ogist with special training and aptitudes the opportunities in private work or in institutional employ are not surpassed financially or scientifically by that in any other field.

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CAREERS IN INDUSTRIAL PSYCHOLOGY

The world of business and industry is not exactly clamoring for psychologists to come and show how factories should be operated, offices organized and sales increased. Indeed, hardly more than one or two men are earning a livelihood in industry to-day as *psychologists*.

There are, to be sure, several trained psychologists who are ably filling business positions—in personnel administration, industrial training, business analysis, sales promotion and management and advertising. Their duties, however, are much like those of other executives who may have studied only in the school of actual business experience. The doctor of philosophy who specializes in industrial psychology can not be confident of a chance to earn his living practicing the applications of his science in a business concern. He should first fit himself for university teaching and research, for this is the main trunk from which branch the opportunities for careers in industrial psychology.

Three outstanding assets for a career in industrial psychology are: a sound training in scientific method; the capacity to be genuinely interested in all sorts of people and the personality to deal effectively with them; and superior practical judgment, especially where money values are concerned.

It is a common error to imagine that an industrial psychologist does not need to be exacting in his scientific ideals and rigorous in his procedures, as does the experimentalist in a university laboratory. When selecting psychological methods for practical use—in an employment office, for example— he must know and evaluate all the considerations of reliability of one method *vs.* another, and *in addition* he must be able to evaluate relative costs in comparison with returns in dollars. For this reason it is essential for the industrial psychologist to have a good grounding in economics, including cost-accounting and industrial management. Mastery of the technique of constructing and administering tests is also of secondary importance, except as it may serve as a discipline in scientific method. The bulk of the training must be in general systematic psychology and in statistical and experimental method. To be an industrial psychologist one must first of all be a psychologist.

For the young man or woman, then, with a strong bent toward practical psychology, the first objective should be to secure the training necessary for doing good teaching and research in general and experimental psychology. Later, when one has made his place in a university or a research bureau as a teacher or an assistant investigator, the psychologist who combines practical good sense with scientific thoroughness and with ingenuity may be certain of finding opportunities in any industrial community for working on the most fascinating practical problems. His financial rewards will then be proportionate to his resourcefulness and his ability to produce an output of cash value to industry.

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EDWARD WILLIAMS MORLEY

EDWARD WILLIAMS MORLEY was born in Newark, N. J., January 29, 1838. His parents were the Reverend Sardis B. Morley and Anna Treat Morley. Soon after his birth they moved to Hartford, Conn., and thereafter for the next twenty-five years his life was spent in New England. He graduated from Williams College in 1860, and from Andover Theological Seminary in 1864, and later taught in the South Berkshire Institute at Marlboro, Mass. He also spent a few years as minister in the Congregational church. In 1868 he married Isabella Ashley Birdsall, of Winsted, Conn., and a year later was called from the pastorate of the Congregational Church in Twinsburg, Ohio, to be professor of natural history and chemistry in Western Reserve College, then located in the neighboring town of Hudson. Later the college was moved to Cleveland and became Adelbert College of Western Reserve University.

During the first years at Hudson Professor

Morley taught not only chemistry and physics but also mathematics, mineralogy, geology and botany. Chemistry was always, however, his chief interest, and he at once had a small room fitted up as a chemical laboratory, where, as one of the early catalogues states, "The class perform, under the guidance of the professor, all those experiments which are suitable for them, while those which demand more experience are performed for the class by the teacher." A course in quantitative analysis was also given at this early date.

Morley was always a tireless worker. In 1873 he also became professor of chemistry in the medical department of the college in Cleveland, which necessitated his spending much time in traveling back and forth between the two towns. In addition he was always engaged on some research and besides undertook analytical work for certain industrial firms in order to obtain funds to finance his needs for special apparatus and books, the college not being able in those days to afford to purchase supplies except those actually required by the students. After the college had moved to Cleveland in 1882 and had acquired a greater endowment, he was able to devote himself to teaching chemistry exclusively and in 1888 to give up his connection with the Medical School. In 1898 the trustees of the college voted that, in consideration of his great scientific achievements, sufficient assistance would be provided so that he could do as little teaching as he wished and devote his time to research. He, however, chose to continue most of his teaching, and taught general chemistry and quantitative analysis until he retired as professor emeritus in 1906.

Professor Morley prepared altogether fifty-five papers for presentation before scientific societies or for publication. His first work of importance, undertaken while in Hudson, was on the relative proportion of oxygen in the air (1878-81). In the course of this he devised and constructed an apparatus for determining the proportion of oxygen in the air rapidly and with great precision. He made analyses of the amount of oxygen in the air on 110 consecutive days in order to accumulate data bearing on the so-called Loomis-Morley hypothesis, which was put forward to account for the variation of the oxygen content of the air with the change of barometric pressure. According to this hypothesis deficiency of oxygen was supposed to occur at times of high barometric pressure, due to downward currents bringing air from high altitudes to the surface of the earth. He summed up his results in the following words: "The theory that deficiencies in the amount of oxygen in the atmosphere are caused by the descent of air from an elevation fairly well agrees with the facts."

The outstanding labor of his life, and for which Morley is best known among chemists, is his work on the density of oxygen and hydrogen and the ratio in which they combine. He was occupied with this during most of the twelve first years he spent in Cleveland and had it ready for publication in 1895. It came out as Smithsonian Contribution to Knowledge, No. 980, and also appeared in German in the *Zeitschrift für physikalische Chemie*. This research placed him in the very first rank of scientists. In it one sees his remarkable insight into the fundamental nature of the problem, his great skill in devising and manipulating apparatus, his precision of measurement and his great patience and perseverance in overcoming obstacles at times seemingly insurmountable. It is a remarkable tribute to his work that now, after nearly thirty years, the accepted values of these quantities, which are the averages of the best recent work in this field, are practically identical with those found by him.[1]

Many other papers published by Morley during or after this period were the results of work bearing on this central problem, as, for example, "On the amount of moisture remaining in a gas after drying with sulfuric acid," "On the amount of moisture remaining in a gas after drying with phosphorus pentoxide," and "On the vapor tension of mercury at ordinary temperatures."

He devised a gauge for measuring small differences of gaseous pressure. This was of two types, one of which he used in collaboration with Professor D. C. Miller in determining the

[1] To consider the density of oxygen alone: in the annual report of the Committee on Atomic Weights for this year (1923) the average of recent determinations is given as 1.42892, which is identical with Morley's figures when reduced to the same standard.

thermal expansion of air, nitrogen and a few other gases, and the other with Mr. C. F. Brush, by means of which differences of gaseous pressure as small as one ten-thousandth mm. of mercury could be measured.

Professor Morley was as eminent a physicist as chemist. His characteristic for precision of measurement is exhibited by his early papers on "Rulings on glass" and "The probable error of micrometric measuremeents." After coming to Cleveland he collaborated with Professor Michelson in the development of the interferometer, an instrument for measuring lengths in terms of the wave-length of light. With this instrument they undertook their well-known experiment on the relative motion of the earth and the luminiferous ether, which was carried on at the same time as the research on the densities of oxygen and hydrogen. A little later with Professor W. A. Rogers he perfected a method for measuring the expansion of metallic rods with the interferometer. After the work on oxygen and hydrogen was out of the way he again resumed the experiments on the drift of the ether with Professor D. C. Miller. Although these experiments yielded negative results as far as the expected magnitude of the motion was concerned, they aroused a great deal of interest, and Professor Miller has since repeated them under more favorable conditions at Mount Wilson Observatory. Professors Morley and Miller also made use of the interferometer in measuring the velocity of light in a magnetic field.

Professor Morley with all his greatness was by disposition of a most retiring and modest nature, almost too much so for his own good, as he was but little known outside the ranks of chemists and physicists. He was in no sense a self-advertiser. However, after the completion of the work on oxygen and hydrogen in 1895 honors were showered upon him. He was president of the American Association for the Advancement of Science in 1895, and of the American Chemical Society in 1899. In 1901 he was the American delegate to the General Conference on International Weights and Measures in Paris. Previously, under the Harrison administration, he was one of the four members at large of the committee to receive the United States Prototype Metric Standards at the White House. In 1907 he was awarded the Sir Humphry Davy Medal by the Royal Society of London, in 1912 the Franklin Institute of Philadelphia conferred upon him the Elliot Cresson Medal, and in 1917 he received the Willard Gibbs Medal from the Chicago section of the American Chemical Society. In 1912 he was honorary president of the Eighth International Congress of Applied Chemistry. He received honorary degrees from many universities: LL.D. from Western Reserve in 1891, from Williams in 1901, from Lafayette in 1907, from the University of Pittsburgh in 1912, and D.Sc. from Yale in 1909. He was an honorary member of the Royal Institution of London, the Chemical Society of London and the American Chemical Society. In addition to this, he was a member or fellow of the National Academy of Sciences, the American Philosophical Society, the American Society of Arts and Sciences and of many other learned societies in this country and abroad.

Professor Morley realized the importance of books in enabling one to keep abreast of the work being done in one's science. Since the college was unable to purchase books for him, he began at an early date to collect a library of the principal chemical journals and by the time he had completed his work on oxygen and hydrogen he owned personally one of the most complete sets of journals on pure chemistry to be found between New York and Chicago. He even purchased a number of Russian journals and learned to read this language so as to gain at first hand knowledge of certain researches which interested him in that country. On his retirement in 1906 the college purchased this library from him. It is now housed in the chemical laboratory, built in 1908-1909, for which he drew plans, and which is now known as the Morley Chemical Laboratory.

Professor Morley in general enjoyed good health and was possessed of remarkable vitality. But no constitution could withstand with impunity the strain of long hours and hard work which he continually imposed upon himself up to 1895. This so impaired his health that he felt obliged to rest, and he was granted by the college a year's leave of absence (1895-1896), the only one during his entire career. This he spent in travel and recuperation abroad. After this the college authorities granted him more assistance, so

that he took life easier and was able to enjoy some of its amenities.

Next after research he enjoyed exercising his skill on difficult chemical analyses, and during his last years in Cleveland he analyzed many complex minerals for his friend and colleague, Professor H. P. Cushing, who spent a portion of his time with the New York Geological Survey. After he retired from active teaching in 1906 and went to live in West Hartford, Connecticut, he built for himself a small laboratory where he still continued making analyses of this sort for Professor Cushing and for other friends interested in geology. His last published paper was with Professor J. P. Iddings on work of this kind.

Professor Morley had a remarkably retentive mind, so that practically everything which he read was stored in his memory, whence it could be drawn whenever needed. He not only possessed a remarkable clarity of expression in writing and speaking, but what is rarer, he had the ability to make scientific and abstruse matters interesting to the layman. His public lectures on such subjects as the ether-drift experiments were always well attended and every one manifested the keenest interest in what was being said.

He was a great lover of music and a good amateur musician. In the early days he played the chapel organ at Hudson, and in his later life derived much enjoyment from the pianola. After his retirement this versatility was a great help to him in getting the most enjoyment out of life. When he became weary at his analytical work, he would turn to music for relaxation. He also took a great deal of pleasure in out-of-door life, raising gladioli or taking trips through New England in his automobile, which he always drove himself. Only last summer he and Mrs. Morley, whose death preceded his by only a few months, took a trip into northern Massachusetts and Vermont in their machine.

He was taken to the Hartford Hospital for an operation on January 21. Another operation was found to be necessary about three weeks later, which was not serious and from which he was expected to recover. Unexpected complications, however, set in and the end came on February 24, just a few days after his eighty-fifth birthday.

Thus in the fulness of years passed a truly great man. The work he left behind him in both chemistry and physics is the best memorial to his genius. His teaching service extended over a period of thirty-seven years and endeared him to several generations of students. By his colleagues he was revered for his genial personality, the wisdom of his counsel and his unselfish service. His broad culture and noble simplicity of character enriched the lives of all those with whom he was associated.

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SCIENTIFIC EVENTS

INTERNATIONAL CONFERENCE ON STANDARDIZATION OF SERUMS[1]

IN December, 1921, an international health conference was held in London, under the auspices of the League of Nations, to discuss the standardization of serums and serum reactions; in December, 1922, a second conference for the same purpose was held in the Pasteur Institute, Paris, at the suggestion and under the chairmanship of Professor Madsen, president of the health committee of the League of Nations. Professor Neufeld, director of the Robert Koch Institute for Infectious Diseases, Berlin, who, with Wassermann, Kolle and Sachs, took part in the conference, gives a report of the proceedings in the *Deutsche medizinische Wochenschrift*, January 5, 1923. The transactions were carried on by subcommittees. The first dealt with the standardization of tetanus and diphtheria antitoxins. These investigations are nearly complete, and it is expected that an agreement will soon be reached as to a generally acceptable method of titration and standardization. Heretofore, not only have other countries used standards (immunity units) different from those of Germany, but there have been fundamental differences in titration. For example, in France, not only is Ehrlich's procedure used for the titration of diphtheria serum (combinations of toxin and antitoxin), but the effect on living diphtheria cultures is also tested.

A second subcommittee took up the question of dysentery serum, which, with us, is not re-

[1] From the *Journal* of the American Medical Association.