THE PRESIDENT-ELECT

A Biographical Note

Professor Michael I. Pupin, president-elect of the American Association for the Advancement of Science, has himself recently given to all of us a rarely perfect means of becoming well acquainted with his own history and with his very memorable contributions to the advancement of science and of civilization. Reference is here made to his well-known autobiography,[1] from which most of the material for the present note has been derived. Men and women of science and all friends of science and upholders of the principles and aims for which our association stands will do better than well to read that book from cover to cover. There is no more satisfactory presentation of the ideals of science, no better picture of the relation of individual scientific workers to the advance of knowledge and appreciation of nature. It is remarkably fortunate that the most recently elected member of the distinguished group of the presidents of the American Association should have just now expressed himself in so full and clear an account of the recent history of fundamental science in America and of his own chief articles of faith in the future of scientific research. This biographical note is consequently almost superfluous.

Born in 1858, in the agricultural hamlet of Idvor, not far from Belgrade, formerly in Hungary but now in the Yugoslav State, Professor Pupin received his early education in local schools and in Prague. Racially his parents were Serbs, as are all the peasant farmers of Idvor. As a boy he tended cattle during summer vacations on the grasslands about his native village and gathered lasting inspiration from the village wise men and from nightly vigils under the stars. The stars seem to have given him many a message in those youthful days. One of his boyhood pranks was to climb the high conical roof of the village mill, recently rethatched, to possess himself of the bright tin star fastened at its peak. The Idvor children thought that it was a real star fallen from heaven. The roof was very steep and smooth and the boy's mother regarded his escape from a serious fall as no less than miraculous; afterwards she interpreted the incident as a sign that he would climb very high in his life-work and that he would gather many real stars as he went. Her prophecy has surely been fulfilled.

In the early spring of 1874 Dr. Pupin came to New York as a steerage passenger without even money enough to supply himself with the much needed mattress and blanket. He had sold about all his belongings to procure his passage. The trip was stormy and he says he spent many nights on the deck of that immigrant ship hugging the warm smoke-stack. He landed at Castle Garden with only five cents in his pocket, wearing his only suit of clothes and with a red Turkish fez as his only hat. With no friend in this country, with all but no knowledge of the English language, with no money and practically no belongings, this young Serb began his American life. His first job was driving a mule-team on a Delaware farm. He had successively many jobs, moved about, sought experience and opportunity, learned the language and history of our country. He studied over the scientific exhibits at the Centennial Exposition in Philadelphia in 1876. He worked in a cracker factory in New York and read evenings in the Cooper Union Library, attending classes there and evening lectures. He gained much from Henry Ward Beecher's sermons in Plymouth Church, which he attended. He was greatly inspired by Booth's presentation of Shakespeare. A German workman cultivated in him a strong love for the Greek and Latin writers. Through attendance at Plymouth Church the young immigrant became acquainted with Dr. Charles Shepard, who made it possible for him to work his way through Adelphi Academy by means of an assistant's position in the Shepard hydropathic sanitarium.

In the fall of 1879 Professor Pupin became enrolled in Columbia University, having passed the entrance examinations with high honors. This was another accomplishment attained against difficulties that would have swamped most young men; another bright star had been achieved. The four years at college were very full. Young Pupin entered thoroughly into college athletics, in which he excelled as greatly as in his studies. He became intimate with youths of the best American culture and with some of their parents, partly through his great success in private tutoring, which was one of the main sources of his money during the college period. He gave little attention to science in these years. There was no laboratory science available and the Columbia science lectures carried little farther than he had already been able to go through hearing lectures at Cooper Union and through his reading. At the end of the college course he found difficulty in deciding whether he should adhere to his original plan and follow science or should turn to literary lines. The years in college rounded him out as a thoroughly representative American and gave him a broad background of American culture. He finally decided to follow Faraday and Maxwell. He wished to seek an answer to the question "What is light?"

Professor Pupin was graduated from Columbia

[1] Pupin, Michael. "From Immigrant to Inventor." Illustrated, 396 pp. New York and London; 1923, 1924.

College in 1883, having been admitted to full and complete citizenship in the United States on the day before the graduation exercises. He returned that summer for a visit to Idvor, his native village, and reported his progress to his mother, who encouraged him to go forward with his scientific work. That fall he entered Cambridge University, under the guidance of Mr. W. D. Niven, a fellow of Trinity College. After nearly a year of drill in mathematics calculated for Cambridge wranglers, Mr. Niven handed him Maxwell's little book on "Matter and Motion." It was apparently this book and the same author's "Theory of Heat" that gave the final bent to the future work of the future president of the American Association. By the end of that first year in Cambridge he had fallen under the spell of the writings of the great Clerk Maxwell. He says that he saw much light ahead and felt confident that the goal for which he was to steer was in sight. The summer of 1884 was spent partly at Pornic, a village in south Brittany ("just where the sea and the Loire unite," as Robert Browning has it), learning French, listening to the nightingales and reading Campbell's "Life of Maxwell"; partly in Paris, where he picked up in a second-hand shop a copy of La Grange's "Méchanique Analytique" and became entranced for life with the writing of the French Newton; and partly at his native village. Olympiada Pupin, the mother, was enthusiastic in her approval of her son's progress and well content that he should return to Cambridge, which she called "a great temple filled with the icons of the great saints of science the contemplation of whose saintly work would lead to communication with the spirit of eternal truth." That is what Cambridge University was and is and that is Pupin's idea of what a university should be.

The study of Maxwell's publications had left much to be cleared up and Pupin turned to a more thorough reading of Faraday's work, which had been the starting-point of much of the work of Maxwell. He sought and received fine advice from Tyndall. He worked with Rayleigh and with Stokes. The summer following his second year at Cambridge was spent at the old Macmillan cottage near Corrie, on the island of Arran in Scotland, reading and pondering over Faraday's "Electrical Researches" by day and turning himself loose evenings in the social activities of the summer colony there.

From Maxwell and Faraday the path of mental development traced in the autobiography leads next to Helmholtz, in Berlin. Professor Pupin went there in 1886, where he found his first extensive opportunities for experimental research. Here he became acquainted not only with Helmholtz and the group about him but also with Siemens and his wonderful organization of applied physics. The impression was made that Helmholtz and Siemens represent the highest type of the cooperation of pure and applied science.

Late in 1887 Pupin was present at a memorable meeting of the Berlin Physical Society at which Helmholtz made the first announcement of the great discovery of his pupil, Heinrich Hertz, which speedily became the main topic of discussion and experiment in all physical laboratories. The electromagnetic theory of Faraday had been extended by Maxwell and, starting from the combined work of these two, Hertz had succeeded, with Helmholtz's guidance, in constructing "a physical embodiment of the Faraday-Maxwell theory, represented by ideally simple apparatus operating in an ideally simple way. The apparatus and its operation are now the heart and soul of the radio art." That was the inauguration day of the electromagnetic theory of radiation. The science of light and the science of electricity had been brought together. It is in this field that Pupin is now especially a great leader.

Professor Pupin received the degree of doctor of philosophy at the University of Berlin in 1889, his dissertation being a mathematical research in physical chemistry, and the three theses that he "defended in public" on that occasion were as follows:

(1) Elementary instruction in physics should be as practical as possible.

(2) The thermodynamic methods of Gibbs, Helmholtz and Planck are the best foundation for studying physical processes that can not be satisfactorily analyzed by the methods of ordinary dynamics.

(3) The electromagnetic theory of light deserves more attention than has thus far been given it in university lectures.

Returning to America in 1889, Dr. Pupin became instructor in the newly established department of electrical engineering in the School of Mines of Columbia University. In a little brick building, dubbed "the cowshed" by the students, he and Professor Francis B. Crocker began their work, the beginning of electrical engineering as a university department in America. Apparatus was poor and scant. By a course of public lectures they secured money to buy some needed instruments. They succeeded with their students and Pupin found time for some fundamental research. He became adjunct professor of mechanics in 1891. It was in those days that he discovered the corona accompanying electrical discharge from a metal sphere in rarefied atmosphere, a discovery that has subsequently led to great advances in solar astronomy.

But the greatest thing that came from Pupin working evenings in his "cowshed" laboratory was the series of deductions that led to his invention of elec-

trical tuning. Applying to Rowland's distorted alternating currents the general principles employed by Helmholtz in his resonator analysis of sounds, an electric resonator was devised, which is now in use on all radio receiving sets. The word "tuning" was suggested by the operation of the Serbian bagpiper as he tunes his pipes. These results were published in 1894. "Tuning" is now generally used in the radio art and the analysis of complex harmonic electric motions accompanying articulate speech is now performed by Pupin's method of 1894.

Professor Pupin took up the subject of X-rays immediately after the announcement of their discovery by Roentgen late in 1895. He secured the first X-ray photographs made in America on January 2, 1896. His laboratory was immediately famous and visitors of many kinds became unbearably numerous. Physicians brought their patients to have X-ray photographs taken. Pupin used the fluorescent screen and could examine objects directly by means of the new radiation. Then he employed the screen between the object and the photographic plate and enormously shortened the requisite exposure. It was in February, 1896, that the first American surgical operation under the guidance of an X-ray picture was performed, and the picture was made by Pupin with his improved method, which is now universally used. A description of it was published in *Electricity* for April 15, 1896.

On that very day, in the midst of a lecture, Dr. Pupin was suddenly stricken with a violent chill, which was followed by a nearly fatal case of pneumonia. Recovery took many months and was finally due to the complete giving up of his usual lines of life and thought. He retired to the Berkshire hills in Connecticut and busied himself with the training of a team of fine horses. With these he won many prizes, including restored health.

In 1894 Pupin's attention had been recalled to La Grange's solution of the hypothetical problem concerning the vibration of weighted strings, and he had succeeded in finding a general solution of the famous problem. The thought shortly occurred to him that the principles involved should be applicable also to electric oscillations along a wire. It was this thought and the far-reaching invention that came of it that occupied Pupin when he returned to his scientific work after his full recovery. The mathematical theory of the Pupin coil for increasing the inductance of a telephone wire was communicated to the American Institute of Electrical Engineers in March, 1899, but the invention itself was not then discussed. Somewhat later a patent was secured and the Pupin high *inductance conductor* is now in general use. It has made international telephony over telephone cables possible, and such cables are called *pupinizierte Kabeln* in German, *les cables pupinizé* in French, while the Italians refer to their construction as *pupinizatione.*

The ideals and aims of the American Association for the Advancement of Science have been ably and continuously supported by Professor Pupin, who became a member of the association in 1895. He is characteristically idealistic and optimistic and a leader in the field of exact science. With a deep and original faith in the democratic principles of Benjamin Franklin and Abraham Lincoln, and with the constant conviction that the highest aim of science is to approach always nearer to everlasting truth, his helpful influence has been very pronounced in the organization of American scientific men. He was a charter member of the American Physical Society when it was organized in 1899 and has been very active in its rapid advance. A similar statement is true of the American Mathematical Society. In the progress of the technological societies in the field of physics and chemistry, the great engineering societies, Pupin has likewise taken an active part. He has ably supported the aims of the special technical societies and of the American Association as a whole, "to give a stronger and more general impulse and more systematic direction to scientific research and to procure for the labors of scientific men increased facilities and a wider usefulness."[2] Especially was Professor Pupin very active in the organization of the National Research Council, which has been successfully putting into practice during and since the war a scheme of wisely laid plans for furthering scientific research in many ways.

Professor Pupin is one of the few Americans who are equally eminent for theoretical research and for practical applications of science. If there be still some votaries of science who regard practical inventions as beneath or outside of the realm of their goddess, he is not one of them. He seems to have been led always by an invincible desire to advance fundamental and precise knowledge, but he has seen many valuable applications of his fundamental researches and has made them available to mankind. He is therefore a public benefactor in two spheres of activity, which in him are joined. He is one of our greatest mathematical physicists and also one of our greatest electrical inventors. He is now professor of electromechanics in Columbia University. He has received many scientific honors, prizes and medals. The doctorate of science was conferred on him by Columbia University in 1904, and that of laws was conferred by the Johns Hopkins University in 1917,

[2] Constitution of the American Association for the Advancement of Science, Article 1.

and by Princeton University and the University of New York in 1924. He has been awarded the Hébert prize of the Paris Academy, the Cresson medal of the Franklin Institute, the medal of the National Institute of Social Sciences, the Edison medal of the American Institute of Electrical Engineers, the Medal of Honor of the Radio Institute, and other similar recognitions. He is a recipient of the Pulitzer prize, for his autobiography. He is a member of the American Philosophical Society, of the American Academy of Arts and Sciences and of the National Academy of Sciences. The American Association for the Advancement of Science is indeed fortunate in having Michael I. Pupin as its president.—B. E. L.

THE WASHINGTON SESSIONS OF THE SECTIONS AND SOCIETIES

Reports of the programs of the sections and societies at the Fifth Washington Meeting have been prepared from accounts sent in by section and society secretaries and others who have kindly acted as reporters. The permanent secretary is much gratified at the fine spirit of cooperation generally evidenced by the secretaries of the organizations that took part in the great Washington meeting. It must be realized that the task of preparing even a brief report on one session or a series is in itself something of an undertaking unless one is used to doing that sort of thing. The magnitude of this task is increased when the report must be prepared within a week or so following the close of such a meeting as we have just had. The permanent secretary wishes to express his thanks and also the appreciative gratitude of the association to all who have helped to make the reports of the Fifth Washington Meeting as good as they are.

The reports received naturally vary greatly in regard to suitability for use. Great improvement is shown from year to year, not only in the promptness with which the reports are sent in but also in the care and thought and ability with which they are prepared.

One of the greatest needs of present-day science is to perfect means by which the workers in any field may easily secure a fairly good idea of what is going on in other fields and the annual publication of these reports is planned to aid in that direction. Each branch of scientific endeavor that is represented by an organization in one of these great scientific conventions surely deserves appreciation by all scientific workers as well as by the intelligent public in general. The work of preparing these reports is consequently just as important to the sections and societies and to the advancement of learning as is that of preparing the programs. The secretaries and other reporters and the members of the various societies are asked to study this year's reports critically, and to note suggestions for further improvement in future years. It is true that the permanent secretary's part in this work is still much more in evidence than is desirable. The permanent secretary has done only his best in cases where the reports received seemed to require alteration or rewriting; doubtless this best is not very good in some instances and suggestions for future improvement will be gladly received.

The section reports are arranged below in the serial order of the association sections to which they pertain, together with the reports of those societies whose fields are of general or less technical interest. Lack of space precludes the publication in this issue of SCIENCE of all the reports of the societies that met with the American Association at Washington. The remaining reports, of which there are about forty, will appear in later issues, grouped according to the association sections to which the societies are most closely related.

Because of the very great attendance at the Fifth Washington Meeting the supply of the general program was exhausted and copies of it can not be supplied. The summary of events was reprinted, however, and copies of that may be had—as long as the supply lasts—on application to the Washington office.

SECTION A (MATHEMATICS)

Vice-president and chairman, J. C. Fields.

Retiring vice-president, Harris Hancock.

Secretary, William H. Roever, Washington University, St. Louis, Mo.

(*Report by William H. Roever*)

Section A held two joint sessions, one on Wednesday morning with the American Mathematical Society and the Mathematical Association of America and the other on Thursday morning with Sections B and D and the two mathematical societies. In the absence of Professor J. C. Fields, Professor H. L. Rietz, president of the Mathematical Association of America, presided at the session on Wednesday morning and Professor Oswald Veblen, retiring president of the American Mathematical Society, gave an address entitled "Remarks on the foundations of geometry." A very brief outline of this address, which will be published in full in the *Bulletin of the American Mathematical Society,* will appear later in the report of the meeting of the society. The other address of this session was given by Professor Harris Hancock, retiring chairman of Section A, on the subject, "The foundations of the theory of algebraic numbers." In this address, which was published in full in SCIENCE for January 2 and 9, Professor Hancock made some general observations on the ultimate