaniel Highmore, an Englishman, whose name is given to the antrum of Highmore, Regner de Graaf, a Netherlander, after whom the Graafian follicle is named. Some others are Johann Swammerdam and Francesco Redi.

Harvey did all his work without a microscope.

The first microscope was perfected during the 17th century by the efforts of Hallander Cornelius Drebel in 1621 and the brothers Janssen of the Netherlands 1608.

Anton Van Leuwenhoek 1632-1723, although not a physician, was the first to apply the microscope in the study of medicine. He was an optician by trade and accordingly developed the first high powered microscope. He accumlated nearly 250 microscopes and over 400 lenses. This man was without medical or scientific training and very secretive in his mode of working. He made a series of disconnected discoveries which for originality and importance have been surpassed by no other microscopic observer.

He improved and extended knowledge of capillary circulation which Malphigi first discovered. He made the first adequate morphologica l study of red blood corpuscles, noted for the first time the histological details of voluntary muscle and was the first to describe protozoa and bacteria. He furnished a complete description of spermatazoa, which were discovered by a medical student Johann Hamm in 1677.

Swammerdam was also a microscopist whose career was cut short by insanity. He produced his "Bible of Nature" which alone of the scientific writings of his age is still consulted by modern naturalists for the unique beauty and accuracy of its figures. He also, like Leeuwenhoek extended the knowledge of embryology.

Swammerdam made a series of physiological experiments which involved the very modern physiological device known as the nerve-muscle preparation. He showed that during contraction a muscle does not increase in size; that is the nerve does not bring anything in the way, of hypothetical nervous fluid in which theory many people believed. He applied the same reasoning to the heart. He was the first to see the blood corpuscle.

These men along with several others explored the minute structures of the animal body to a considerable extent. Their findings showed the unexpected complexity of all the parts, and also the resemblance of one part to another which appear different to the naked eye. In this manner the structure of the body came to be subjected to a process that we call "microscopic analysis."

Malphigi was the Father of Histology. He was also the greatest microscopist of his time. An Italian, he lived between the years of 1628 to 1694. He was professor at Bologna, Pisa and Messina and also physician to Pope Innocent XII. His first work in 1661 described the a ctual passage of blood from the arteries to the veins through the capillary blood-vessels. Malphigi discovered the capillaries through the dissection of a frog's lung. This discovery brough the attention of the Royal Society who thereafter published his researches. His studies of the embryology of the chicken gained for him the reputation of being the founder of descriptive embryology. He discovered the mucosum or Malphigian layer of skin, and the taste buds of the tongue and made minute studies of the red blood corpuscles. His microscopic work on the lungs uprooted established physiological conceptions, by demonstrating the vesicular structure of these organs and the termination of the trachea in the smallest bronchial tubes. He also established the histology of the liver, spleen and kidneys, showing the well known Ma lphigian corpuscles of kidney and spleen.

His discovery of the capillaries filled the missing link in Harvey's chain of circulation.

After these men Leeuwenoheck, Schmmerdam, Malphigi and the others until the 19th century, microscopic work was slow. However, with the improvement of the microscope, the method was taken up again and has gone on to triumphant results.

The basic science of Mechanics had been placed on a firm foot by Galileo during the 16th and the first part of the 17th century. As tronomy had made a break with the past. Anatomy and Physiology were going forward.

Chemical knowledge had thus far remained in the background. C harlatans, who since the Middle Ages had been seeking the Philosopher's Stone.

The old theory of the four elements, earth, air, fire and water formed an ill basis for experiment. Some philosophers had put forward crude atomic theories, but they had very little experimental proof. Nevertheless, there was some advance for the alchemists had perfected a system of weighing.

The great defect of ancient view of matter was that it contained no definite conception of the nature of a pure substance. Metals were regarded like other substances, as a mixture in certain proportions of the four elements of Aristotle. Thus, the change of one metal or one substance into another by distillation did not seem absurd or even a very difficult task.

The main agent in changing the chemical outlook was Robert Boyle (1627-91). He was a member of a small association of men, the Invisible college, which met first in London, then in Oxford, and finally in 1663 was incorporated by Royal Charter as the Royal S ociety.

These men thought that the only way to learn anything about Nature was by observation and experiment. They met to compare experiences, to demonstrate experiments, and to draw immediate deductions. Boyle introduced many new actual chemical and physical discoveries, but his greatest achievement was the new spirit with which he imbued chemistry.

Chemistry became an independent science, the principles of which were ascertained by experiment, and its truths pursued for its own sake.

Boyle demonstrated that air is a material substance and has weight. By means of his air-pump he oroved conclusively that the substance was necessary for the support of respiration. The law of the compressibility of gases is still known by his name.

"Most important of all Boyles' contributions to chemical theory was his conception of a chemical element in our modern sense, and his view, which he borrowed from another philosopher, of the atomic structure of matter."

Under the ins piration of Boylw and his colleagues, chemical works in the second half of the 17th century exhibit in general a positive, cautious, experimental spirit and show a great contrast to the mystical and obscure writings of the first half of the 17th century, which have much affinity with Alchemy.

A fine example of the new spirit was John Mayone 1645-79, who was first to recognize clearly that there is a substance or principle in air which is concerned at once with combustion, respiration and the conversion of venous into arterial blood. In this sense he was the discoverer of Oxygen.

The 18th century dawned with the refreshing breeze of Newtonian philosophy blowing through it. During the previous two hundred years there had been an immense amount of new and fruitful research along diverse lines. Chemistry and Mechanics, Botany, and Comparative Anatomy, Descriptive Anatomy and Experimental Physiology, Epidemiology and Microscopic Analysis all yielded startling results. The new generation was bewildered with the very mass and novelty of this material.

Due to the enormous amount of new material that had been introduced into its sciences as a result of Newton's discoveries, the first half of the 18th century was spent in consolidating this knowledge and in teaching. So it is that the first half of the 18th century exhibits something of a gap in the progress of research. The medical field is largely filled by two great figures, Boerhaave and Haller.

Until the 17th century there was no systematic clinical teaching. The Universities gave medical degrees on the basis of a spoken disputation. No contact with the patient was demanded. The first effective attempt to change this was at Leyden, where about 1636 clinical teaching was instituted. Owing to this and also, as at Padua, students of every religious denomination were accepted, Leyden became much frequented by foreign and especially Protestant students.

The attractions of the place were increased by Sylvius who in the second half of the 17th century, added laboratory instructions to his clinical teaching.

Leyden had several eminent anatomist, while its botanic garden and museums added to the practical character of the medical instructions that it offered.

Hermann Boerhaave (1668-1738) was first appointed as a teacher at Leyden 1701. Because of him the medical school attained a front rank reputation, which even surpassed that of Padua.

Boerhaave made the most of his opportunities. Besides clinical chemical, botanical and anatomical instruction, he performed autopsies on those patients of his who died and demonstrated the relation of lesions to symptoms.

Boerhaave was a man of culture. He saved and published the plates of Swammerdauss' priceless "Bible of Nature."

He brought Bernard Siegfried Albinus,(1697-1770), the best anatomist of his age to Leyden. Albinus and Boerhaave edited the collected works of Vesalius in a superb form. "To Albinus and indirectly to Boerhaave, we owe the most beautiful of all works on muscular anatomy, a book which is still in current use. Apart from his clinical ability and acumen Boerhaave was a skilled chemist, botanist and anatomist. "With all these accomplishments Boerhaave was better able than any man of his time to achieve something like a medical synthesis, to bring all the sciences to the service of the patient. Taking one thing with another, considering his influence as a teacher, his clinical acumen, his power of inspiring younger workers, his wide learning, his balanced vision, his eagerness for new knowledge, his sanity, his humanity, his generosity, and his prophetic power, Boerhaave must be regarded as the greatest physician of modern times." To him the debt of British Medicine, and through it of British well-being, is quite incalculable.

Through his pupils he is the real founder of the Edenburgh Medical School and through it of the best medical teaching in the English-speaking countries of the world. The success of the Edenburgh school founded while the great Legden professor was still in his prime, can be ascribed to two causes which are perhaps reducible to one--the inspiration of Boerhaave.

These two courses are, first, the enthusiasm of its early teachers, and second, the concentration of all the medical teaching, both clinical and subsidiary in one great University school.

Albrecht Von Haller--Swiss (1708-77)--pupil of Boerhaave, acheived distinction as poet, botanist, anatomist, and novelist. He was perhaps the most voluminous of all scientific authors. His special distinction is as a physiologist.

Haller's great work, "Elements of the Physiology of the Human Body" marks the modernization of the subject of which it treats. His researches were on the "Mechanics of Respiration," on the formation of bone and on the development of the embryo and digestive juices. His most important contributions were his conceptions of the nature of living substance and of the action of the nervous system. These conceptions formed the main background of biological thinking for a hundred years, and are still integral parts of physiological doctrine.

All departments of medicine are influenced by the views held on nature and action, of the nervous system. Thus growth in knowledge of the physiology of the nervous system is extremely important if we would gain a true idea of the progress of Rational Medicine.

Before Haller there was very little known about the nervous system. It consisted of speculations on the topic of the seal of the soul, together with explanations which suppose the passage either of a fluid or of some chemical change, down the nerves. Haller was the first to construct a theory of the nervous system that has any appearance of modernity. During the 17th century the favorite doctrine of nervous action supposed the existence of a nervous fluid. An experiment by Swammerdam disproved this but his work was unknown until 1738 when Boerhaave published it. Thus, it was stationery until Haller's time. He concentrated the problem on an investigation of the fibers. He pointed out that a muscle-fiber had in itself a tendency to shorten with any stimulus, and afterward to expand again to its normal length. This capacity for contraction was called irritability. He recognized the existence of irritability as an element in the movement of the viscera and notably of the heart and of the intestines. The feature of irritations is that a very slight stimulus produces a movement altogether out of proportion to itself and that it would continue to do this repeatedly, so long as the fiber remained alive.

But besides the inherent force in a muscle fiber, there is another force which comes to it from without, is carried rom the central nervous system by the nerves, and is the power by which muscles are normally called into action. This force, like that of irritability, is independent of the will and like it can be called into action after the death of the animal. Thus Haller distinguished inherent muscular force and nerve force. He further distinguished these forces from the natural tendency to contraction and expansion, under changing conditions of humidity, pressure, and so on of all tissues, living or dead. He then turned to the question of feeling and was able to show that the tissues are not themselves capable of sensation, but that the nerves are the sole channels or instruments of this process. He showed how all the nerves are gathered together into the brain and he believed that they tended to its central part. These views he supported by experiment and observations involving injuries or stimulation to the nerves and different parts of the brain. He ascribed special importance to the cortex, but the central parts of the brain he regarded as the essential seat of the living principle, the Soul. Haller always displays the rational spirit in his discussions. His view of the nature of the Soul may lack clarity, but he does separate such conceptions sharply from those which he is able to deduce from actual experience.

Many of his themes were cleared up by other workers. Among these was Sir Charles Bell--(1774-1842)--a Scottish surgeon, who in 1811 showed that of the two roots from the spinal cord by which all the nerves of the body arise, one root conveys only sensory elements, while the other conveys only motor elements. By this discovery Bell not only completed the views of Haller on the central nervous system, but also brought them within the range of practical Medicine.

Following Haller we have a new genius Francis Xavier Bichat. He died of tubersulosis at the age of thirty-two. Like so many other consumptives, he was intensely interested in the subject. It is said that he performed 700 autopsies during the course of one winter., and as a result he left behind him nine volumes of contributions to medical literature.

Bichat is regarded as the founder of modern histology, which had been started by Malphigi. Bichat described a variety of tissues, such as areolarti, nervous tissue, vascular tissue, osseous tissue, cartilaginous, fibrous, lymphatic tissues and so on until the number included twenty-two kinds. He called his work General Anatomy to distinguish it from descriptive anatomy, and the work was done without the aid of a microscope.

After working out the basic principle of separate tissues, he established the fact that "every tissue has everywhere a similar disposition and its diseases must everywhere be the same. Whether sinous tissue belongs to the heart--to the lungs--to the joints--or to the abdominal viscera, it takes on inflammation everywhere in the same way; everywhere dropsies occur in the same way." Bichat was called the Napoleon of Medicine. He placed facts in the first rank and banished ideas and idealogists. Even with all his genius, he fell into error by theorizing too much, and diverting to spirits in order to explain some of the basic phenomena of life.

Pathological anatomy was founded by Giovanni Morgagni. He was first to direct attention to the gross anatomical change induced by disease. Before him, only rare pathological conditions attracted interest. Morgagni gathered everything in literature bearing on pathology: he classified his own extensive experience and collected pathological data verbally and from other medical men. He did this work in his book with the idea of showing the difference between normal and diseased organs and correlating post-mortem findings with clinical diagnosis and interpretations. The book was in the form of letter, occupying seven volumes.

During the 18th century there was a great advance in medicine and there were many enthusiastic workers who contributed much to the field.

We must not leave this century without mentioning Edward Jenner. His introduction of preventive innoculation for smallpox was one of the greatest victories of science. Jenner made the important observation that the Gloucestershire cowpox seemed to be immune to smallpox. He believed thatt this fact could be based on an attempt to secure acquired immunity to smallpox on a large scale. Jenner worked with this idea in mind, making observations from 1788 until May 14, 1796, when he performed his first va ccination on a boy, using pus from the arm of a dairy maid infected with cowpox. About 2 months later the boy was inoculated with small pox virus and proved to be immune. In 1798 Jenner published his celebrated, "An inquiry into the Cause and Effects of Variolae Vaccinae."

Vaccination had accurred before but Jenner was the one who worked out the procedure on a scientific basis strong enough to withstand the inevitable torrents of abuses and opposition that it aroused.

Jenner for the most part of his life was a typical English gentleman but spent his later years in London.Parliament awarded him 20,000 pounds, with which to carry on his experiments and London erected a monument to him after his death.

Naturally, in a paper a short as this we can only mention a few of the many men who contributed to medicine and give only a little of the credit that is their just due.

The 19th Century is really ours, because many persons born in the late 1800's can recall some of the major events of that era. This century was really one of incredible accomplishments.

There was advancement in all scientific lines and in medicine we have Schlieden and Schwann who announced the cellular theory of plant and animal organisms, Mayer and Helmholtz discovered the principle of conservation of energy, and Von Liebig established the science of agricultural chemistry. Helmholtz also invented the ophthalmoscope. The drugs morphine chloral, cholroform, quinine, and strichnine were isolated. Fehling developed his quantitative test for sugar. Vorchow established the doctrine of cellular pathology. Pasteur and Koch made their famous contributions and anesthesia was introduced into surgery. Roetgen discovered the X-rays. Nursing was elevated by Florence Nightingale. Diphtheria antatoxin was discovered and Lister practiced his antiseptic surgery.

The bacillus of typhoid fever was discovered and also the plasmodium of malaria. The solution of the yellow fever problem was solved by Gorgas and Kitasato and Yersin found the cause of bubonic plague. Eraliche founded the modern conception of immunity and serology.

This is but a slight review of the outstanding achievements of the century before our. To elaborate on some of the better known accomplishments we have the introduction of anesthesia. Oliver Wendell Holmes, the American, coined the word anesthesia. Crawford Long of Georgia in 1842 used ether to remove a tumor from the neck. He repeated this several other times with success, but never published his cases until 1849.

There are several others who used ether but it was Henry J. Bigelow, a Boston physician who announced it to the world in 1846. There had been several arguments over who was the founder of anesthesia. So as a result in 1867 a monument was erected in Boston to the discovery of ether, but is not dedicated to any one. Nitrous oxide was discovered by Pritstly in 1776, a nd Sir Humphrey Davey suggested its anesthetic properties in 1799.

Chloroform was discovered in 1831 by the American Dr. Samuel Guthrie and also by a Frenchman Eugene Soubeiran. It was introduced as an anesthetic by Sir James Young Simpson of Edinburg in 1847.

During this century there arose several types of false dogmas in medicine. Some of these wer Nature, Philosophy, Mesmerism, Homeopathy, and Phrenology or Cranioscopy. These cults were developed more or less as an easy way to obtain money. Of course they disappered but others took their place, and we have these events today in newer forms, but based on the old methods.

The discovery of local anesthesia dates from Karl Haller in 1884. Nieman discovered cocaine in 1860 when to determine the taste of the drug he tasted it and found his tongue was rendered insensitive. Anrep in 1880 made the practical application of this fact and then in 1884 Holler published such complete studies that local anesthesia immediately came to be used in surgery.

Although the first half of the nineteenth century was rather a period of transition than one of unqualified advance, nevertheless, tendency to stablilize knowledge on the basis of rigid adherence to facts.

Another man who contributed his share to medicine was Pierre Louis of Paris who was a clear-minded clinicia and made studies of pulmonary tuberculosis and typhoid fever. He developed the principle of the statistical study of disease, demonstrating the futility of any so-called system or method that could not stand up under the test of statistical inquiry.

The other outstanding man who contributed to medicine in the first half of the 19th century, was Rene' Laennec who invented the microscope (1819). Avenbrugger had discovered the method of percussion about the middle of the 18th century.

He contributed some very good works on various chest diseases and furnished an analysis of the various signs determinable by auscultation and percussion.

The greatest advances made during the 19th century was the introduction of the principle of antisepsis. This principle rested on the fundamental work of Pasteur and was applied practically by Lister. Louis Pasteur (1822-1895) was the sone of a French tanner. Pasteur was a chemist and though most of him inumerable discoveries were in the field of medicine, he did not study medicine. At twenty-six he was made Professor of Physics at the college of Dijon and later was made Professor of Chemistry at Strassburg, then at Lille, and finally became director of the Normal School at Paris.

As a result of his chemical investigations, such as the cure of disease of silk worm, which threatened the silk industry of France; his work of the fermentation of wines and beers; the study of fowl cholera; his discovery of immunization against anthrax and the great work on prevention of hydrophobia has given him the place of one of the world's greatest scientists.

He was responsible for the overthrowing of the false doctrine of spontaneous generation, for the establishment of the role of microorganisms in fermentation and in disease; his conception of the existence of anaerobes and aerobes, his descriptions of staph-ylococci and streptococci and for his experiments with gas gangrene along with many other medical discoveries.

It was known shortly after the discovery of the microscope that organisms were the cause of disease, but the belief was that they arose from spontaneous generation. This theory Pasteur proved false.

It was Joseph Lister, an English surgeon, who proved the theory that germs were the cause of disease by demonstrating it in the surgery and the surgical wards. This technique was called antisepsis.

Before Lister's time, people thought it was necessary to have a rich flow of pus in order to have a wound heal. The term "laudable pus" originated from this idea. Hospital gangrene was so common after surgical cases that it was considered almost an inevitable plague. About seventy per cent of all compound fractures and fifty per cent of major amputations were fatal.

Lister graduated in medicine at the University of London in 1852 and then moved to Edinburg, where he was resident surgeon under Syme. In 1860 he became Professor of Surgery in the University of Glasgow. He was a student as well as a surgeon and grasped the relationship between Pasteur's experiments and the deadly infections of surgery, such as septicemia, pyemia, gangrene, tetanus and secondary hemorrhage following infection. After recognizing these facts he set out to remedy the situation and did so by protecting wounds from contamination by the use of carbolic acids on dressings and in the surgery.

Lister and Pasteur established the bacterial theory of disease but Robert Koch is the man who developed a systematic method of cultivating, grouping and classifying bacteria.

His efforts practically brought about the birth of the science of infectious diseases.

Koch is a German and received his medical degree at the University of Goettinger in 1866. He was a general country practitioner, but kept up his microscopic studies.

In 1876 Koch published a paper in which he gave the complete life history of the bacillus of anthrax, originating methods of culture, staining for spores, and of animal inoculation. By this work he set the foundation stones of the science of bacteriology.

A year later he published his method of fixing, drying and staining films of bacteria on cover glasses. In 1878 he published a work in which he announced the isolation of six different pathogenic organisms, all of them agencies in causing wound infections.

In 1881 he described the method plating, to secure pure cultures and issued his postulates for obtaining pure cultures, which are; (1) the organism must be shown to be present in abundance in the tissues, blood, or discharges of animals suffering from the disease, (2) it must be isolated and studied in pure culture, (3) it must be shown capable of producing the same disease in healthy animals, (4) it must subsequently be found again in abundance in the experimentally innoculated animals.

Today these postulates still hold true in isolating the causative organism in a disease, although the last two steps must sometimes be omitted as certain human diseases cannot be transmitted to animals.

In 1882 Koch discovered the tubercle bacillus, and followed in 1883 with the cholera vibrio. Also, during this time, he introduced steam sterilization and as a reward was asked to come to Berlin as Professor of Hygiene and Bacteriology in the University. Here by his experiments and thos of his followers, they firmly cemented bacteriology into the structure of medicine.

Following Koch others found organisms of disease: Loeffler discovered the bacillus of glanders, and Klebs the bacillus of diphtheria. Israel isolated the organism of actinomycosis, Hehleisen , the so-called streptococci of erysipelas, Eberth the typhoid bacillus-Kitasto and Yersen the bacillus of bubonic plague, Neisser the gonococcus, and Welch and Nuttall the gas bacillus. Pfeiffer discovered a bacillus which is considered to be that of influenza, but this fact is not accepted by all bacteriologists.

At this period there were so many men contributing valuable material that we can mention only a few.

Maternal mortality was vey high at childbirth. As a result of this Ignaz Phillipp Semmelweiss who was working on Obstetrics in Vienna, conceived the idea in 1840, that the death rate was due to uncleaniness. He worked with this thought in mind and reduced it from almost 10% to 1%. His paper on "The Etiology, Nature and Prophylaxis of Puerperal Fever" published in 1861 was one of medicines most precious classics. However, he was so ridiculed by his colleagues, that he lost his mental balance and death was his reward.

Our own Oliver Wendell Holmes, in 1843, published his views in a paper on the above subject which was entitled "On the Contagiousness of Puerperal Fever".

Semmelweiss'later independent work confirmed Holmes' assumption. Holmes' work on puerperal sepsis was his most important contribution to medicine. He had a Professorship in anatomy at Harvard, but is best remembered now for his well-known literature.

All medical science was advancing and America was producing many important men in all fields.

James Maricen Sims introduced the vaginal speculum and silver wires for the radical cure of vesico-vaginal fistula. He established the Women's Hospital of New York in 1855 and is regarded as one of the founders of modern gynecology.

In anatomy, histology, physiology, and pathology many fertile mindswere at work.

Jean Cruveilhier (1791-1873) devoted himself exclusively to gross pathology. Carl Ernst Von Boer (1792-1876) worked at the development of embryology. He founded the modern science of comparative embryology, established the doctrine of three germinal layers, discovered the mammal ovum and set the lines along which nearly all subsequent embryological work has traveled.

Sir Charles Bell (1772-1842) made valuable contributions to the anatomy of the nervous system, and also made the physiological discovery that the spinal nerves come off from the spinal cord through motor and sensory roots. Robert Knox of Edinburgh combined histological and descriptive anatomy.

Some Americans who worked in anatomy were John Goodman, Samuel ~~M~~ Norton, Caspar Wistar who gave his name to the Wistar Institute of Anatomy and Biology, and William Honner who discovered the tensor tarsi, Honner's muscle. Goodman contributed to physiology too; and Morton in addition to his anatomical studies contributed to paleontology and cliniatology.

Jacob Henle and Joseph Hyrtl were the two most famous German anatomists. Henle, a histologist, also was the first to see the minute structure of the kidney as a structure of tubules.

Rober Remak made the discovery of the non-medullated nerve fibers, Purkinje found the Purkinje cells of the cerebellum and also gave the special application of the term protoplasm, as we now use it.

Most of the medical science workers directed their work along the lines of physiology. Johannes Mueller, a German furnished a new impetus to physiology through his investigations of nerve impulse, color perception, auditory mechanism, voice production and other physiological processes.

In America the only physiologist we had was William Beaumont. He was an army surgeon. His genius as an experimenter and physiologist was brought about through treating a half-breed Canadian who on June 6, 1822 had part of his abdominal wall and the anterior stomach wall, shot away in an accidental shooting. The man recovered with a resulting gastric fistula, and through this fistula, Beaumont made the first studies of gastric digestion and gastric motility. These studies form the basis of all subsequent work on the physiology of gastric digestion.

The last half of the 19th c ntury was one of brilliant work leading on toward a even more promising future.

This period opens with the work of Darwin, Huxley and Haeckel, in the discovery and establishment of the doctrine of evolution. A battle resulted between these men and other scientists who like the clergy did not recognize the theory. The battle was settled in all probability by clarification of ideas and will protect the mind of man from any similar obscurities.

"Science divorced theology and in due time established an hopefully propitious and properly qualified courtship with religion."

Some of the men who added their brilliance to this period are: John Tyndall, the great physicist; and Sir Charles Lyell, a geologist, who along with huxley popularized science in England. Herbert Spencer, biologist and philosopher of whom we have all heard, added his great works to this time. Augustus Waller of Kent, England made the great discovery that nerves degenerate beyond the point of their section (so-called Wallerian degeneration) and this idea seemed to furnish a new stimulus to physiological investigation.

Sir Michael Foster, one of the outstanding physiologists of modern times, established the Cambridge school of physiologists, when he revolutionized cardia physiology, and also gave a new impetus to physiology through his own and his pupils work.

Henry Pickering Bowditch established in 1871, the first physiological laboratory in the U.S. at Boston.

Carl Ludwig, a famous German scientist, introduced into physilogy the modern methods of instrumental recording, he made important contributions to the physiology of urinary secretion and blood and lymph circulation, his greatest service, however, was his influence on his pupils for greater research.

Hermann Von Helmholtz, whose essay on the Conservation of Energy is a classic,invented the ophthalmoscope in 1851 and revolutionized this science.

Carl von Voit was a pioneer in the study of metabolism; Rudolph Heidenhain, professor at Breslan, made studies of all the secretory activities of the body.

Physiological chemistry was making her entrance through the inspiration of Justus von Liefig, the founder of agricultural chemistry was opened, that of experimental hygiene, by Max von Pettenkofer. He established the first Hygiene Institutute at Munich.

The science of Pathology was developing rapidly. Morgagni introduced gross pathology, some authors disagree on the subject of Morgagni's contributions. He went even a step further and developed the new field of cellular patholody. In fact he enriched all the fields of this science.

In order to sum up the work of the 19th century, we will mention a few new names: Sir James Paget gave his mame to a disease of the bone and also to one of the nipple. Sir Jonathon Hutchinson is best known because of his studies of herediary syphillis (now considered only congenital) and pupillary changes in intracranial injury. Sir Victor Horsley established neurological surgery as a distinct speciality.

In all countries internal medicine was advancing more rapidly than surgery.

In France Jean Villenun proved the infectious nature of tuberculosis before the discovery of the bacillus. Jean Charcot, a great clinician was also the greatest neurologist of his time.

In the U.S. William Osler, Weir Mitchell, Jacob Da Costa, Edward Janeway, Abraham Jacobi, Nathan Smith Davis, William Pepper, Reginald Fitz and Austin Flint, Sr. These men were accomplished internists and there works are well known; with the we also have the American surgeons.

We have covered considerable material and even so we have only touched the high spots in our subject. In order to realize what the work of these scientists mean we must think of the uncountable number of people who are being helped and cured today, only because these men spent their best years in investigating diseases.

To the layman, who is the receiver of the treatments, the advances of medicine mean the most, because it enables him to be cured.

The physician is thankful for this work because through laboratory work on blood, spinal fluid, urine, biopsies, metabolism, x-ray, nutritional and numerous other means, he can diagnose a condition without waiting for a patient to deveope symptoms so obvious that it is too late to treat them.

A nurse in order to do her best in caring for a patient and serving her doctor, should know the complete story, but she should realize what symptome to expect as a reaction to a certain condition.

It might seem that we have finished our story, but the story of medical science will never be finished. It has been deveoping since the begin ing of time and will continue on until the end of time. We know that today we have great laboratories and brilliant men working untiringly on all the unanswered questions. We know also that many helpful ideas and products are being introduced into the fields.

There will always be new subjects to study and anew observations to make and we of the nursing profession should do all in our power to encourage and help this important work.