SCIENCE

VOL. 95 FRIDAY, MAY 15, 1942 NO. 2472

Astronomy During the Early Years of the American Philosophical Society: DR. S. A. MITCHELL 489

Obituary:

Arthur Newell Talbot: PROFESSOR F. E. RICHART. *Recent Deaths* 495

Scientific Events:

Scientific Research in Sweden; The Wartime Service of Harvard University; The Accelerated Program of Medical Schools; The Seventy-fifth Anniversary Celebration of the Torrey Botanical Club ... 496

Scientific Notes and News 498

Discussion:

An Untried Method of Federal Reapportionment: DR. WALTER F. WILLCOX. *Tick Parasites on Cape Cod:* DR. SIDNEY COBB. *The Effective Presentation of Scientific Reports:* ROBERT D. POTTER 501

Scientific Books:

Rotations in Psychology and the Statistical Revolution: PROFESSOR HAROLD HOTELLING 504

Societies and Meetings:

Biology and Medicine in the War: J. E. HAWKINS, JR. 507

Reports:

First Report of the War Policy Committee of the American Institute of Physics 508

Special Articles:

The Biochemical Specificity of Sulfanilamide and of Other Antibacterial Agents: DR. HENRY MCILWAIN. *The Effect of Insulin Shock on Learning in the White Rat:* DR. LOUIS BERMAN and DR. BERNARD RIESS. *Toxin Formation by Ceratostomella ulmi:* DR. GEORGE A. ZENTMYER 509

Scientific Apparatus and Laboratory Methods:

A Photoelectric Membrane Manometer: DR. WARREN E. GILSON 513

Science News 8

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington, D. C.

ASTRONOMY DURING THE EARLY YEARS OF THE AMERICAN PHILOSOPHICAL SOCIETY[1]

By Dr. S. A. MITCHELL

LEANDER MCCORMICK OBSERVATORY, UNIVERSITY OF VIRGINIA

"IT was not without being sensible how very unequal I am to the undertaking that I first consented to comply with the request of several gentlemen for whom I have the highest esteem, and to solicit your attention to a subject which an able hand might indeed render both entertaining and instructive. I mean astronomy." These words are not my own but rather they were spoken by David Rittenhouse in an "Oration" delivered on February 24, 1775, before the American Philosophical Society. According to the minutes of the society, the oration was delivered in the college "to a crowded audience, consisting of his Honor the Governor of the Province, the Assembly, and a great number of gentlemen of the first distinction, besides the members of the Society." Moreover, the oration was dedicated "To the delegates of the Thirteen Colonies, assembled in Congress at Philadelphia, to whom the future liberties, and consequently the virtue, improvement in science and happiness in America are intrusted."

Again to quote the words of Rittenhouse:

Astronomy, like the Christian religion, if you will allow me the comparison, has a much greater influence on our knowledge in general, and perhaps on our manners, too,

[1] Address at the mid-winter meeting devoted to the Early History of Science and Learning in America with especial reference to the part played by the American Philosophical Society, Philadelphia, February 13 and 14, 1942.

than is commonly imagined. Though but few men are its particular votaries, yet the light it affords is universally diffused among us; and it is difficult for us to divest ourselves of its influence, . . .

You are all of you very familiar with the fact that the American Philosophical Society was founded in the year 1743. A valued letter from Benjamin Franklin kept in the society's library gives the names of the nine original members, with himself as secretary. (In 1743, Franklin, the fifteenth of seventeen children, was thirty-seven years old.)

At a meeting held in the State House on February 2, 1768, we read in the minutes:

A Society having subsisted for some time in this City under the name of the American Society held at Philadelphia for promoting and propagating useful Knowledge, whose Views have been nearly the same with those which are published of the American Philosophical Society, and it being judged that the Ends proposed by both could be carried on with more advantage to the Public if a Union could take place between them, it is proposed that such a Union may take place.

Accordingly during the year 1768, the society took on a new lease of life and more than 100 members were elected.

Early in the following year, on Monday, January 2, 1769, the foremost citizen of Philadelphia, Benjamin Franklin, was elected president of the society, an office he continued to hold until his death in April, 1790. David Rittenhouse succeeded Franklin as president and he continued in office until his death in June, 1796.

As your speaker to-day has lived for more than twenty-five years in Virginia on Mount Jefferson in sight of Monticello, four miles distant, I hope you will pardon me for quoting from the letter of the four secretaries of the society in advising Thomas Jefferson of his election as the society's president. Under date of January 7, 1797, the letter reads:

We have the pleasure of informing you, that at the annual Election of Officers of the American Philosophical Society for promoting useful knowledge, held at Philadelphia on the 6th inst., you were chosen President of that respectable Institution.

To this Jefferson replied:

I have duly received your favour of the 7th inst., informing me, that the American Philosophical Society have been pleased to name me their President. The suffrage of a body which comprehends whatever the American World has of distinction in Philosophy & Science in general, is the most flattering incident of my life, and that to which I am the most sensible. . . . Permit me to avail myself of this opportunity of expressing the sincere Grief I feel for the loss of our beloved Rittenhouse. Genius, Science, modesty, purity of morals, simplicity of manners, marked him one of Nature's best samples of the Perfection she can cover under the human form. Surely, no Society till ours, within the same compass of time, ever had to deplore the loss of two such members as Franklin & Rittenhouse. Franklin, our Patriarch, whom Philosophy and Philanthropy announced the first of men, and whose name will be like a star of the first magnitude in the firmament of heaven, when the memory of those who have surrounded & obscured him, will be lost in the Abyss of time.

Jefferson continued as president of the society during the eight years he was President of the United States. Late in the year 1808, when he was planning soon to move from Washington back to his home at Monticello, Jefferson tendered his resignation as president of the society. His resignation was not accepted and he continued in office until January 6, 1815. Then after again tendering his resignation he was succeeded by Dr. Caspar Wistar.

Franklin, Rittenhouse and Jefferson between them had been presidents of the American Philosophical Society from 1769 to 1815, a space of almost half a century. The real cause of the awakening to life of the society in 1768 was literally a heaven-sent event, namely, a Transit of Venus that was most successfully observed in and near the city of Philadelphia and the genius who organized and carried the plans through to perfection was David Rittenhouse. The older members of the society have heard time and time again about Rittenhouse. To-day I wish to call briefly to the attention of the younger members and those who are not astronomers some of the high spots in the life of Rittenhouse, and at the same time to suggest to all of you that you go upstairs to the members' room and see for yourselves the astronomical clock and the transit telescope both made and used by Rittenhouse in his observations of the Transit of Venus on June 3, 1769. Also upstairs is a Dollond refractor that took part in the Transit of Venus observations and also a theodolite that formerly belonged to William Penn and which was used for laying out the City of Philadelphia.

Rittenhouse was born on April 8, 1732, in a small stone house that now stands on the main drive through Fairmount Park. Even as a boy he showed extraordinary mathematical and mechanical ability and as he grew older he was always very resourceful in supplying his own needs. He acquired great proficiency in observational, practical and theoretical astronomy and in instrument making. The construction of his first telescope dates from 1756. His first observations as an astronomer were in 1763–64 when he carried out a survey for William Penn to settle the boundary dispute with Lord Baltimore. This boundary, between the present states of Pennsylvania and Maryland, was done with such high accuracy that it became part of the Mason and Dixon line.

His early fame rested primarily on the construction

of his celebrated orrery of 1767, acquired by a college founded in New Jersey in 1746 and now known as Princeton University. This first orrery was lost, but a second one is now the proud possession of the University of Pennsylvania. For each of these instruments Rittenhouse received £300.

It is most interesting to read over the minutes of the society after its reorganization in 1768. At the meeting of March 8 held at the State House, "a fine of one shilling for non-attendance of members at meetings was ordered as a by-law of the Society. Six organic committees were then constituted by distributing the members present among the committees." At this early period in the life of the first learned society in the western hemisphere, rewards for attendance and penalties for non-attendance were put into effect. The minutes of succeeding meetings of the society furnish no information, however, regarding the amount the treasury's balance was enhanced by the one shilling fines.

At the very next meeting of the society (1768, March 22), Rittenhouse described his new orrery, and at the following meeting the committee on Rittenhouse's orrery reported that "they have the greatest Reason to expect from his known Abilities" that the orrery "will do honor to himself & to this Province, the place of his Nativity; and the Committee beg Leave to recommend it to the Society to order his description to be published; not doubting but it will give Pleasure to Persons of a curious and Philosophical Turn." Hence the first paper ordered to be published by action of the society was one on astronomy, which then as now one and three-quarter centuries later had a strong popular appeal.

The description which appears as the first article in the first volume of the society's *Transactions* states that the orrery represents the motions of the sun, moon and planets, and therefore illustrates solar and lunar eclipses and other phenomena "for a period of 5000 years, either forward or backward." For showing the motions of the heavenly bodies it was the forerunner of the planetarium. Jefferson spoke of the orrery in these words: Rittenhouse "has indeed not made a world; but he has by imitation approached nearer its maker than any man who has lived from the creation to this day."

As I have indicated, it was the Transit of Venus that brought great fame to our society in its early years, and once started on the high road it has continued to function with great dignity for nearly 200 years. At the meeting on April 19, 1768, plans were started to observe the Transit from three different sites, the State House square, the Rittenhouse farm at Norriton and Cape Henlopen. In addition to Rittenhouse, other enthusiastic observers were John Ewing, provost of the University of Pennsylvania, Joseph Shippen and Hugh Williamson. The society may well be proud of Ewing. Besides being provost of the university, he was professor of natural philosophy, and it was said of him that "in the absence of any other professor, the Provost could take his place, at an hour's warning, and conduct the instruction appropriate to that Professorship with more skill, taste and advantage than the incumbent of the chair himself."

The condition at that time of the country surrounding the City of Brotherly Love may be surmised by reading from the minutes of the society that an inquiry was made "to know whether the Indians would allow proper Persons to pass through their Country in order to make the Transit of Venus observations." Perhaps the lives of the members of the expeditions sent out from this city were in no greater danger than were the lives of eclipse observers in the year 1900, for we have it on good authority that before crossing the Atlantic Ocean to witness the eclipse, the head of one of the British expeditions appealed to the United States Government to protect the lives of the party from the wild natives (sic) of North Carolina. I might add that on arriving in New York the fears were effectively dispelled when the party found themselves aboard a luxurious Pennsylvania train and discovered that they themselves, their baggage and their instruments were routed through to destination—and entirely free of charge. Of course this was in the good old days now gone forever!

For the great event, Rittenhouse had a clock which he himself had made, a transit telescope also constructed by his own hands and now considered the first telescope made in America and a refracting telescope. These instruments are now in the members' room upstairs.

For the expenses incurred in observing the Transit of Venus, the society paid more than £100 from its treasury. Thus we find that Dr. Conklin, the chairman of our research committee, has long-established precedent for paying out society's funds to aid research.

The accuracy of the observations by Rittenhouse, who was assisted by William Smith and John Lukens, has been attested by Nevil Maskelyne, astronomer royal of England at the time, and by Simon Newcomb. The latter[1] states that "his observations of the celebrated transit of Venus in 1769 have every appearance of being among the best that were made." Combination with Greenwich results by a method improved by Rittenhouse gave 8.″805 for the solar parallax, in remarkable agreement with the value 8.″803, which has been the accepted value until a few months ago when the present astronomer royal of England, H. Spencer

[1] "Dictionary of American Biography," Vol. XV, page 630.

Jones, gave the refined value of 8.″790, coming from observations made the world over on the planet Eros.

For carrying on the observations in Philadelphia the minutes read, "The Honorable House of Representatives had generously granted the privilege of erecting the Observatory in the State House Yard, and voted £100 for erection and observation to be paid to the Society Treasurer." Thus we see that the first observatory in the United States to be created at public expense dates from the year 1768.

In 1770, Rittenhouse moved to Philadelphia. His observations included transits of Mercury, solar and lunar eclipses, variable stars, the new planet Uranus (discovered by Herschel in 1781) and comets, including one discovered by himself in 1793. His work in astronomy was many-sided. To adjust instruments in the meridian, in 1785 he invented the collimating telescope, since then universally used. The same year he introduced spider threads into his telescope. In 1786 he made a plane transmission grating, thus anticipating Fraunhofer's grating by about 30 years. Newton had previously used "scratches made in polished plates of glass," but Rittenhouse measured grating intervals and deviations of several orders of spectra. He was frequently engaged in boundary surveys and commissions involving Pennsylvania, Delaware, Maryland, Virginia, New York, New Jersey and Massachusetts. Outside of astronomy, he served on the commission to organize the United States bank, and George Washington appointed him the first director of the Mint, on April 14, 1792, thus exemplifying the fact that a resourceful practical astronomer is equipped to tackle almost any job. At the University of Pennsylvania he was professor of astronomy and later trustee and vice-provost. In the American Philosophical Society he served as curator, librarian, secretary, vice-president and president. The highest of the many honors that came to him was his election, when president of our society, as a foreign member of the Royal Society. The first American to be so honored after the Revolution was James Bowdoin, governor of Massachusetts and president of the American Academy of Arts and Sciences.

As an eclipse observer myself, I wish to direct your attention to the fact that only one week after the British evacuation of Philadelphia, "The first eclipse of the sun to be carefully observed[2] in the British colonies of America was that of June 24, 1778, which was watched by the astronomer, David Rittenhouse." Although the eclipse was total, with the gorgeous beauty of the corona readily visible to the naked eye, no mention was made in the record of Nature's most beautiful phenomenon. To us at the present day, one of the strangest portions of the history of astronomy before the middle of the nineteenth century is the evident lack of interest in, or perhaps one should say, the dearth of observations of the corona and of the rosy prominences visible without telescopic aid at the time of a total eclipse of the sun. The only scientific observations made were the accurate times of the contacts of the limbs of the sun and moon. At a total eclipse of the sun there are four contacts. Similar observations are still made at eclipses, the purpose being the perfection of the motion of the moon, which even to-day is an erratic member of the sun's family. Possibly for this reason the moon is always designated by the feminine gender.

In the midst of the revolutionary war, in 1778, life in Philadelphia evidently went on about the same whether the British soldiers were present in the city or not. That was ages before we had heard of the word "schrecklichkeit" or of "the scorched earth."

The next total solar eclipse visible in the United States was only two years later, on October 27, 1780; it was not total in Philadelphia but was total in New England. This eclipse is memorable for two distinct features. It was the occasion of the first American eclipse expedition, under Professor Williams, of Harvard College. I think you will be interested in hearing some of the details from my own book, or as published in *Memoirs American Academy of Arts and Sciences,* 1, 84, 1783. The account by Williams reads:

> Though involved in all the calamaties and distresses of a severe war, the government discovered all the attention and readiness to promote the cause of science, which could have been expected in the most peaceable and prosperous times; and passed a resolve, directing the Board of War to fit out the Lincoln galley to convey me to Penobscot, or any other port at the eastward, with such assistants as I should judge necessary.

When the great day arrived, the Harvard party found itself outside the path of totality. However, an observation of great value was made, as you may learn from the following.

> The sun's limb became so small as to appear like a circular thread or rather like a very fine horn. Both the ends lost their acuteness and seemed to break off in the form of small drops or stars some of which were round and others of an oblong figure. They would separate for a small distance, some would appear to run together again and then diminish until the whole disappeared.

Here is a clear description of the eclipse phenomenon known to all of you as Baily's beads, as the result of observation by Francis Baily, a London stock-broker at the eclipse more than a half-century later, in 1836.

Another total eclipse of the sun, that of June 16, 1806, was again visible in Massachusetts but not in Philadelphia. This might be regarded as an instance of undue partiality to the rival scientific society in Boston, the American Academy of Arts and Sciences. However, I have been pleased to find that a member

[2] "Eclipses of the Sun," page 128.

of the American Philosophical Society, Andrew Ellicott by name, also described Baily's beads thirty years before the 1836 eclipse. The description I have never before seen published nor referred to. I found it in the "Manuscript Communications," Vol. 2, page 57, in a letter from Andrew Ellicott, part of which reads:

> Those detached luminous points of the sun's limb seemed to retain their brilliancy till the instant of their disappearance, which it would appear should not be the case, if the moon was surrounded with an atmosphere—those points particularly, which are formed by depression in the moon's limb would have had their splendour somewhat diminished by the density of the atmosphere, if one existed,—but nothing of the kind was observed.

In the same collection of manuscripts in the society's library, and four pages after Ellicott's letter I found another letter regarding the 1806 eclipse, this time from Simeon De Witt of Albany, N. Y., the contents of which pleased me mightily. The letter reads:

> With this I send you for the American Philosophical Society a painting intended to represent the central Eclipse of the Sun on the 16th of June last. It is executed by Mr. Ezra Ames, an eminent portrait painter of this place and gives I believe as true a representation of that grand and beautiful phenomenon as can be artificially expressed. The Edge of the moon was strongly illuminated and had the brilliancy of polished silver. No common colors could express this; I therefore directed it to be attempted as you will see by a raised silver rim which in a proper light produces tolerably well the intended effect.
>
> As no verbal description can give anything like a true Idea of this sublime spectacle with which man is so rarely gratified, I thought this painting would not be an unwelcome present to the Society or an improper article to be preserved among its collection of subjects for philosophic speculation.

A little more than a century later I myself was a Simeon De Witt and was instrumental in discovering another eminent portrait painter, Howard Russell Butler, who was with me in Oregon for the total eclipse of June 8, 1918. Again the artist and the astronomer engaged in team-work, as had been done for the eclipse of 1806, Mr. Butler in the ten days before the eclipse doing the difficult task of attempting by his skill as an artist to bring out the fire and the glory immediately surrounding the moon in the inner corona, the astronomer doing the easy task of criticizing as the result of experience gained at three previous total eclipses. Most of you have seen Mr. Butler's famous paintings of the eclipses of 1918, 1923 and 1925. For the first and third of these eclipses he was with me. He was near me at the 1923 eclipse but "unusually unusual" clouds in "beautiful sunny California" prevented him from being with me. The originals of the paintings form a triptych at the Hayden Planetarium of the American Museum of Natural History, and copies by Mr. Butler are in the Franklin Museum in this city and in the building of the National Academy of Sciences in Washington.

Andrew Ellicott (1754–1820) has been to me a most interesting character. He was of Dutch and English Quaker stock and belonged to the family that founded Ellicott City, Maryland. He was a mathematician and a surveyor and therefore an astronomer. In 1784, he was appointed member for Virginia for the group of surveyors that continued the Mason and Dixon line southward. In 1791, he began the survey, occupying two years, that gave the boundaries of the ten-mile square tract ceded by Maryland and Virginia as the site of the present District of Columbia. In 1811, Georgia invited him to run the line between that state and South Carolina. When the job was finished, Georgia refused to pay him more than his expenses for the simple reason that his line ran 18 miles farther south than Georgia's hopes. He appears to have had many stormy times in his career, but he found a haven of rest in 1813 at West Point, where he was professor of mathematics.

I have quoted from one of Ellicott's letters. Another was written from Lancaster, to Thomas Jefferson, president of the United States and of the American Philosophical Society, under date of December 29, 1801. Part of the letter reads:

> I enclose a few astronomical observations. . . . Being now the only native of the United States left, which time has not spunged (sic) away, and who has cultivated practical astronomy for the purpose of rendering it useful to commerce, to the division of territories, and the determination of the relative positions of the different parts of our own country, I feel a desire to keep the subject alive, till succeeded by some American, whose fortune may put it in his power to be more useful, by allowing him to devote his whole time to the improvement of so important a branch of science.

The observations referred to are chiefly lunar distances to check up on the lunar theory and to determine the longitude. From these and other letters, I have come to the conclusion that he had a fairly high opinion of his own importance and that he was at times a bit difficult to get along with, perhaps a bit cantankerous. It has been said of him that "He had a happier hand with the theodolite than he had with the pen."

In spite of some shortcomings Ellicott was a most careful observer. At the eclipse of 1806 he determined the difference in longitude between Lancaster and Greenwich. The value obtained exceeded that derived earlier by 17 seconds of arc. He gave the correct explanation for this difference, namely, "imperfections in the lunar tables, which appear to give the moon's longitude at the time of the eclipse at least 1′ too much. The error in latitude at the same

time is almost insensible." Also he correctly pointed out that by noting the northern and southern limits of the moon's shadow path on the earth, "observations were made for the express purpose of correcting the lunar tables." The most perfect results following this plan were at the total eclipse of January 24, 1925, when the southern edge of the moon's shadow was accurately determined at Riverside Drive in New York City. At the top of the apartment house at 96th street and south of the street the eclipse was not total, but north of the comparatively narrow street the corona was visible and the eclipse was total. The edge of the shadow of totality was, therefore, pinned down to within two hundred and twenty-five feet on the west edge of Manhattan Island.

Going back once more to the early minutes, we find the following, noted for the meeting of 1769, September 15. "Dr. Williamson delivered to the Society a paper in which he endeavored to explain the theory of the motion of the Comets, the probability of their being inhabited, etc." This paper was referred to the Committee on Astronomy with instructions that they "publish it if they think proper without reporting." The publication appeared in *Trans.* (O.S.) 1, 1771, appendix 27–36.

My audience to-day will smile at the apparently absurd idea that comets might ever be thought to be habitable. But let us stop a minute and look back. In 1715, the great Halley[3] thought that the appearances on the eastern and western edges of the sun at a total eclipse might reasonably be expected to be different, for the reason that "the eastern limb of the moon had been exposed to the sun's rays for a fortnight, and as a consequence it would be natural to expect that the *heated lunar atmosphere* might exert some absorbing effect on the solar rays while on the contrary the western edge of the moon being in darkness and cold for two weeks could exhibit no such absorbing action." Of course we now know that the moon has no atmosphere. A half-century or more later, one of the greatest men in observational astronomy of all time thought that the dark spots on the sun might be openings into the cooler portions of the sun that even might be habitable. To Herschel, astronomy owes the great reflecting telescopes, to him we owe the discovery of the planet Uranus, and to him and to his son Sir John we owe tremendous advances, particularly in stellar astronomy. Herschel's telescopes (judged by modern standards) were very crude affairs. It was not until 1817 that the art of glass-making had advanced enough to permit Fraunhofer to construct the "great Dorpat refractor," as it was called, with the then unprecedented aperture of 9½ inches.

This review of astronomy in the early years of the society would not be complete unless I called to your attention the enormous difference in an observatory then and now. At the present time an observatory may mean a 200-inch telescope and six millions of dollars. In the eighteenth century an observatory meant a structure costing a few hundred dollars, with a telescope small and crude, the telescope usually fixed in the meridian, chiefly to determine time and to assist in surveys of the virgin country. Most of these, like that on the State House Square, had a transitory existence. The first observatory belonging to a college was not erected near Philadelphia or New York or anywhere in the North, but south of the Mason and Dixon line. I have told you of the all-round ability of John Ewing, provost of the University of Pennsylvania. To illustrate the fact that Virginia never takes second place to any state in the Union (I should add that I am not a Virginian by birth) I would like to tell you a little about a contemporary of Jefferson, by the name of James Madison (1749–1812). At the age of 28 he became the president of the College of William and Mary, the second oldest college in the United States, and later he was the first bishop of the Protestant Episcopal Church in Virginia. In the year 1780 in November, he sent to Rittenhouse observations of the eclipse of Jupiter's satellites and the value of the longitude from Paris derived therefrom. In volume 3 of the *Transactions,* page 150, reference is made to the "observatory" and to observations made of a lunar eclipse on November 2nd and of a Transit of Mercury on November 5, 1789.

The second observatory in this country was likewise not in the North but in the South, at the University of North Carolina. Joseph Caldwell was born in 1773 and graduated from Princeton when only 18 years old. At the age of 23 he went to Chapel Hill as professor of mathematics and at the age of 31 he became president of the university. In the year 1824 the trustees of the university had enough confidence in their president as to give him $6,600 and to send him to Europe to buy books and laboratory apparatus; the money spent was about equally divided between books and instruments. The equipment was chiefly astronomical and consisted in a meridian transit telescope, an altitude and altitude telescope, a refracting telescope, a good clock with a mercurial pendulum, a sextant, a Hadley's quadrant and a portable reflecting circle. An observatory was built in 1830 and 1831, largely at President Caldwell's own expense. Its cost is given as $430.29½. Unfortunately, the construction was not very solid, and the roof leaked. After President Caldwell's death, the building deteriorated and it burned in 1838. The instruments, however, were saved. My friend, Dr. MacNider (of the University of North Carolina), writes me, "I wish so much you could see these beautiful old instruments. The brass

[3] *Phil. Trans.*, 29, 248, 1715.

is one of the softest, loveliest things in the form of a metal that I have ever looked at." Some of Sherman's soldiers on their march to the sea passed through Chapel Hill. They too admired the lovely finish of a telescope found on a dusty shelf in one of the laboratories. In picking up the telescope tube to examine it more closely, they found something loose inside, which turned out to be two gold watches placed by professors for safe keeping in the securest place imaginable. Needless to say, the watches were immediately appropriated. When the soldiers had left the laboratory, the professors returned to wind up their watches, only to find no trace of them. The loss was at once reported to the commanding officer. The story does not end there, and furnishes another triumph for the course of true love. It is said that the commandant was in love with the daughter of the president. The gold watches were promptly recovered and were returned to their rightful owners.

In the North, Yale University in 1830 secured a 5-inch Dollond refractor of 10 feet focus. There was no observatory. The telescope was pulled around in the Athenaeum Tower and pointed through one of the windows. Unfortunately, the windows were low and no object more than 30 degrees above the horizon could be observed. Similarly, Harvard College[4] possessed astronomical instruments from an early date but no astronomical observatory. Harvard College Observatory was established in October, 1839.

As might have been expected, astronomy, the so-called queen of the sciences, played a most important part in the early years of the American Philosophical Society. And this was so, largely because astronomy more than any other science of 150 to 200 years ago was useful in the promotion of useful knowledge. To-day, when some of us can get along very well with a very inexpensive watch, we perhaps forget that before the days of the electric telegraph the only manner of ascertaining exact time was to make astronomical observations. Although exact time and topographic surveys were necessary as useful knowledge, the only astronomers whose names have lived throughout the two centuries are those who pursued knowledge for the useful purpose of gaining information about matters with no immediate practical application to business or to mundane affairs.

The history of astronomy of our society, revealed through manuscripts in our valuable library in the Drexel Building across the street, includes a few outstanding names of men who gained valuable knowledge regarding the distance to the sun or who progressed a step further toward solving Nature's secrets, through observations of eclipses of the sun or moon or of Jupiter's satellites.

And now in closing I wish to state that I am not vain enough to believe that you have found my review of astronomy "both entertaining and instructive," to quote the words of David Rittenhouse, even though I did find my brief excursion into the early history most entertaining and instructive to myself.

OBITUARY

ARTHUR NEWELL TALBOT

1857–1942

ARTHUR NEWELL TALBOT, professor of municipal and sanitary engineering, emeritus, at the University of Illinois, died in Chicago on April 3 after a short illness. Although he had retired from formal university duties in 1926, Dr. Talbot had continued his active interest in research and in engineering society affairs, and was attending the annual meeting of the American Railway Engineering Association when stricken on March 17. Just a year previously he had relinquished the direction of the association's investigation of stresses in railroad track, a project that he had actively conducted for 27 years.

Born in Cortland, Illinois, and educated at the University of Illinois, he graduated in civil engineering in 1881. After four years of railroad engineering in the West, he returned to teach in the university in 1885. He was made professor of municipal and sanitary engineering and placed in charge of theoretical and applied mechanics in 1890. Thenceforth, his achievements are acknowledged to have "contributed more to the development and distinction of that college and its engineering experiment station than the work of any other man."

Dr. Talbot was a pioneer in engineering education and research in this country. He made numerous contributions to engineering practice in sewage disposal and sanitary engineering, in drainage and water supply, in surveying and railroad construction, in materials testing and specifications, in the construction of sewers, pavements, bridges and buildings, and in many allied fields. Beginning in 1903, he conducted extended researches in reinforced concrete and did much to establish this new building material on a rational and scientific basis of design. This work and his 27-year study of the problems of design and maintenance of railroad track are probably his greatest achievements in the field of engineering research.

Dr. Talbot was active in many engineering and scientific societies. He was a past-president and honorary member of the American Society of Civil Engi-

[4] W. I. Milham, "Early American Observatories," *Popular Astronomy*, 45: 523, 1937.