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OF

EDWARD LEAMINGTON NICHOLS

1854–1937

BY

ERNEST MERRITT

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Edw L Nichols

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It was not until nearly the close of the last century that physics became firmly established in America as one of the sciences to which this country is every year making significant contributions. Previous to the year 1890 a few physicists were doing work of outstanding importance; but in the main the departments of physics in our universities restricted their work to undergraduate teaching and in only a few laboratories was scientific investigation actually under way. Industrial research laboratories were not even mentioned as a possibility, and general public interest in physics simply did not exist.

Edward Leamington Nichols was one of the small group of physicists who "carried on" in spite of all discouragement and whose enthusiasm and persistent effort finally brought about the increased activity and interest in physics which, beginning about 1890, is so much in evidence today. Nichols was a pioneer in several branches of physics and the results of his experimental work were not only important but often of such a character as to arouse wide interest. As a teacher he had the power of arousing the lasting enthusiasm of his students, many of whom themselves became teachers and spread his influence still further. Prominent and active in many scientific organizations, he kept continually before the public the cultural and practical importance of physics and the dignity of scientific research in general. By founding the *Physical Review* he stimulated research by providing a place for its publication. In all these ways he helped. But back of all these activities, and more important than any of them, were his firm belief in the value of scientific research, his enthusiasm for experimentation, his sympathetic and helpful interest in the work of others, and a host of personal characteristics which won the respect and affection of his students and associates.

Edward Leamington Nichols was born on September 14, 1854 in Leamington, England, where his parents were making a prolonged stay. The Nichols family had come to this country from

England early in the eighteenth century and his ancestors on his mother's side at about the same time. Nichols's grandfather, Noah N., was a Baptist minister in Boston. His father, Edward W. Nichols, for a time a teacher of music and a student of law, was later a successful landscape painter, member of the Academy of Design. Of his paintings, now chiefly in private collections, about twenty are listed in the exhibition catalogues of the Academy. The mother of Edward L. Nichols, Maria Wilkinson, from Hartford, Conn., had spent some time not long before her marriage as a volunteer teacher in a missionary school in Smyrna.

For a number of years Nichols's parents lived abroad, in Italy, France and England, always in some locality that offered opportunities to an artist for sketching or study. It was during a two years' stay in Leamington, England, that their only child, Edward Leamington Nichols, was born.

Even so brief an outline of his ancestry suggests the basis for many of the traits of character that were so important in Nichols's career—the wide range of his interests, for example, which prevented him from becoming a narrow specialist and which added so much to his power of sympathetic helpfulness as a teacher. In the firmness of his convictions, also, he showed the effect of his New England ancestry, but he was made tolerant by his wide interests and his taste for music and art. Even his enthusiasm for foreign travel seems to have a basis in heredity.

Returning to America when Nichols was only a few years of age the family lived in New Jersey, in Peekskill, and frequently during the summer in the New England mountains. Nichols went to school first in Orange, N. J., and prepared for college at Peekskill Military Academy. He entered Cornell University in 1871 and was graduated in 1875. There seems to have been nothing in his early life to suggest a special interest in science. At Cornell, however, he became much interested in chemistry and toward the end of his course still more strongly interested in physics. There can be little doubt that it was the influence of Professor William A. Anthony that led to his choice of physics as a career. Although not himself an investigator in any modern sense, Anthony was thoroughly abreast of his time—in many ways far ahead. His lectures were illustrated by experiments and Cornell was one of the few colleges which were at that time beginning to offer laboratory instruction in physics. It was while Nichols was at Cornell also that Anthony built a gramme dynamo, one of the first in this country, and established an electric lighting system for the campus. There was no routine, nothing standardized, about Nichols's first contact with physics; it was development work in a new field, for teacher and student alike. It is easy to see how this pioneer work, in close contact with an able teacher, must have appealed to his love of adventure and aroused his interest and enthusiasm.

After graduation at Cornell, Nichols spent four years in Germany, studying first in Leipzig with Gustav Wiedemann, then for two years in Berlin with Helmholtz and Kirchoff, and finally at Göttingen, where he received the degree of Ph.D. in 1879. His stay in Germany served to broaden his interests still further and gave him a firm belief in the importance of research and in the liberal spirit then so characteristic of the German universities.

Upon his return to America he found this country still suffering from the effects of the panic of 1873 and had difficulty in finding a position. At the suggestion of Andrew D. White, then president of Cornell, he applied for a fellowship at Johns Hopkins and upon receiving appointment devoted the year 1879-80 to the repetition of Rowland's experiment on the magnetic effect of a moving charge. He had had some experience with Rowland's original apparatus while still in Berlin. Nichols's work led to a better understanding of the reasons for the contradictory results that had been obtained and helped eliminate some of the sources of error in this important experiment. But it was not until the work of Crémieu and Pender that the sources of confusion were finally removed.

The following year Nichols was one of Edison's assistants in the famous Menlo Park Laboratory. His special work there was the development of photometric methods for use with the incandescent lamp, then just coming to its practical form; but his work broadened so as to touch on most of the projects then under way in the laboratory. His experience with Edison undoubtedly increased his interest in experimental work in new fields.

Nichols's first experience in teaching was at Central University, Kentucky, where he held the chair of physics and chemistry from 1881 to 1883. He was called to the University of Kansas in 1883 and remained there as Professor of Physics and Astronomy until he returned to Cornell as head of the department of physics in 1887. He became Professor Emeritus in 1919.

In 1881, at the beginning of his teaching career, he married Ida Preston of South Dover, N. Y. who had been a fellow student at Cornell during the years 1872-5. Their two children are Elizabeth (Mrs. Montgomery H. Throop), now living in Shanghai, and Robert Preston Nichols of Hollywood, Florida.

Nichols's interest and activity in research, and especially in pioneering work in new fields, was early in evidence. Five papers were published on work done while still in Germany. It is interesting to note that among them was a paper on the color of the sky, a subject to which he returned many years later when, with specially constructed portable apparatus, he made spectrophotometric studies of skylight during a trip around the world. He published four papers while at Johns Hopkins, one a joint paper with Rowland. Even under the unfavorable conditions which then existed at Central University he was able to obtain material for four papers. One of them gave the results of a difficult and dangerous investigation of the undercooling of vapors. Another, far ahead of the times, was on the influence of the electric light on plants.

It was while at the University of Kansas that Nichols's special interest in problems connected with light began to be evident, and from this time on an increasingly large proportion of his papers fall into this field. Undoubtedly his interest in these lines of work had been greatly stimulated by his contact with Edison during the early development period of the incandescent lamp. However, both at Kansas and later at Cornell, his interest in electrical problems remained active. With W. S. Franklin he published several papers on the chemical behavior of iron in a magnetic field, a subject at that time attracting considerable attention. Several other investigations, also published in collaboration with Franklin, dealt with fundamental questions raised by the Maxwell Theory of Electricity. One of the most important of these was an attempt, attended with great experimental difficulties, to detect evidence of motion in the ether surrounding a moving body. To illustrate the variety of Nichols's interest and the pioneering character of his work attention should be called to a short article which he published during this same period on the "Regulation of Dynamos by Means of a Third Brush"—a method of regulation which in recent years has been extensively used with automobile generators.

The numerous papers on color, physiological optics, and illumination published during the first twenty years of Nichols's scientific activity exerted a great influence upon the development of these fields in America. In recognition of his pioneer work in these fields he was elected an honorary member of the American Optical Society and of the Illuminating Engineering Society. In the case of the latter society, Nichols and Edison were for many years the only recipients of this honor.

The subject of luminescence first attracted Nichols's interest in 1903. From that time on his research work was devoted almost entirely to problems in this general field. In the beginning the writer of this memoir was associated with him in this work, and seventeen papers were published by Nichols and Merritt under the general title "Studies in Luminescence", the last one appearing in 1917. Pressure of other duties, and finally the war, made it impossible for the writer to continue this joint work, and in the continuation of his research in this field Nichols either carried on his experimental work alone or in a collaboration with H. L. Howes, D. T. Wilber, Frances G. Wick, Mabel K. Slattery, or L. J. Boardman.

For many years the work was supported by grants from the Carnegie Institution of Washington, Nichols being a Research Associate of the Institution from 1908 to 1936. The results of his individual work and that of his associates and students were collected and published in book form as Carnegie Publications: Studies in Luminescence. Nichols and Merritt, 1912; Fluorescence of the Uranyl Salts. Nichols, Howes, Merritt, Wilber and Wick, 1919; Cathodo-Luminescence. Nichols, Howes and Wilber, 1928.

All of Nichols's research work had to do either with something that was altogether new or with some new aspect of phenomena already known. He was essentially a pioneer, both in his interest and in his mode of approach. Much of his work called for manipulative skill of a high order; all of it called for ingenuity in meeting new problems. But when an investigation reached a point where high precision was called for he was ready to go on to something beyond. Perhaps his summers spent in the Colorado mountains during his early years had had an influence on his scientific tastes. He was not interested in building roads or in making detailed topographical maps—valuable as he recognized this work to be. What interested him more was climbing by the best route available to the next hill top to get a glimpse of what was beyond.

Next to the results of his own research work and the stimulus of his enthusiasm Nichols's most outstanding contribution to American physics was the establishment of the *Physical Review* in 1893. Previous to that time there was in this country no journal devoted exclusively—or even primarily—to physics and the need of more adequate provision for publication had been keenly felt. With the financial support of Cornell University, Nichols established such a journal six years before the American Physical Society was organized and when the number of active physicists in this country was far too small to make any cooperative plan of publication practicable. He remained editor-in-chief for twenty years and during this period the growth of the *Review*, both in circulation and in size, was rapid and continuous. Even before the organization of the Physical Society the material to be published increased more rapidly than the income and it was not until 1910 that the journal became selfsupporting. In 1913, after a balanced budget had been maintained for two years and when the American Physical Society, with six hundred members, had become strong enough to ensure its continued support, Nichols retired from his duties as editor and the *Review* was transferred to the Society.

Nichols's enthusiasm for his subject and his friendly and sympathetic interest in the problems and difficulties of his students made him a most inspiring teacher. Not long after he became head of the department at Cornell, in 1887, it was my good fortune to spend a year as a graduate student under his guidance and I can well understand the reason for the respect and affection which all his students since have felt for him. Graduate students began to come to him in increasing numbers as soon as he returned to Cornell, and in only a few years his laboratory there became an important center of advanced study and research. The weekly meetings of the Journal Club and Seminary for advanced students were held in the Nichols home on the university campus and with the understanding help of Mrs. Nichols were made occasions which no member would willingly miss. For many years also Mr. and Mrs. Nichols were at "home" to give a cordial welcome to all advanced students and staff members every Thursday evening. In this way, and because of Nichols's frank and cordial attitude in all his contacts with his students, the workers in his laboratory came to form almost a family group. The result was not only the creation of a pleasant social atmosphere in the department but also a broadening of the scientific interests of the members of the group and the creation of new opportunities for Nichols's influence to make itself felt. Undoubtedly one of his most important contributions to American physics was the indirect influence that he exerted through the students who had received their inspiration and their scientific ideals from him and who later entered the field of college teaching or industrial physics. At the time of his retirement the heads of the departments of physics in thirty-five colleges, fifteen of them state universities, were men who had received their physics training from him. Add to this list the large number of his students who held important posts in government and industrial laboratories or who were college teachers but not department heads, and we get some idea of how great his indirect influence was.

Although Nichols enjoyed teaching, especially when it meant personal contact with advanced students, he greatly disliked the administrative side of his university duties, and this in spite of the fact that he was highly successful in this work. His success came, I think, from his thoroughly democratic attitude toward the problems of administration. Administrative duties and responsibilities were shared with his colleagues in the department and every encouragement was given to individual initiative.

Although he would have preferred to devote his whole time to research he took his duties as a member of the faculty seriously and his wise and altogether unprejudiced approach to the general educational problems of the university made him a most influential and valuable faculty member. When a plan for faculty representation on the University Board of Trustees was adopted, Nichols was one of the first to be elected by the faculty as one of its representatives. His distaste for administrative work and his dislike—which almost amounted to resentment—for over organization in scientific work are evident in the following quotation from his address as retiring president of the American Association for the Advancement of Science in 1908:

"When in any of our institutions a man distinguishes himself by productive work he is frequently made a dean, director or even president, and is thus retired from what might have been a great career as an investigator. Thereafter he is compelled to devote himself to administrative duties, which some one not equipped for the important task of adding to the world's stock of knowledge might just as well perform. It is as though the authorities were to say: 'X has written an admirable book; we must appoint him bookkeeper—or Y is developing a decided genius for landscape; we will increase his salary and ask him to devote all his time to painting the woodwork of the university buildings.' Nor does the mischief stop with the sacrifice of a few bright spirits. It extends to the bottom. The head of each department is a petty dean, cumbered with administrative detail. He is expected to hold every one under him to account, not for scholarly productiveness, but for the things which chiefly hinder it."

"In this exaltation of administrative ability over creative gifts which are much rarer and more precious, our institutions share the weakness which pervades our industrial establishments. In both we see the same striving for a certain sort of efficiency and economy of operation and for the attainment of a completely standardized product. This tends in both cases to the elimination of individuality and to sterility. In the University it retards instead of developing research. In industry it discourages originality."

At the dinner given in Nichols's honor at the time of his retirement in 1919 it was a matter for humorous comment that five of the seven speakers were either college presidents or deans whose appointment had resulted from their success in other than administrative work; and of the three deans Nichols himself was one! But Nichols's acceptance of the position of Dean of the College of Arts and Sciences may almost be said to have been forced upon him. Upon the initiative of President Schurman the office had been made elective and with a two years' term. It was expected that a permanent staff would be organized for the handling of administrative detail and that the dean would be concerned only with broad questions of policy. With this understanding, and because the democratic character of the original plan made a strong appeal to him, Nichols accepted election as the first dean under the new plan.

Even in the early years of his scientific career Nichols fully appreciated the practical value of scientific research. The fact that research furnishes the foundation on which the applications of science in industry must build is now generally appreciated and it is rarely necessary to stress the point. But this was not true sixty years ago. Probably only the members of Nichols's own generation are in a position fully to realize how great the change has been. The attitude of the general public toward those who devoted themselves to scientific research was then merely one of kindly tolerance. What the scientist did was recognized as harmless and sometimes interesting. But his work was regarded as having no relation to the affairs of every day life. In his teaching, in his public addresses,—in every way possible—Nichols exerted himself to correct this misapprehension and to point out the practical value of pure science. He went further than this and repeatedly called attention to the fact that those nations and communities in which there is activity in pure science research are usually the ones in which progress in the application of scientific knowledge is most rapid. To quote again from his presidential address before the American Association:

"A country that has many investigators will have many inventors also. A scientific atmosphere dense enough to permeate the masses brings proper suggestions to many practically inclined minds. Where science is there will its by-product, technology, be also. Communities having the most thorough fundamental knowledge of pure science will show the greatest output of really practical inventions. Peoples who get their knowledge at second-hand must be content to follow."

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"Nearly all really important technical advances have their origin in communities where the great fundamental sciences are most extensively and successfully cultivated."

Many interesting illustrations are then given to support this statement.

A firm believer in the value of scientific research to humanity, Nichols also greatly enjoyed his experimental work for its own sake. One might almost say that his belief in the value of science was as much the justification as the cause of his scientific activity. In my long association with him I was again and again impressed by the vigorous and almost joyous way in which he met and overcame experimental difficulties and by his enthusiastic welcome of new and unexpected results. His attitude was that of a young athlete engaged in a game which called for all his energy and skill, and which for that very reason he thoroughly enjoyed. No one could be associated with him long either as student or colleague without acquiring in some degree this same attitude toward scientific work.

After having served for thirty-two years as head of the department of physics at Cornell, Nichols retired from active teaching in 1919, at the age of 65. His scientific activity, however, was by no means at an end. Between 1919 and 1936 he published thirty-seven papers, all but five of which dealt with the results of his own experimental work. During the greater part of this period also he was active in guiding the work of his assistants and in helping by his suggestions and advice former students, now connected with other colleges, who returned each summer to use the special equipment and the large amount of experimental material which he had accumulated for work in the luminescence field. His presence in the laboratory was a continuing stimulus to the graduate students and the members of the staff.

It was Nichols's habit to devote himself to his experimental work as continuously as his other duties would permit until the need and opportunity for rest came—and then to drop his scientific work for a time completely. He greatly enjoyed foreign travel and usually spent his sabbatic leave in Europe. On several occasions, however, more extended trips were made, and at one time or another he visited each of the six continents. During the later years, after failing eyesight seriously interfered with his experimental work, and when the health of Mrs. Nichols made a milder climate desirable, he spent much of his time in Florida. It was in West Palm Beach, Florida, at the home of his son, Robert, that he died, November 10, 1937, in his 84th year.

Throughout his life Nichols was a member of the Episcopal Church and for many years he was a member of the vestry of St. John's Church in Ithaca. The difficulties that some have felt in reconciling the results of scientific discovery with their religious belief did not exist for him. He saw no "conflict" between religion and science. It is not easy to summarize his views on such questions, for although he sometimes gave informal talks on the relation of science and religion he published only one short article on this subject. The following quotations from this article are, however, helpful:

"Science * * * strives to give an account, intelligible and systematic, of the world in which we live—and, so far as physical science is concerned—solely of the material world."

"Science has certain important by-products: Engineering is such a by-product, * * * Citizenship is another, and I propose to show that science tends to produce a religious citizenship."

"The normal man of science of to-day may, rarely, be an agnostic; never an atheist. He is more likely to be, and generally is, a Christian of profound religious feeling."

"Thoughtful contemplation of the material universe * * * leads inevitably to belief in an intelligent creator, * * * without the aid of theology or of any revelation aside from that afforded by the material universe and our relations to it we reach the idea of a personal God * * *."

"Science demands of its followers as the conditions of the highest success certain characteristics that are no less essential to the religious citizen * * *. Such are a passion for knowledge, the love of truth, honesty, patience, singleness of mind, simplicity of character, humility, reverence, imagination. This list of great attributes, to be sure, cannot be ascribed to all men of science—not all citizens are good citizens!—but search the lives of the truly great in science and you will find these characteristics represented in notable degree."

I am sure that Nichols felt that dogmatism is no more justified in the scientist than in the theologian: that we have penetrated so short a distance into the unknown that while the scientist may well speak of some seeming violation of natural law as extremely improbable, he is never justified in using the word impossible. I have several times heard him comment on the fact that many of the scientific facts that are almost commonplace today would have seemed, only a few centuries ago, as impossible as do any of the miracles of the Bible. Of greater importance, however, in the case of his own religious beliefs was, I think, his feeling that the subject matter of science is altogether different from that of religion; and that science, which deals only with material things, can therefore throw little light on the questions that are dealt with by religion. His attitude toward the beliefs of others was one of sincere and very real tolerance.

In recognition of his scientific work Nichols was awarded the Elliott Cresson Medal of the Franklin Institute, the Ives Medal of the Optical Society, and the Rumford Medal of the American Academy (1928) and was made an honorary member of the Illuminating Engineering Society and of the American Optical Society. Honorary degrees were conferred upon him by the University of Pennsylvania (1908) and Dartmouth (1910). Among the scientific societies of which he was a member, and in most cases a very active member, were the American Association for the Advancement of Science, the Illuminating Engineering Society, the American Optical Society, the Institute of Electrical Engineers, the American Philosophical Society, the American Academy of Arts and Sciences, and the National Academy of Sciences. He served as president of the Kansas Academy in 1885, of the National Society of Sigma Xi in 1908, the American Association for the Advancement of Science in 1907, the American Physical Society (1907-1909).

KEY TO ABBREVIATIONS

Amer. Inst. Elec. Eng. Trans.—American Institute of Electrical Engineers Transactions.
Amer. Jl. Sci.—American Journal of Science.
Amer. Phil. Soc. Proc.—American Philosophical Society Proceedings.
Bull. Nat. Res. Council—Bulletin, National Research Council.
Elec. Soc. & Soc. Mech. Eng., Cornell Univ.—Electric Society and Society of Mechanical Engineers, Cornell University.
Illum. Eng. Soc. Trans.—Illuminating Engineering Society Transactions.
Int. Elec. Cong. St. Louis—International Electrical Congress, St. Louis.
Jour. Franklin Inst.—Journal of the Franklin Institute.
Jour. Opt. Soc. Amer.—Journal, Optical Society of America.
Kans. Acad. Sci. Trans.—Kansas Academy of Sciences Transactions.
Nat. Acad. Sci. Biog. Mem.—National Academy of Sciences Biographical Memoirs.
Nat. Acad. Sci. Proc.—National Academy of Sciences Proceedings.
Phil. Mag.—Philosophical Magazine.
Phys. Rev.—Physical Review.
Physikalische Zs.—Physikalische Zeitschrift.
Pop. Sci. Mo.—Popular Science Monthly.
Proc. Amer. Assn. Adv. Sci.—Proceedings American Association for the Advancement of Science.
Sci. Abs.—Science Abstracts.
Sci. Mo.—Scientific Monthly.
Sibley Jour. Eng.—Sibley Journal of Engineering.

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