

# MILESTONES OF SCIENCE COLLECTION AT THE BUFFALO MUSEUM OF SCIENCE

Chauncey Hamlin, read before the Thursday Club, March 12, 1942

In the warm confidential atmosphere of The Thursday Club perhaps I may be forgiven for presenting what might appear to outsiders as a paper stressing too heavily the autobiographical, the personal part played by myself in gathering together our Museums now internationally famous collection of *Milestones of Science*. Inasmuch, however, as I am amongst old friends, and had much to do with the inception and carrying out of the plan I am going to cast discretion to the winds and tell you about it.

One day, a number of years ago, as I was rummaging about amongst some of the old papers and books at the Museum, I came across a small collection of photographs of a number of distinguished scientists. This suggested to me that it might be perhaps worthwhile to try and secure pictures of the one hundred greatest scientists, and to put such a collection of pictures on permanent display in the corridor which runs immediately in front of the entrance to our Research Library on the second floor of the Museum creating there a sort of Hall of Scientific Fame at the entrance to our Scientific Library.

On returning to my home that evening I began what later proved to be a most fascinating bit of research work. The question first to be decided was, of course, what men should be selected to be included in such a list of the greatest scientists. Nowhere in my library or elsewhere could I find such a list, so I decided to attempt to develop one of my own. Fortunately I had a number of books touching on the history of the various sciences and encyclopedias were also handy. Many a pleasant evening was spent delving into these books and discussing with my friends and associates the tentative lists that I prepared in each one of the different fields. It was not long before we discovered that it would be impossible to limit the number of men who had made really great contributions to the advancement of scientific knowledge to an even hundred – the list had to be expanded. Finally when the lists were more or less completed, came the hunt for pictures. Some trips to New York and rounds of the old print shops soon produced a goodly number. A residual want list was then circulated by mail amongst the old print shops and second hand book dealers in this country and abroad, and finally as the result of accessions our want list was reduced to a respectable number. About this time a skilful artist became available, capable of making creditable pen and ink portrait sketches from photographs or pictures printed in books. In this way we gradually completed our series. We had previously adopted a uniform size and our Photographic Department, by re-photographing and by either increasing or reducing the size of such pictures as we had obtained, brought them all into uniformity. During the process of collecting the pictures and circulating the lists many valuable suggestions were made for additions or eliminations.

One day I remember receiving a most interesting suggestion of a new name to be added to our list which no one else up to that time had thought of. On the day in question, as I passed along the corridor where our collection was hung, I noticed a group of men, strangers to me, who were examining intently the various pictures. I stopped to speak to them. One of them turned out to be the biographer, Emil Ludwig, who had been brought to the Museum by some friend. He expressed himself as being surprised that we did not have a portrait of Göethe in our collection. He had just published a biography of Göethe, in which he had made the claim that Göethe was one of the forerunners of Darwin. On looking the matter up later I found that Mr. Ludwig was right and we now not only have Göethe's picture in the series of upwards of one hundred and eighty scientists but, also, a first edition of his book *Versuch die Metamorphose der Pflanzen zu Erklären*, published in 1790, is included in our collection of *Milestones of Science*. It was in this work that Göethe foreshadowed the theory of evolution.

In reading so many different and fascinating histories of scientific achievement in order to make up our lists I became naturally very much interested in the subject and as happens so often, one thing leading to another, I began to wonder if it would not be possible to secure any first editions of some of the great works of science written by these men – the works in which they had announced their epoch making discoveries to the world.

One day in May 1937 a young man called at my office. He proved to be Mr. Edward Sy, Dr. Alfred Sy's son. Young Sy told me that he was thinking of starting a rare book business in Buffalo and had come in to see me to find out whether the Museum might possibly be interested in obtaining a few of the more famous books announcing outstanding scientific discoveries. Within a few days he returned, this time with a fine copy of the first edition of the great work of Copernicus and several other rare books under his arm. The purchase of these started our collection. Later, on a trip to New York, I found that David Randall of Scribner's & Company had assembled a considerable number of first editions of famous works in the fields of science and medicine and had published a most interesting catalogue concerning them. We shortly negotiated a second purchase and were now off to a fair start. The nucleus of the collection grew rapidly. Of course there had to be a second search of the books dealing with the history of science, and many consultations with scientists and others to determine what items should be included in our want list. We early decided that only books or other publications were to be included which actually first announced to the world outstanding discoveries. Only the books which might be properly called *Milestones of Science*.

Further, we did not want to make our list so large as to make it unimpressive because one could not see the individual trees on account of the forest. The idea back of the collection was to have something unique, something that would lend distinction to our Museum and to Buffalo. The books, moreover, were to be used largely as supplementary items in our various Halls of Science. Time was largely of the essence; we wanted to be able to announce the completion and possession of such a collection as soon as possible. We could not find that any other museum in the world possessed such a collection. Some libraries had notable collections

and some private collectors; notably Dr. Harvey Cushing of Yale University in New Haven, and Dr. Herbert Evans of the University of California in Berkeley, California, but no museums. We felt that such an announcement when made and broadcast would tend to bring national and even international prestige to our Museum and to Buffalo. We hope to reach circles which perhaps hitherto had not had our museum and its work or the cultural achievements of our city previously brought to their attention. A museum or city's international reputation in the cultural field is largely based upon its recognized distinctive features, unusual educational services, or the high quality and range of its publications.

There was only one phase of the problem which momentarily gave us pause. One of the museums in the central west had recently been subjected to a lot of undeserved criticism and unfavorable publicity because in the midst of the depression years it had been fortunate enough to secure by purchase a splendid though expensive sculpture of an Egyptian Cat. Parades of unemployed were even organized to picket the Museum in protest of the purchase of this valuable and important art object. We wondered if some parlor pinks or other excitable elements in Buffalo might not raise the same unreasoning outcry against us. A happy solution however was soon found to set our fears at rest.

One evening Mrs. Hamlin and I were invited to be guests of the Florentine Society, one of Buffalo's Italian organizations, at a small dinner meeting at the Hotel Buffalo. I was asked to speak on the Museum and its work. Searching about for an introductory subject which might interest this group I decided to tell them about some of the great works of science produced by Italians, which we hoped to be able to secure in order to add them to our collection of *Milestones of Science*, as for instance, the works of Galileo, Galvani, Volta, Malpighi, Torricelli, and Marconi amongst others. I also spoke of the universality of science in its international aspects. The idea of developing such a collection evidently appealed to this group. I was asked many questions about the plan and finally one of the members proposed that there should be organized a great international Mardi Gras celebration in Buffalo, in which all nationality groups represented in our city's cosmopolitan population would be asked to participate, for the purpose of raising a fund to be used by the Museum in adding to its collection of rare books. This idea met with instant approval and a committee was thereupon appointed to foster the plan.

Later there was organized the All Nations Mardi Gras to raise funds for the Museum's collection of the *Milestones of Science*. Five thousand people attended this great cosmopolitan gathering in the Broadway Auditorium on the evening of March 1, 1938. The Poles danced to help us raise the funds to pay for the great work of Copernicus. The Italians sang to help us secure the first edition of Galileo. The Greeks gave a beautiful pageant to the end that we might secure the first printed editions of Aristotle, Euclid, and Archimedes. Twenty odd national groups participated – amongst others representatives of England, France, Russia, Germany, Spain, Czechoslovakia, Switzerland, Greece, Holland, Hungary, Ireland, Italy, Poland, Scotland, Sweden, and Wales took part. Each one of these countries had contributed a number

of great scientists to the world. The works of these men announcing their discoveries were on our lists for purchase. This Mardi Gras celebration was a huge success, and put at rest for all time any fear of criticism and served at the same time to advertise in advance, to all the city, the great collection of the *Milestones of Science* which we were engaged in assembling, giving moreover to the people who participated a sense of ownership or partnership in the enterprise.

On April 26, 1938, less than a year after we first initiated the program through the purchase of our copy of Copernicus, we opened our collection to public exhibition in the Central Hall of our Museum, especially inviting for this occasion all those (over 1,000 in number) who had actively participated in the Mardi Gras Celebration. Many of these books we have since kept on permanent exhibition and from the collection select each month one book which we call the Museum's-Book-of-the-Month. This book is put on special display in a case by itself near the entrance of our Main Hall. We send a special write-up about this book-of-the-month to the press and print a notice about it in our monthly Schedule of Events. Selections from the collection have also served as a basis for a splendid series of articles prepared by our Research Librarian, Miss Ruth Sparrow, which have been printed in our little monthly magazine, *Hobbies*, and which we hope we can later bring out in book form.

Several special events have been dignified by recourse to items in this collection. On one occasion the Italian Colony in Buffalo gave to the Museum a splendid portrait of Marconi, painted by the well-known local artist, Anthony Sisti, to commemorate Marconi's birthday, and the placing on special exhibition of Marconi's first publication of his discovery of wireless telegraphy.

Last winter on the occasion of the 400<sup>th</sup> Anniversary of the announcement of the Copernican theory a celebration was held in our Museum presided over by Dr. Francis E. Fronczak, at which Alexander Jacimowicz, a representative of the Polish Consul General's Office in New York presented a distinguished address. On this evening the Museum was presented with a finely executed portrait of Copernicus, dressed in his fine robes, painted by Joseph C. Mazur, a local artist of Polish descent.

Shortly after we had made a start in getting together our collection our Museum was invited by Mr. David A. Randall, the Chairman of the Rare Book Committee of the New York Times National Book Fair to lend them our copy of the first edition of to be included in their exhibit of the *Ten Books That Shook the World*. These ten books so put on display were Copernicus' *De Revolutionibus Orbium Coelestium*, Bacon's *Xovum Organum*, Newton's *Principia*, Darwin's *Origin of Species*, Pasteur's *Études sur la Bière*, More's *Utopia*, Machiavelli's *Prince*, Marx and Engel's *Communist Manifesto*, Einstein's *Electrodynamics of Moving Bodies*, and Freud's *Interpretation of Dreams*. It may be interesting for you to know that we possess in our collections of first editions five of the books so selected by this committee.

Later we placed on exhibition, on the invitation of the New York World's Fair authorities, during the year 1939, two books from our collection, to wit: Copernicus' *De Revolutionibus Orbium Coelestium*, and Newton's *Principia*. Through the years there undoubtedly will develop other opportunities to utilize the unfathomable resources of this collection.

In preparing the list of great books to be included in the series it was necessary to call a halt in respect to dating, at least somewhere along the line. We arbitrarily set the year 1900 beyond which we would not attempt to go and only in a few instances have we violated this rule. Our reason for this was that since that date the selections of great scientists, whose works should by all means be included in any such list, have been made for us by the Nobel Prize Committee. It has been suggested that we should endeavor to secure copies of the first publications or books of the notable discoveries of these scientists who, year by year, have been so selected by this Committee to receive their Scientific Reward. It might even be possible to obtain autographed copies of the works of those who are still living or at least of those who are the recipients of current awards. I believe an effort should be made to secure such a collection and keep it up to date. This would undoubtedly give us, as the years roll on, a remarkable record of recent scientific achievements to supplement the really outstanding collection of the earlier scientists which we now possess.

Now having given you the background story of our collection I should like to devote the balance of this brief paper to telling you something about a number of the outstanding books included in it.

Perhaps the most dramatic series of books which we possess can be found in the field of Astronomy. This field I represented by twenty-five titles in our collection. I will, however, only mention a few of them. The first two are the first printed editions of Aristarchus of Samoa and Ptolemy. Our copy of Aristarchus was printed in 1572 and our copy of Ptolemy's *Almagestum* was printed in 1528.

Aristarchus was a Greek, who lived in Samos in the third century B.C., and was the first credited with proposing that our sun was the center of our system and that our earth revolved about the sun. He was followed by Ptolemy of Alexandria who worked out a most intricate solution to solve the puzzle of the heavens. He held that the earth was the center about which the sun and the planets all revolved, and had to invent a most ingenious scheme of so-called epicycles to account for the peculiar movements of the several planets. His theory fitting in with the religious philosophy of the times, was generally accepted, and held the stage for centuries – as a matter of fact down to the time when Copernicus published his great work and Galileo came to his support.

Our copy of Copernicus was published in Nuremberg, in 1543. The story goes that Copernicus had worked out his theory many years before its final publication. On several occasions he was asked to publish it but feared the reception which might be accorded it and the possible consequences of that reception to himself. Finally, one of his friends, Rheticus by name,

published a short paper which gave a brief account of the theory, - "Narratio Prima." This paper was published in 1543. We really ought to possess a copy of it in our collections. It is an extremely rare item. One time it was offered to us but at a price which we could not afford to pay. Upon the publication of this brief paper some of Copernicus' friends prevailed upon him to publish his great work. This he authorized finally and the story is told that one of the first copies of this publication was brought to him on May 24, 1543, the day on which he died. We are very happy to possess a copy of this great work as one of the foundation stones of our collection. The publication of this work caused a considerable flurry.

The next man that I should like to mention in connection with the field of Astronomy is Tycho Brahe (1546-1601). He was the son of a Danish nobleman. When he was thirty years of age, a friend of his, King Frederick II of Denmark presented him with an island in the Kattegat (1576), and built and equipped for him on this island a great observatory. This was called Uraniborg, or the "City of the Heavens." Tycho worked here with the greatest energy for twenty-one years. He did not have available any astronomical instruments except those of the most primitive type, so he invented some finely constructed ones with which he achieved the best possible results of pre-telescopic days. He was a keen-eyed and careful observer and kept very careful accounts of all his observations.

We have two books of Tycho Brahe in our collection. The first and most important was published in 1602 and contains a full description with illustrations of the astronomical instruments which he had developed and used in his observatory.

A story is told about Tycho Brahe, which may or may not be true. It seems that a dog caused the trouble. This dog in a way is immortal. You can see him in one of the pictures of Tycho's Observatory. Walchendorf, the Chancellor of Denmark, visited Tycho Brahe one day. The dog got in the Chancellor's way and the Chancellor kicked him. Tycho interfered. He is credited with having told the Chancellor just what kind of a coarse-grained lout he was. When Tycho got thru, the Chancellor was for leaving Uraniborg in a hurry. King Frederick died, being succeeded by Christian IV, with whom Walchendorf had influence. The result - Tycho was stripped of his resources and finally had to leave Denmark in exile.

Tycho reached Prague and was there befriended by Rudolph II, King of Bohemia, who gave him a castle as a home and observatory, and granted him a pension.

It was here that the fourth great figure in our story enters the story - Johann Kepler (1571-1630). He came to join Tycho Brahe just before the latter's death. On his death bed Tycho Brahe plead with Kepler to arrange for the publication of his new tables of planetary motions to be called the *Rudolphine Tables*, in honor of King Rudolph, his benefactor patron. This Kepler promised to do and succeeded finally in 1627 in carrying out this trust of completing and publishing these tables. We have the first edition of these tables in our collection. They served for more than a century as the sole basis for the calculations every seafaring man had

to make if he wanted to keep his ship afloat and himself alive. It was in these tables that the observations of Tycho Brahe in regard to the peculiar motions of the planets were recorded.

These peculiar motions, which gave birth to the invention of epicycles by Ptolemy, presented an intricate problem to the mind of the mathematical genius of John Kepler. From the study of these tables and the application of every imaginable test go account for these motions Kepler finally worked out what are now known as Kepler's three fundamental laws of planetary motion. First, that the planets move in ellipses with the sun in one focus. Second, that the straight line joining a planet to the sun sweeps out equal areas in any two equal intervals of time. Third, the square of the periodic time of any planet is proportional to the cube of its mean distance from the sun. The discovery of these three laws has won for Kepler the name of "The Lawmaker of the Heavens." The first two laws were given to the world in 1609 in his work *Astronomia Nova*. The third law in 1619 in *Harmonices Mundi Libri V*. First editions of these two great books are among the treasures in our collection. Our copy of *Astronomia Nova* is a dedicatory copy. It came from the library of the Archduke Ferdinand of Bavaria.

Tycho Brahe was exiled from Denmark by the successor of Frederick II and curiously enough Kepler was also in exile from Styria. The interest in this dedicatory copy is that it belonged to the successor of the ruler who had exiled Kepler, on account of his Protestantism, from Styria.

The fifth great figure, Galileo Galilei (1564-1642) was a contemporary of Johann Kepler. Galilei's first announcement of his invention and the foundation of telescopic astronomy was published in Venice in 1610 under the title of *Siderius Nuncius Magna*. This work together with Galilei's publication announcing the discovery of sun spots in 1613 *Istoria e Dimostrasioni intorno alle Macchie Solari* and his great controversial work, the famous *Dialogo* published in Florence in 1632, are all three in our collection.

It was in the presentation of facts and in the argument published in this *Dialogo* that the Copernican theory that the earth goes around the sun was definitely proven. Galileo was ordered to Rome. He was 70 and not well. There he was subjected to the rigorous examination of the Inquisition. Somewhere along the line his spirit broke. At some point he must have cried out. "Enough. I recant. I adjure. I curse my heresy. What more can I do?" "Sign," said the ten cardinals. In the presence of one of the first editions of Galileo's great work one can believe as tradition has it that you can hear his voice mumbling as he rose from his knees, "E pur si Muove" (Nevertheless, it moves). The rarity of our treasure is accounted for not only in part by its age but also by the fact that the church had ordered all known copies to be burned.

And now comes the mathematical genius, Isaac Newton (1642-1727) to put the final keystone in the arch, through his discovery and application of the laws of gravity, affording a reasoned explanation as to why the planets move in their respective orbits. This he established in his *Principia* published in London in 1687,-- a first edition of which is another one of our *Milestones*.

The story of these books and these men, a Greek, a Pole, a Dane, a German, an Italian, and an Englishman prove the internationalism of science. Step by step truth has been wrested from the great ocean of truth in which we are all immersed. The picture puzzle has been pieced together by men of different nationalities, each working in his own sphere, each in turn relying upon the findings of his predecessors. Just as Marconi, an Italian, in the realization of the wireless depended upon the discoveries of a long line of scientists and more immediately upon the work of James Clerk Maxwell, a Scotchman, and Heinrich Hertz, a German, so every other scientific discovery has been built upon the work of a multitude of men in a kind of melting-pot process.

One of my very good friends, with whom I served in the last war, is Oswald Knauth. His charming wife is a descendent of Nathaniel Bowditch. Bowditch in 1829-1939 translated and published the first English edition of *Mecanique Celeste* by Pierre Simon Laplace, a book which constitutes one of the foundation stones in modern theoretical astronomy. In the first edition of this work, presented to our Museum by Mrs. Knauth, appears the following graceful dedication. I read it with pleasure in memory of the long line of faithful and devoted women who in aiding their husbands have also contributed to the advancement of science:

This translation and commentary are dedicated, by the author, to the memory of his wife, Mary Bowditch; who devoted herself to her domestic avocations with great judgment, unceasing kindness, and a zeal which could not be surpassed; taking upon herself the whole care of her family, and thus procuring for him the leisure hours to prepare the work; and securing to him, by her prudent management, the means for its publication in its present form, which she fully approved; and without her approbation the work would not have been undertaken.

I suppose that most of the members of the Thursday Club found difficulty in coping, as I did, with that famous proposition known as the "Pons Assinorum" trying to prove to the satisfaction of some hard-boiled and unsympathetic teacher that the square of the hypotenuse of a right-angle triangle is equal to the sum of the squares of the other two sides. I am sure that you will be pleased to view the first printed edition of Euclid, printed in Venice in 1482, known as the *Praeclarissimus Liber Elementorum Euclidis*. We possess, in addition to this work, a small but important group of twelve books which constitute fundamental contributions toward the history of mathematical thought. Among these are found the collected works of the greatest mathematician and physicist of antiquity, Archimedes. Our copy is the first complete edition of the Greek text published in Basel in 1544. The publication of this work was followed in 1545 by the publication in Nuremberg of *Ars Magma, sive de Regulis Algebraicis* by Heironymus Cardanus. This book constitutes the foundation stone of modern algebra.



A member of our club, Mr. Philip Wickser, has made several contributions to our collection. Amongst them is the work *Fundamenta Arithmetica et Geometrica cum eorundem usu varij problematis* by Ludolf van Ceulen, published in 1615. It contains amongst other matters the value of pi to 35 decimals. This calculation was considered so important that this number was engraved on Ceulen's gravestone at Leyden and is often called Ludolf's number. It is 3.14159265358979323846264338327950288.

Another one of the outstanding milestones in the history of mathematical thought was the publication in 1614 by John Napier of *Mirifici Logarithmorum Canonis Descriptio*. In it he announced and described his invention of the logarithmic system.

Supplementing these works we also possess that great classic in the history of science and philosophy in which Rene Descartes announced his discovery of analytic geometry. The title of this book, which was published in Leyden in 1637, is *Discours de la Methode pour Bien Conduire sa Raison, et Chercher la Verite dans les Sciences*.

In 1638 from the Elsviver press in Leyden came the first modern book of mechanics, the work of Galileo Galilei, entitled the *Discorsi e Dimostrazono Mathematiche*.

Our collection also includes three important works dealing with the subject of the calculus. The original paper on the discovery of the differential calculus of Gottlieb W. von Leibniz, published in Leipzig in 1684; Jacques Bernoulli's *Ars Conjectandi* published in Basel in 1713 contains the investigations of the principles of the calculus of probabilities; and L. Euler's work *Methodus Inveniendi Lineas Curvas Maximi Minimive Proprietate guadentes* created the calculus of variations. It was published in Lausanne and Geneva in 1744.

Another important work in our series is the great classic of mechanics *Mechanique Analitique* by Joseph Louis la Grange, published in Paris in 1788.

From the descriptions that I have given of the books in the fields of mathematics and astronomy I believe that you can begin to sense the plan and the character of our collection. As I said above we have attempted to include only the recognized outstanding works. The other fields covered in our collection are Chemistry, Physics, Biology including Botany, Geology, Geography, and Medicine.

In addition there are included in the collection certain important philosophical and general works as; for instance, a first edition of *Novum Organum* by Sir Francis Bacon published in London in 1620, and *Opus Majus* by Roger Bacon published in the same city in 1733.

We also have included in this group of general works the literary works of Leonardo da Vinci, compiled and edited from the original manuscripts, which had never been printed before until they were published in London in 1883.

A pleasant gift was made to this group a few years ago by Hendrik Willem van Loon of one of the earliest encyclopedias ever printed, the *Margarita Philosophica* published in Basel in 1517. This work is described as the first modern printed encyclopedia and gives in its twelve books "a compendium of the trivium and quadrivium and the natural and moral sciences." Lest you don't know what the trivium is – let me tell you it is "grammar, logic, and rhetoric." While the quadrivium consists of "arithmetic, music, geometry, and astronomy."

One of the eight incunabula found in our collection is another general work the *Historia Naturalis* by Plinius, published in 1476 by Jenson.

In some of the fields of science which are included in the collection there are too many books included to describe each one in detail without making this paper altogether too long. For instance, in the field of Chemistry there are over seventeen items. Among these, however, are three or four which should have special mention, for instance, *The Sceptical Chymist* by Robert Boyle, published in London in 1661. This happens to be one of the rarest books in the history of scientific [?] The publication marked the transition from alchemy to modern chemistry. Dr. John Fulton of Yale University, in 1932, made a census of the first editions of Robert Boyle. He states that "a careful census has been made of all copies of the first edition which could be found in the large English, Continental and American libraries, and all copies recently sold have been traced. Thus far, eleven perfect copies have been found." Our copy constitutes the foundation stone in our chemistry series.

We also have a second book by Robert Boyle, published in Oxford in 1662, entitled *New Experiments Physico-Mechanical*. This is the work in which Boyle announced his famous law of gases.

Our chemistry series includes such classics as the works of Joseph Black, Henry Cavendish, Antoine Lavoisier, Joseph Priestly, the discoverer of Oxygen who by the [?], Sir Humphry Davy, Gay-Lussac, John Dalton, [? of ? Theory], Amadeo Avogadro, Friederich Wohler announcing his discovery of the Periodic Table of the Elements, Justin Liebig, Robert Bunsen and the work of Dmitri I. Mendeleef, and also we have the work of Deville Sainte-Claire published in Paris in 1859 in which he announced the discovery of aluminum, which plays such an important part in the world's affairs today.

Our series in the subject of Physics is an even longer one. It contains thirty-five items. Among these there are perhaps a few which deserve special mention, as for instance, William Gilbert's great work on the magnet published in London in 1600. Blaise Pascal's work in which he announced his laws on the pressure of liquids and air. Otto von Guericke's discovery of the vacuum. Torricelli's development of the barometer.

Of course any such collection should include as ours does *Experiments and Observations on Electricity made at Philadelphia in America* by Benjamin Franklin, which was published in London in 1769.

Volts, Amperes, and Ohms are represented by the works of their respective discoverers – Alessandro Volta, Andre-Marie Ampere, and Georg Simon Ohm.

The outstanding discoveries and inventions in the field of light are represented by the notable works of Christian Huygens, Sir Isaac Newton, Sir William Herschel, William Hyde Wollaston, Joseph Fraunhofer, and Gustav H. Kirchoff.

Closely connected with light is the subject of heat. In this field we have the works of Count Benjamin Rumford, Jean B. Fourier, Herman Helmholtz, and James Prescott Joule.

Our largest series containing forty-eight items is found in the works touching on the subject of biology in all its different phases. The series starts out with two or more of our incunabula, *De Animalibus* by Aristotle published in Vendice in 1476, and *Historia Plantarum* by Theophrastus, an Aldini edition, published in Venice in 1497. These two works are followed by one of the great treatises of Albertus Magnus *Parva Naturalia* including *De Vegetabilibus* published in Venice in 1517. With the exception of Albertus (12 century A.D.) there was no botanist of any note from the days of Aristotle and Theophrastus until the Renaissance. His book shows the first indication of real scientific grouping of plants which he divided into leafless and leaf-bearing.

In our Biology series we have a number of interesting illustrated works including one of the most beautiful and rarest herbals *De Historia Stirpium Commentarii Insignes* by Leonhard Fuchs published in Basel in 1542, followed by *Historia Animalium* by Conrad Gesner published in Zurich in 1551. This last is a fundamental work in zoology in which animals are illustrated and listed alphabetically by their Latin names.

This series of illustrated works also includes the encyclopedic work *Histoire Naturelle* in thirty-six volumes by Georges L. L. de Buffon, published in Paris in 1749-1789.

The botanical section includes works by Andreas Caesalpinus, Nehemiah Grew, Stephen Hales, Linnaeus, Christian K. Sprengel, and Asa Gray.

Among other interesting items, we have in our collection the announcement of Antony von Leeuwenhoek's invention of the microscope just as we fortunately have Daguerre's first announcement of the invention of photography.

Leeuwenhoek's discovery of the microscope was followed by the work by Robert Hooke *Micrographia* published in London in 1665, in which he describes the making of the compound microscope, which he invented, together with a description of his observations into microscopical life. This is one of the most fascinating books we have in our whole collection. A companion piece is Jan Swammerdam's *Sibilia Naturae* in two volumes, published in Leyden in 1737, which is also a classic and contains one of the finest collections of microscopical observations.

No series of works in the field of Biology would, of course, be complete without there being included the works of Darwin, Wallace, Huxley, Lamarck, and Cuvier, containing their contributions to the development of the theory of evolution.

The announcement and development of the cellular theory is covered by the works of M. J. Schleiden and Theodore Schwann.

One afternoon while in New York I had an appointment with Dr. Frederick C. Keppel, the President of the Carnegie Corporation, to talk about some matters in connection with the American Association of Museums. In the course of our conversation, while we were waiting for some data to be prepared, I mentioned the fact that we, in Buffalo, were engaged in getting together a collection of Milestones of Science. Dr. Keppel was very much interested and suddenly interrupted my account of some of the books we had been able to secure by the remark that there was a book we certainly ought to include. He then went on to describe the discoveries of the Monk, Gregor Johan Mendel, in the field of genetics. He described Mendel's work at considerable length and stressed the importance of his work. It was rather fun to be able to open my portfolio as he finished and produce the first paper of Mendel for his inspection. This I had just gotten that morning from Scribner's and Company, through their agent in Berlin.

In the field of heredity we not only have the two papers by Mendel, published in Brünn, 1865-1870, but also the contributions of August Weismann, Francis Galton, and Hugo de Vries.

Among our twelve items in the field of Geology there are two which deserve special mention. First is the great book by Gregorius Agricola *De Re Metallica* published in Basel in 1556. This work not only deals with mining and metallurgy but for the first time gives an account of the chemistry of metals. We not only have the first edition of this work but also fortunately possess the first translation in English made of this monumental work, published in 1912 by Herbert Clark Hoover and Lou Henry Hoover. The other publication that deserves special mention is the Geological Map prepared and printed in London in 1815 by William Smith, in which he delineated the strata of England and Wales, with a part of Scotland. This map is important in the history of geological science in that it is the first attempt to report on a large scale the geological relations of any extensive tract of ground.

We have several extremely interesting items in our geographical series including four editions of the atlases published by Claudius Ptolemy. The first was printed in 1490 prior to the discovery of America. The second, printed in 1525, contains maps printed from the blocks used in the 1522 edition, which was the first Ptolemy to contain a map using the name of America. We also have the 1535 edition which is of special interest on account of the fact that the text was written by "Servetus." In connection with the map of the Holy Land in this edition, the text of Servetus described this territory as being mostly desert. After mentioning the claim that Judea was a land flowing with milk and honey he ended up by saying "Nevertheless, be pleased to know, dear reader, that it was with deliberate insult, or else from sheer

boastfulness, that such excellence was ascribed to this land, for the very reason that the experience of merchants and those who travel abroad reveals this land to be uncultivated, arid, and destitute of all charm. Therefore, you may declare the "promised land" to be a land promised, and not, according to our ordinary speech, a land of promise." Servetus was burned at the stake by the Calvinists in 1553. The authorship of this edition of Ptolemy was one of the charges preferred against him.

One of the most charming contacts that I made in connection with gathering together the collection of *Milestones of Science* was my meeting with Mr. Grenville Kane. Mr. Kane is a private collector of many years standing, one of the trustees of the New York Public Library and Chairman of its Rare Book Committee. One of his daughters married the late George H. Baker, President of the First National Bank of New York. Mr. Kane lives at Tuxedo Park, New York. He is an agile man of upwards of eighty years of age, a member of the Board of Directors, among other things, of the Delaware and Lackawanna Railroad. I spent a most delightful morning at his house at Tuxedo, during which he showed me many of his treasures. He was especially interested in Ptolemy and had many editions. It seems that some years ago he was sailing in his son-in-law's yacht in the West Indies. They were off the shores of San Salvador. Mr. Kane spoke of the great works of Ptolemy, mentioning that editions of Ptolemy had been printed in almost every language in the world except English. Mr. Baker proposed that there ought to be an edition in English and the conversation ended by Mr. Baker proposing to finance such an enterprise. The book was printed by the New York Public Library in 1932 and a copy to complete our series of Ptolemy was presented to us through the kindness of Mr. Grenville Kane.

Mr. Grenville Kane has also done us another kindness by depositing with us one of his rarest items, a manuscript map known as a Portolano, containing four maps of the Mediterranean and the West Coast of Europe and Africa. This I have brought with me tonight to show the members of the Club.

There are so many interesting stories and tales about almost every one of the books in our collection that it is very difficult to decide what to mention and what not.

In closing our account of our geographical series, however, I should like to speak of an item I was able to pick up in Munich in 1933, a world map printed in 1475. This is the first dated woodcut map of the world ever published. It is known as the *Rudimentum Novitiorum*.

Our medical series, with a description of which I will close this paper, contains twenty items. Among these are some of the most important books in our whole collection. Three of our incunabula are found in this series. *De Mineralibus*, by Albertus Magnus, printed in 1476; the works of Galen published in Venice in 1490, one of the most beautiful books in our collection; and the Aldine edition of *De Materia Medica* by Dioscorides published in Venice in 1499.

Perhaps one of the books making the greatest appeal to the published in our whole collection is our first edition of Hippocrates published in Venice in 1526. This work contains the first printing of the Hippocratic Oath. We had the Greek in our copy translated by Professor Edward G. Schaubert at the University of Buffalo. You might be interested in hearing his translation of this oath.

Another one of our great treasures is a first edition of Vesalius, which gave to the world, when published, the first comprehensive and systematic view of human anatomy.

One of our very rarest items is the first edition of William Harvey's *Do Moto Cordis et Sanguinis in Animalibus Anatomica Exercitatio* published in Frankfort in 1628. This is, of course, the great medical classic on the circulation of the blood.

In the field of bacteriology we have that great triumvirate – Pasteur, Lister, and Koch – a Frenchman, an Englishman, and a German.

No series in the history of medical science would however be complete without having represented therein Aureolus Theophrastus Bombastus von Hohenheim, 1490 – 1541, otherwise known as Paracelsus. We have his complete works published long after his death in Strassburg in 1618.

We also have the *Opera Chirurgica* published in Frankfort in 1594 by Ambroise Pare – one of the founders of scientific surgery. This work by Ambroise Pare recalls to my mind a delightful visit that I had with Dr. Harvey Cushing in his Library at New Haven. He at this time told me the following choice story about his friend Dr. John Fulton. [Spoken "story"]

In all we have gathered together under the roof of the Buffalo Museum of Science in our collections of the Milestones of Science one hundred and ninety-four books. We feel that we are extremely fortunate to possess such a collection and that the task of collecting these items, which was initiated in the spring of 1937 through the purchase of our copy of Copernicus was carried through so rapidly that it was practically completed before the end of 1938. With the present state of affairs in the world it would be impossible today to either initiate or complete any such program. None of us know what is going to become of the great libraries of the world. Many of the great booksellers from whom we obtained items have since been bombed out and the end is not yet. Many of the items in our collection may never be obtainable again. Perhaps it will be found that one of the greatest values inherent in our collection was the speed exercised in assembling it.

I will close this paper by reading a comment contributed as an introductory note to the [?] by Dr. John C. [?] the President of the Carnegie Institution of Washington on Feb. 11, 1938

[Spoken "Quote"]