Collecting Archives for the History of Science

By D. THEODORE McALLISTER
Michelson Museum, Naval Weapons Center, China Lake, Calif.

I SHALL center my discussion on this question: *What* to collect concerning an important scientist? My quick answer is, "Everything!"—everything you can get, from every source you can locate, in whatever form available—while there is still time. The immediate result, I have found, will be several solid blocks of material, plus a great variety of pieces and bits that at first can only be arranged rather loosely about the core of whatever is already available to you—if you are lucky enough to have had that kind of nucleus handed to you. Then, only after careful comparison and intelligent analysis of these, sifting out the grains of truth not otherwise available from even the most outrageous chaff of folklore, does it seem possible to build up a body of reasonably complete and well-organized reliable information genuinely useful in the study of science as a vital element in the history of our culture.

The two most important immediate applications, of course, of the materials at the Michelson Museum will be in the publication of Michelson's collected scientific papers and a comprehensive, definitive bibliography.

Many persons would hesitate to use the formidable term *everything.* And yet, in connection with that particular famous scientist, that powerful individualist who is the center of our attention at the museum, it is only a slight exaggeration. Indeed, when I set out to compile, for my present purpose, a systematic list of the types of items we have found valuable, I discovered that I was coming up with an even more formidable catalog of terms, the mere reading of which would take up all my time and prove exceedingly dull to you.

The list began with all the standard kinds of manuscripts and documents, then included such troublesome additional things as large and small scientific instruments, miscellaneous pieces of hardware, sheets of raw data, laboratory notes, calculations, graphs, machinist's drawings, patents, textbook entries, photographs in every conceivable form, paintings, recordings of interviews, and most types of published and unpublished records of the scientific and governmental organizations, foundations, and societies with which Michelson was associated. I shall simply illustrate a few of the problems I have encountered with some interesting examples. But first I must give you some background

The author, Curator of the Michelson Museum, read this paper at the workshop on scientific manuscripts, at the annual meeting of the Society of American Archivists, Ottawa, Canada, on Sept. 30, 1968.

on the Michelson Museum. In May 1948 the United States Navy dedicated its large new laboratory building in the upper Mojave Desert of California at the Naval Ordnance Test Station near Inyokern, about 150 miles north of Los Angeles and just east of the southern end of the Sierra Nevada. This was headquarters for the scientific research conducted by the Navy in continuation of its rocket program during World War II under contract with the California Institute of Technology. The name Michelson Laboratory was chosen in honor of that eminent graduate of the Naval Academy who became the first American scientist to be awarded the Nobel Prize, and the name itself is a constant reminder of the importance both of outstanding work in science and of military-civilian cooperation. Since then the plural form, Michelson Laboratories, has been used for the entire complex of scientific facilities at our location; the community has acquired the name China Lake, and the station has been rechristened Naval Weapons Center, as of July 1967.

At the dedication, an impressive array of Michelson's instruments, publications, data records, honors, and other memorabilia was exhibited by courtesy of the University of Chicago, the Mount Wilson and the Naval Observatories, the Michelson daughters, and other individuals. Afterwards, at the suggestion of our Technical Director, L. T. E. Thompson—with the generous concurrence of Dean Walter Bartky of the Physical Sciences Division of the university and the directors of the observatories—most of this exhibit was retained as a continuing display. Then, through the efforts of Thomas J. O'Donnell, for many years Michelson's instrument designer and assistant, and William B. Plum, our Education Director serving as curator, the collection was expanded considerably and labeled the Michelson Museum.

During the next dozen years, our display was viewed by thousands of scientists and military dignitaries on official visits, as well as by our friends, relatives, and casual visitors. But no real further activity took place until, as a result of the general awakening of interest in the history of science in the United States, we began to receive requests for information from authors, graduate students, institutions establishing Michelson awards, and even children working on science projects at the junior high school level. Indeed, Michelson's picture had appeared on a box of breakfast cereal!

So the Head of the Technical Information Department, who in the meantime had been given custody of the collection, turned to me as his consultant to find out what we actually had, what it meant, and what we should do about it all. Somewhat to my own surprise, I discovered that (1) Michelson is indeed a key figure in the history of modern science; (2) his real importance was appreciated in Europe long before it was on this continent, but recognition at home is

now coming rapidly; (3) as the result of a rather unusual combination of circumstances, we already held a most significant assortment of valuable documents as well as instruments that could well serve as the core of a truly definitive collection on Michelson's life and work; but (4) identification was incomplete, inaccurate where based on hearsay, or lacking entirely; adequate records did not exist; and much directly related background information was totally lacking.

It was decided to reactivate the museum; and I was asked to accomplish what I could with the aid of a single assistant. My program has evolved along these lines: (1) correcting the deficiencies I have just mentioned; (2) expanding the collection in all the ways I have implied by my use of the word *everything;* (3) aiding scholars and organizations in making effective use of the museum's resources; and (4) working toward the first of the publishing projects I have named—the collected papers. My emphasis at present is on the scientific aspects of Michelson's career, in order to complement rather than duplicate the work of his daughter, Dorothy Michelson Livingston, who is writing a biography from the personal view.

A scientist of Michelson's temperament is interested primarily in the results of his experiment, once he has devised the method of obtaining them, and afterwards only on how to improve on what he has accomplished. His instruments at any one stage are of only passing interest. Without hesitation he modifies them for the next stage, or uses certain critical components for a different experiment. The instruments associated with the work of famous scientists are therefore rarely preserved intact, if at all, unless the components were unique, the experimental approach a failure, or a continuation was postponed indefinitely. Yet I am convinced they are of vital importance to the history of science, although I find this aspect of our work is generally not appreciated. Very few archival institutions or museums, I discover, are equipped to handle effectively an integrated collection of both hardware and documents. (Our collection includes about 150 pieces of such hardware, from complete instruments to chunks of speculum metal.)

An interesting problem was the identification of a small revolving mirror. It is an item we have, but obviously remounted to be only a demonstration model. It was discovered to be the one Michelson used at Ross Field in 1929 for the preliminary tests preceding the full-scale experiment at the later Irvine Ranch location. In naming the types of materials exhibited at the Michelson Laboratory dedication, I have deliberately avoided mentioning correspondence and manuscripts, for there were almost none in that array. Michelson, unlike Morley, corresponded mostly in longhand and wrote out his manuscripts in the same way. Unlike Simon Newcomb, he was either not interested in retaining pressbook copies or his files were destroyed, including the originals of incoming correspondence.

Recovering such items from the collected papers of the scientists with whom he corresponded and from the files of the institutions with which he was associated is proving to be a major chore. Sometimes it is unexpectedly rewarding; in other instances, unbelievably exasperating—particularly when the files of an important society of which he was an officer prove to be nonexistent or inaccessible. The only recourse has been to search painstakingly through the published proceedings, minutes, and the like—often page by page—for pertinent entries, then try to obtain photocopies of these by one means or another.

But I must move on to a different example. Biographical sketches, textbook treatments, entries in standard reference works on Michelson, and popular articles based on these are valuable historically but dangerous when taken at face value. Our local newssheet, *The Rockeeteer,*[1] published the following paragraph on Michelson in the body of an article on the retirement of our senior naval officer to a civilian administrative position at Case Western Reserve University:

> Throughout the 1880's Dr. Michelson made a series of fundamental studies involving the speed of light in various media. In 1887 together with Edward Morley of Western Reserve, he conducted the famed Michelson-Morley experiment which disproved the existence of a suppositious ether through which the earth was supposed to move. This experiment, a landmark in modern physics, later became a foundation of Einstein's special Theory of Relativity, and led to Michelson winning the first Nobel Prize in the sciences awarded an American.

Folklore is rampant here, distilled by the writer from secondary sources without checking with me. That experiment did not disprove the existence of the ether, did not serve as a foundation for the Einstein Theory, and was most certainly not the reason for the award of the Nobel Prize.

Indeed, the persistence of this tendency to award the Nobel Prize to Michelson for his achievement best known or understood by the public at a given time shows up in the most unexpected places. A card at one of our famous museums, in describing another of Michelson's revolving mirrors, reads in part:

> MICHELSON'S MEASUREMENT OF THE VELOCITY OF LIGHT
>
> The most precise measurement was made by . . . Michelson. . . . His experiments, begun in 1878 while he was on the staff of the U. S. Naval Academy, won for him the 1907 Nobel prize in physics. . . .

Perhaps the citation as worded on the certificate itself—which fortunately we have at the museum—is not generally known or, when read by the uninitiated, cannot be understood out of the context of the diagrams worked into the design of the certificate,[2] the short

[1] Vol. 22, no. 5:1 (Feb. 24, 1967).

[2] See *The Albert A. Michelson Nobel Prize and Lecture* (China Lake, Calif., U.S. Naval Ordnance Test Station, Mar. 1966), Michelson Museum Publication no. 2.

presentation speech by the President of the Swedish Royal Academy of Sciences, and the lengthy laudatory speech of Prof. K. B. Hasselberg that was to have been given but was only published later.

The citation reads in translation: ". . . for his precision optical instruments and the spectroscopic and metrological investigations conducted therewith." This means, in broad terms, "for his invention of the Michelson interferometer and related instruments and for their application to the determination of the standard meter in wavelengths of light, to fine-line analyses of the spectrum, and to similar measurements of extraordinary precision." Further confirmation of historical value has turned up in the correspondence between the same Professor Hasselberg of the selection committee and George Ellery Hale, Director of the Mount Wilson Observatory, before and after Michelson's nomination for the prize.

Another lively bit of folklore concerns the purpose of the Michelson-Morley experiment. As beautifully worded by Lincoln Barnett in *The Universe and Dr. Einstein*[3] it reads: ". . . To discover once and for all whether there really was any such thing as ether, two American physicists, A. A. Michelson and E. W. Morley, performed a classic experiment in Cleveland in the year 1881." But the experiment actually performed in 1887 by Michelson the physicist and Morley the chemist was only the third of a long series of experiments by Michelson, begun in Germany in 1881 and ended in Pasadena, Calif., in 1928. The title of the paper of 1881 is the same as that of 1887: "The Relative Motion of the Earth and the Luminiferous Ether."

The stated purpose, reduced to everyday terms, was to find out whether the earth in its orbital motion moved through the ether pervading all space and matter, or dragged the ether with it. The famous technique that Michelson devised was adequate to detect minute differences between the velocity of light in the direction of that motion and at right angles to it—but none could be detected. This null result was debated for years, before and after Einstein developed his theory; and in the long run Michelson himself accepted it as a confirmation of the Einstein theory, although many commentators on the subject have refused to admit that he did.

As to his scientific papers, I should like to point to an important family of problems. Michelson wrote for the small group of specialists in his field, as do most scientists. He assumed that his readers had all the background information, understood his schematic diagrams without detailed descriptions of apparatus and techniques, and had no need of actual photographs or complete tabulations of data. This kind of information must now be ferreted out from all possible other sources: the publications of other physicists, the records of his assistants, the standard textbooks and reference volumes of his time, and evaluations and

[3] P. 31 (Time Reading Program special ed., New York, Time Inc., 1962).

interpretations of his work by his contemporaries in their speeches, correspondence, and articles.

Moreover, most of Michelson's important papers were published in several versions, both at home and abroad, sometimes in French, German, or even Russian. These versions differ not only editorially but in scope, technical details, and corrections of errata. And the reprints occasionally differ from the journal versions—because they were printed later from handset type left standing (and sometimes dropped, then reassembled without proofreading, or rearranged for new pagination, or even corrected by request of the author himself). In preparing the way for a definitive edition of his papers, therefore, copies of every version must be critically compared.

The brief paper by Michelson, Pease, and Pearson entitled "Repetition of the Michelson-Morley Experiment" is a simple example. It appeared both in the *Journal of the Optical Society of America*[4] and in *Nature*.[5] In the JOSA version a key sentence reads: "The results gave no displacement as great as one-fiftieth of that to be expected on the supposition of an effect due to a motion of the solar system of three hundred kilometers per second." The corresponding sentence in *Nature* reads "as great as one-fifteenth." Which is correct may, we hope, be determined sometime from Pease's records.

For the sake of the well-rounded story, then, "everything" does not really seem to be too much to collect on an important scientist.

[4] Vol. 18, no. 3:181–182 (Mar. 1929).
[5] Vol. 123, no. 3090:88 (Jan. 19, 1929).