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The Pioneering Professors

BY MICHAEL PUPIN

The author of "From Immigrant to Inventor" and "The New Reformation" points out the practical value of the work of mute heroes of science.

Two centuries are a tiny span of time in the history of humanity, and yet innumerable changes which have completely revolutionized our civilization have been produced by the intellectual achievements of the last two centuries. Among these achievements those of science stand foremost. How many of us recognize that the foundations of this science were laid by university professors? I call them the pioneering professors. The world does not recognize clearly how great is its indebtedness to these mute heroes of science. Let me illustrate my meaning by a brief review of some of the achievements of the electrical science.

It was only two centuries ago when Newton, a professor in the University of Cambridge, created a new science, the science of motion of material bodies. This was the beginning of modern physical sciences. Newton's science of motion ruled supreme in the scientific thought of those days. Stephen Gray, a contemporary of Newton, and undoubt-

edly inspired by his science of motion, was the first to study the motion of electricity. This study led him to a great discovery, the discovery of the electrical conductors, which are to-day the great channels through which moving electricity conveys its many blessings to grateful humanity. Following in Gray's footsteps Franklin demonstrated to the wondering world that one of the most irresistible forces in nature, the force of lightning, is due to the motion of electricity. It is not surprising then that motion of material bodies and motion of electricity became the principal objects of study of the physical sciences during the eighteenth century.

The greatest achievement of those early studies of electricity in motion was Professor Volta's invention of the Voltaic battery. The eminent importance of this ideally simple generator of electrical motions was exhibited by Sir Humphry Davy, a professor of the Royal Institution, when by its electrical current he decomposed chemical com-

pounds and thus discovered electrolysis. This great discovery was the first contribution to the electrical science of the nineteenth century. It gave us our first glimpse of that remarkable relationship between chemical and electrical forces which is one of the most significant physical facts of to-day. Operating with a powerful Voltaic battery, such as Sir Humphry Davy had developed, Professor Oersted, of Copenhagen, discovered that moving electricity generates a magnetic force in every part of space. A few years later Professor Faraday made another startling discovery, the discovery, namely, that moving magnetism generates electrical forces in every part of space. These three great discoveries are the foundation pillars of the modern electrical science and of its industries. They were made by professors, the pioneers of the electrical science during its early history. The names of Maxwell, Roentgen, Becquerell, and of others testify that down to the present time the university professors remained the pioneers of the electrical science. The same can be said of other sciences; their pioneers were also university professors.

The visible services of science which one sees in every nook and corner of our daily life were created by the pioneering professors. I delight in making this statement; it is a fitting answer to those people who are inclined to believe that a professor of science is necessarily an apostle of abstract scientific theories which may sound well in the lecture-rooms of the universities, but contribute very little to the solution of the practical problems of life. Practical men, it is true, formulate practical problems, and they also develop and exploit their solutions. But it is also true that the science which leads to the solution of these practical problems is a creation of the

pioneering professors. Morse, the practical promoter, installed the first telegraph-line, but Joseph Henry, the Princeton professor, supplied the knowledge for the earliest solution of the telegraph problem. Marconi, the practical Italian youth, was the first to transmit a wireless message between ship and shore, but Professor Hertz told him the story of the electrical waves which carried the message, and this story of the electrical waves was born in the soul of immortal Maxwell, the great professor of Cambridge University. The Wright brothers, the practical men, were the first to step into a flying-machine and fly, but in their technical development of that machine they started from the knowledge which Professor Langley's experiments had created. Many other illustrations could be given, all showing how the pioneering professors guided the hand of the so-called practical man. The cradle of the most practical things in the world is the science which the pioneering professors created. Moreover, they originated not only the visible but also the invisible services of science. These are not seen in every nook and corner of our daily life, but they are, perhaps, even more important than the visible services. I shall describe them by referring briefly to the history of one historic development in American science during the last fifty years.

Joseph Henry, the first secretary of the Smithsonian Institution and one of the most eminent pioneering professors in American science, rendered invaluable scientific service to President Lincoln during the Civil War. It was the service of an idealist in science to an idealist in political philosophy. Idealism of the highest type was the bond of union between these two great men. The National Academy of Sciences, or-

ganized in the very midst of the Civil War and transformed into a national institution by a congressional charter, was the offspring of this warm friendship between Lincoln and Henry, and it was destined to become the cradle of American idealism in science. Under the leadership of Joseph Henry the members of the National Academy of Sciences started the historic movement for higher endeavor in our universities. Johns Hopkins University, founded in 1876, and dedicated to the highest intellectual endeavors, was the earliest concrete manifestation of this movement. Other American universities followed the noble example of Johns Hopkins in rapid succession. They soon developed into real universities, that is, institutions of higher learning, well equipped with research laboratories which were guided by the spirit of scientific idealism of Joseph Henry and of the other idealists in the National Academy of Sciences. The birth of the university research laboratories marks a new epoch in American history, the epoch in which the idealism of science and scientific research is gradually penetrating deeper and deeper into every phase of our national life. I shall point out now that this is one of the greatest invisible services of science rendered by the university professors.

There was a time when the American industrialists, the so-called practical men, paid small attention to the research laboratories of the universities. The practical man saw in the scientific research man a theorist only, whose work had no bearing upon industrial progress. But the scientific research laboratories of our universities soon compelled the practical man to change his opinion and his mental attitude. He soon learned that scientific research cul-

tivated in the research laboratories of the universities is the fountainhead of all industries. He was ready then to worship at the altar of scientific idealism which guides the scientists in the university laboratories. Their achievements soon convinced the captains of our industries that the scientists, trained in the university laboratories, are indispensable in industrial progress. This conviction is responsible for our modern industrial research laboratories, like those of the DuPont Chemical Works in Wilmington, of the Eastman plant in Rochester, of the Western Electric, of the General Electric, of the Westinghouse companies, and of many others. Their work is directed by men who received their training and discipline in the research laboratories of the universities, and, hence, the same spirit of scientific idealism which guides the university laboratories guides also the industrial research laboratories. This spirit is the bond of union between them and this union represents one of the greatest achievements in our American civilization during the last fifty years. The rise of our industries to a much higher level of efficiency is not the only result of this great achievement. There are other results which are, perhaps, even more important in our advancing civilization; one of them I shall mention briefly.

The phrase "scientific idealism" which I have employed several times in the course of this discussion is not an abstract concept; it is a simple philosophy which cultivates a definite motive, a definite mental attitude, and a definite method of inquiry. The motive is unselfish search of the eternal truth; the mental attitude is open-minded and unprejudiced interpretation of the language of nature; the meth-

od of inquiry is observation, experiment, and calculation. This is the philosophy which guided the great pioneers in science whose achievements conferred innumerable blessings upon humanity. One of the greatest of these blessings is the growing popular belief that this philosophy of scientific idealism is the safest guide in all human activities. It has stood the test of all experience in science and industries, and its motive, mental attitude, and method of work obviously recommend it to all the arts of human endeavor, and particularly to the art of government in a democracy like our American democracy. American scientists and engineers believe that the philosophy of scientific idealism will make democracy safe for

the world, a mission which is perhaps even more difficult than the mission of making the world safe for democracy. If this is really one of the great missions of the philosophy of scientific idealism, and I firmly believe that it is, then we must offer every opportunity to the disciples of this philosophy, to the scientists and engineers, to perform this mission. Let them have an opportunity to demonstrate that they can guide the machinery of our government just as successfully as they have guided the machinery of our industries. If they succeed in that, it will be the greatest blessing conferred upon humanity by the pioneering professors, the creators of the philosophy of scientific idealism.



A Sky-Pilot Taxies

BY THOMAS H. WHELPLEY

Feeling that ministers were too far removed from life, the pastor of the Chelsea Presbyterian Church of New York became a taxi-driver by night to see how the rest of the city lived. We asked Mr. Whelpley to tell us, after some months of experience, what he really found.

ONE of a minister's greatest handicaps, I have often felt, is being a minister. To really help people it is necessary to win their confidence, and for a minister to win that confidence is not easy. There is a surface congeniality, a seeming intimacy. In reality people do not feel safe with a minister, in the sense that they are not themselves in his company. And until the man in the pulpit has proven his worth, until he has earned their love

and respect, he is divided from his people by indifference, pretense, and practised piety.

An unhappy state of affairs; often the lack of any real understanding between my congregation and myself, especially during my early days in the pastorate, had been brought home to me. I would join a gay group of Sunday-school students, and their laughter would end. I would chance in at a choir rehearsal, and the conversation between