Milestones in Medicine

From the Medicine Man to X Ray

By Ruth A. Sparrow

"Milestones in Medicine" by Ruth A. Sparrow, Librarian, is the third in her series describing the collection of first editions in the Museum's "Milestones of Science." The books on medicine displayed in connection with the Cabana Hall of Man, (indicated by asterisk), are the printed records of the development of this science through the ages. Purchased from the Cabana endowment fund, they are the highlights in the history of medicine. The other titles, while definitely in other fields, are described here because they are so closely related to the development of medical knowledge. —Editor's Note.

● ● ● Disease is older than medical cures. In the days when the mastodons roamed the earth, there is evidence that they had broken bones and toothaches. The Richmond mastodon, now being restored in the Buffalo Museum of Science, has marks indicating that it suffered a fractured rib which nature nicely healed.

The Cro-Magnons had their medicine men as had all primitive tribes. These medicine men were persons who professed to cure sickness and drive away spirits. All science and medicine was intricately involved with magic. In the early days ailments were believed to be inflictions of the gods; thus priests and holy men were appointed to appease the gods.

All early records of the medicine of antiquity have been gleaned from the observations of archaeologists who have found evidences in rock pictures and in the skeletons of men and animals.

Hippocrates, Father of Medicine

It was Hippocrates (460-375 B. C.) who first founded medical science on a basis such as we recognize today. He introduced a new method of treatment. He ignored all of the gods. He preached that disease was a part of the order of nature and that in order to conquer and understand it, it must be studied as any other natural event. He made careful studies of his patients, recording honestly the signs and symptoms. Having diagnosed the disorder he set about curing it by directing the ill one how to care for himself, letting nature do the large part of the healing. Hippocrates is called the Father of Medicine. It was he who gave medicine its fine ethical oath. His writings, *Opera Omnia* (Venice, Aldine, 1526: First edition in Greek) are undoubtedly the work of many men, the crystallization of the thought of a school.

Fact and Fancy Intermingle

Pliny the Elder was one of the few Romans who wrote on science, and his work is perhaps the most voluminous of all early writers. Pliny was learned and well educated in the subjects considered essential in his time. His great curiosity took him into all fields of knowledge. His desire to witness at close range the eruption of Vesuvius was the cause of his untimely death in 79 A. D. *Historia Naturale* (Venice, 1476) is one of the outstanding books in the Museum's collection of first editions. It is a copy of the first edition in a modern language. It is based on his reading of several hundred Greek and Roman authors and is a compilation of the knowledge of the time. In the history of scientific principles it may be disregarded, but it is important in the history of the promulgation of knowledge. It is divided into thirty-seven books and is a veritable encyclopaedia. Fact and fancy are freely intermingled. It covers a description of the

universe, geography, animals, minerals, arts, medicine, botany, and astronomy. It contains marvelous tales of monstrosities, myths, and folklore. He had great influence on medicine after his time, though he knew little about it himself. He preserved all the old systems of medicine, he named many physicians forgotten elsewhere, he listed remedies for all sorts of ailments, and his fund of knowledge was inexhaustible.

Dioscorides (c. 50 A. D.) was a Greek, long a resident of Rome and a surgeon in the army of Nero. He was intensely interested in botany, and as he travelled extensively and was always looking for plants he became the greatest medical botanist. He knew over six hundred plants, considerably more than Theophrastus. Dioscorides is called the Father of Materia Medica.

The outstanding physician of antiquity and one whose work endured for over fifteen hundred years was Galen. He was a Greek physician who went to Rome and shortly became physician to the emperor. His books were regarded as the authority on everything concerned with health and disease. In his *Opera* (Venice, 1490) is contained in a systematic form all medical knowledge, and it was his purpose to prove that everything was created for a useful purpose for man. He had an explanation for everything, and no one doubted his word.

Scientific Spirit Awakens

Science ceased to advance for many centuries, and people turned to religion. Until the Renaissance Galen was accepted as the authority in all matters pertaining to medicine.

In the closing days of the fifteenth century Aureolus Theophrastus Bombastus von Hohenheim, who called himself Paracelsus, was born. He awakened the scientific spirit among physicians and spread the contagion of the revival of learning to medicine. Paracelsus derided the doctors and greatly changed and improved the preparation and administration of many drugs.

In 1476 there was published in Padua a book since become very rare, *De Mineralibus* by Albertus Magnus (c. 1193). This book describes the general properties of "medical minerals" used in prescription.

A great figure in the history of Italian medicine was Caesalpinus (1519-1603). He was a physician-naturalist devoting himself mainly to botanic studies. Apart from these, in the consideration of medicine, interest centers about claims which have been made that he described the greater circulation. This is contained in *De Plantis* (Florence, 1583).

The Father of Human Anatomy

In 1543 there appeared a book by one Vesalius, the Father of Human Anatomy. He was a Belgian physician, and his work marked the beginning of the period of rationalism in medicine. The book *De Humani Corporis Fabrica* (Basel, 1543) marked a breaking with the past and the abandoning of the Galen tradition. In the same year Copernicus's great work *De Revolutionibus Orbium Coelestium* was also published. This disproved the Ptolemaic theory that the earth is the center of the universe. Vesalius showed that man's structure is of one and the same material as the bodies of lower animals. Both were revolutionary works. When one realizes the difficulties under which Vesalius worked, his book is all the more remarkable. The Church forbad dissection of human bodies, so he had to secure abandoned corpses in order to obtain his subjects. Then for the first time the body was described accurately and fully. It is a joy to go over his illustrations in this work. There are many splendid woodcuts representing majestic skeletons and flayed

figures very carefully depicted.

After Vesalius the study of anatomy developed so rapidly that within a hundred and fifty years there was little or nothing to be added. The great names in anatomy are scattered like nameplates over the human body: Fallopius, De Graff, Eustachius, Variolius, Willis, Brunner, Stenson, and a host of others.

Blood Circulation Discovered

In 1578 in England was born William Harvey, destined to make one of the greatest contributions of all times to medical science. By observation Harvey discovered that the heart pumps blood and that the blood circulates in the blood vessels. The third edition of his great classic, *De Motu Cordis et Sanguinis in Animalibus, Anatomica Exercitatio* (1639), as rare as the first of 1628, is one of the choicest of books among the Museum's Milestones.

However, one confirmation Harvey's principle was lacking—the exact passage from the arteries to the veins necessary to complete the circulation. He assumed that the blood filtered through the tissues and thus entered the veins. It was Malpighi, an Italian, born the year of the first edition of Harvey's work, who completed the last link of the chain which Harvey had all but established in proving the course of the circulation of the blood.

The Father of Microscopic Anatomy

Malpighi (1628-1694) was an anatomist and physiologist and has been called the Father of Microscopic Anatomy. In 1661 he discovered the capillary vessels connecting the veins and the arteries also by aid of the microscope.

The first "flea" glasses were made in Holland in 1590. They were more in the nature of playthings and curiosities and were the forerunner of the microscope. They magnified about ten times. Anthony van Leeuwenhoek was born in Holland in 1632 and five years later, Jan Swammerdam. These men were to make microscopes that magnified two to three hundred times. And in England in 1635 another potential microscopist was born, Robert Hooke. Hooke was keenly interested in the microscope and made one of his own. He cut thin slices from all sorts of bodies, both animal and vegetable. With the aid of his microscope he discovered that all were perforated and porous, much like a honeycomb. To these pores he gave the name of "cells." His observations were published in *Micrographia* (London, 1665).

To these four microscopists the world owes much, for as a result of their studies more was known of the human body and its functions than ever before. Leeuwenhoek discovered the red blood corpuscles, the spermatozoa, and the capillary circulation of the blood. These are recounted in *Selected Works* (translated by Samuel Hoole, London, 1800). To Hooke we owe the term "cell" as well as the first microscope at all resembling our modern instruments. Swammerdam discovered that the blood is not a homogeneous liquid but that it is composed of little round globules floating in serous liquid. He too discovered the red blood cells. Malpighi was the greatest of all these, and his investigations of such organs as the kidneys and the lungs made him, after Vesalius, the greatest anatomist who ever lived.

Physics and Chemistry Enter

Physics and chemistry now begin to play an important part in the scientific advancement of medicine. At the end of the eighteenth century scientists were experimenting with electricity. Gray experimented with conductors and non-conductors; Franklin successfully worked on lightning conductors. But it was an Italian phy-

sician named Galvani (1737-1798) who first discovered the application of electricity to medicine and the reaction of muscles to electricity. One day while working in his laboratory he accidentally touched the leg of a frog with an instrument he had been using while turning an electric frictional machine. The leg of the dead frog moved, and he began at once to investigate this phenomenon. As a result we have his great work on animal magnetism, *De Viribus Electricitatis in Motu Musculari* (Modena, 1792), the keystone of the literature on the subject.

One of the most prevalent and most feared diseases of the eighteenth century was smallpox. No one seemed to be immune. Then in 1796 a discovery was made which practically did away with the dread disease. Edward Jenner (1749-1823) observed that dairymaids who contracted cowpox from cattle seemed immune to smallpox. He began collecting his evidence and on May 14, 1796, performed his first vaccination upon a country boy, using matter from the arm of a milk-maid who had contracted cowpox in the usual way. The experiment was then put to the test by inoculating the boy with smallpox virus in July. The immunization proved successful. In *An Inquiry into the Causes and Effects of the Variolae Vaccinae* (London, 1798) Jenner records one of the greatest triumphs in the history of medicine —the successful introduction of preventive inoculation.

Cells As Universal Principle

In 1837 two young Germans met in Berlin for dinner — Theodore Schwann, a botanist, and M. J. Schleiden, a physiologist. They discussed their common interest in natural science. They agreed that vegetable and animal tissues alike were essentially and ultimately the same thing—cells. In two papers published by these young men the cell theory was established. Schleiden's theory of nucleated cells as propounded in *Gründzuge der Wissenschaftlichen Botanik* (Leipzig, 1842-3) marked the transition from the historical to the biological story of nature. Schwann's coordination of previous ideas on cellular construction and his researches produced his theory that "there is one universal principle of development for the elementary parts of organisms, however different, and that principle is the formation of cells." This generalization was a landmark in the history of biology. In the first English edition of his work *Microscopical Researches into the Accordance in the Structure and Growth of Animals and Plants* (London, 1847), there is also a translation of Schleiden's *Contributions to Phytogenesis.*

Louis Pasteur's Contribution

The story of Louis Pasteur (1822-1895) is well known, and space does not permit retelling it here. Pasteur was a chemist who taught us the life history of bacteria. He began his investigations on the "diseases" of wine. In *Etudes sur le Vin* (Paris, 1866) he described the process of heat sterilization to prevent diseases in wine, later known as "pasteurization." He continued his investigations with a study of the silkworm. The raising of the silkworm was one of France's chief industries. Disease of the worm had seriously affected the industry. As a result of his observations and experiments he saved the silkworms. *Etudes sur la Maladies des Vers à Soie* (Paris, 1870) is the record of the case. The step from silkworm diseases to human diseases is one which Pasteur made with little effort. His work on anthrax and rabies places him high in the ranks of medicine.

After his successful work on the silkworm he turned his attention to the study of beer. It was an attempt to make French beer superior to Ger-

man beer. No scientific persons were in accord with Pasteur on the subject of microörganisms. In his work *Etudes sur la Bière* (Paris, 1876), Pasteur gave the discovery that fermentation is the result of microörganisms, which superseded the contact theory of Berzelius and the mechanical one of Liebig.

It was during his researches on the nature of fermentation, with their revolutionary influence on brewing, that Pasteur received a letter from Joseph Lister, eminent English surgeon, acknowledging the value of his (Pasteur's) work in relation to antiseptic surgery. Thus Pasteur was transformed into a medical man, particularly in his method of handling the problem of infectious diseases.

Antisepsis in Surgery

Joseph Lister (1786-1869) had long sought to overcome infection and the dreaded gangrene in dealing with wounds and in operations. He found that bacteria produced infections in wounds. He experimented with carbolic acid with some success; then he sterilized his bandages and ligatures. His success was unbelievable. On March 16, 1867, he reported his results in an article in the *Lancet*, a great English medical weekly. On August 9 of the same year he read his paper *On the Antiseptic Principle in the Practice of Surgery* (London, 1867).

The Tuberculosis Baccilus

It was Robert Koch (1843-1910) who showed that bacteria were the cause of specific infectious diseases. If it had not been for him the new science of bacteriology which Pasteur delivered would never have matured. He produced the method of cultivating bacteria outside the body, the inoculation of animals with pure cultures, the fundamental bacteriological methods of the incubator, the hanging drop, and the discovery of tuberculin. In his paper *Die Aetiologie der Tuberculose* (1882) he announced the discovery of the tubercule baccilus. In three papers read at the Tenth International Medical Congress at Berlin he announced his discovery tuberculin. These were *Weitere Mittheilungen über ein Heilmittel gegen Tuberculose* and *Fortsetzung der Mittheilungen . . .* and *Weitere Mittheilung über das Tuberculose* (Leipzig and Berlin, 1890-1891).

X Ray Developed

Strictly speaking the principle of x ray began when Torricelli invented the barometer of mercury, (*Lezione Accademische*, Florence, 1715), or more specifically when von Guericke established the theory of the vacuum, so long sought for by scientists (*Experimenta Nova*, Amsterdam, 1672). In 1753 Abbe Nollet experimented on electrical discharges through vacuum tubes and germinated the work which resulted in the x ray. It was Röntgen, however, who made the complete experiments which established it. He announced his discovery in a lecture before the Würzburg Physico-Medical Society in December, 1895. His paper, *Eine Neue Art von Strahlen*, is one of the few offprints taken from the Society's *Transactions* (Würzburg, 1895-1896). X ray meanwhile has become one of the most valuable methods of the medical diagnosis.

Radio Activity Shown

The discovery of x ray stimulated interest in a group of substances known to emit spontaneously some sort of phosphoresence or rays of energy. In 1896 Henri Becquerel discovered the principle of radio activity (*Recherches sur une Propriété Nouvelle de la Matière*, Paris, 1903). The word was suggested by Madame Curie. At Becquerel's suggestion the Curies began to work on the properties of uranium and thorium, and in 1898 they obtained polonium

and radium. After a lengthy experiment the medical use of radium was discovered, and it has become one of the greatest healing agencies in medical science. In 1903 the Curies shared the Nobel Prize with Henri Becquerel. In 1910 Madame Curie isolated radium for which she received the Nobel Prize in Chemistry in the following year. Her classical work, *Traité de Radioactivitié*, was published in 1910.

The progress made in medicine since the turn of the century has been phenomenal. No attempt has been made to cover this field as yet. Some of the important discoveries and researches have been in yellow fever, malarial fever, typhus fever, diphtheria antitoxin, salvarsan and neosalvarsan, vitamins, anaphylaxis and serum therapy, cancer, and the treatment of infantile paralysis—to name but a few.

MILESTONES IN MEDICINE

**De Mineralibus Liber Primus by Albertus Magnus, Padua. 1476*

**Historia Naturale by Plinius Secundus, Venice, 1476*

**Opera by Galen, Venice, 1490*

**De Humani Corporis Fabrica Libri Septem by Vesalius, Basel, 1543*

De Plantis by Caesalpinus, Florence, 1583

**Chiurgische . . . by Paracelsus; edited by J. H. Brisgium, Strassburg, 1618*

**De Motu Cordis et Sanguinis in Animalibus, Anatomica Exercitatio by William Harvey, Lugduni Batavorum, 1639*

Micrographia: on Some Physiological Descriptions of Minute Bodies . . . by Robert Hooke, London, 1665

Experimenta Nova (ut Vocantur) Magdeburgica de Vacuo Spatio by Otto von Guericke, Amsterdam, 1672

Lezione Accademische . . . by Evangelista Torricelli, Florence, 1715

The Book of Nature; or, The History of Insects . . . by John Swammerdam; translated from the Dutch and Latin original editions by Thomas Flloyd; revised and improved by John Hill, London, 1758

De Viribus Electricitatis in Motu Musculari by Galvani, Modena, 1792

**An Inquiry into the Causes and Effects of the Variolae Vaccinae . . . by Edward Jenner, London, 1798*

The Selected Works of Antony Leeuwenhoek Containing His Microscopical Discoveries . . . Translated from Dutch and Latin editions . . . by Samuel Hoole, London, 1800

**Gründzuge der Wissenschaftlichen Botanik by M. J. Schleiden, Leipzig, 1842-43.*

Microscopical Researches into the Accordance in the Structure and Growth of Animals and Plants by Theodore Schwann, first English edition, London, 1847; also contains Schleiden's Contribution to Phytogenesis

**Études sur le Vin by M. L. Pastcur, Paris, 1866*

**On a New Method of Treating Compound Fracture, Abscess, etc. by Joseph Lister, in* Lancet, *March 16, 23, 30 and April 27, 1867*

**On the Antiseptic Principle in the Practice of Surgery by Joseph Lister in* Lancet, *September 21, 1867*

**Études sur la Maladie des Vers à Soie by M. L. Pasteur, Paris, 1870*

**Études sur la Bière by M. L. Pasteur, Paris, 1876*

**Die Aetiologie der Tuberculose by Robert Koch in* Berliner Klinische Wochenschrift, *April 10, 1882*

**Weitere Mittheilungen über ein Heilmittel gegen Tuberculose by Robert Koch, extract from* Deutsche Medinische Wochenschrift, *November 13, 1890*

**Fortsetzung der Mittheilungen über ein Heilmittel gegen Tuberculose by Robert Koch, extract from* Deutsche Medicinische Wochenschrift, *January 15. 1891*

**Weitere Mittheilungen über das Tuberculose by Robert Koch, extract from* Deutsche Medicinische Wochenschrift, *October 22, 1891*

Eine Neue Art von Strahlen by W. Röntgen (2 papers), Würzburg, 1895, 1896

Recherches sur une Propriété Nouvelle de la Matière by M. Henri Becquerel, Paris, 1903

Traité de Radioactivité by Madame P. Curie, Paris, 1910

**On display in connection with the Cabana Hall of Man*