SCIENCE

VOL. 80 FRIDAY, OCTOBER 5, 1934 NO. 2075

SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. MCKEEN CATTELL and published every Friday by

THE SCIENCE PRESS

New York City: Grand Central Terminal

Lancaster, Pa. Garrison, N. Y.

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

SCIENTIFIC IDEALS[1]

By Dr. CHARLES L. REESE

THIS is the occasion on which your president makes his formal adieu to the society, as a whole, and makes ready for his successor, who, according to our custom, is already elected and waiting his time to take up his duties.

It has been my good fortune to serve the society in many capacities, during the last forty years, of both major and minor importance, within and without the direct activities of the society.

The object of all scientific work is the search for truth, requiring honesty of purpose, the enlargement of human knowledge and service for the benefit of mankind. These ideals, when properly instilled into the student, by the teacher, usually have the effect of stimulating honesty of character, which, I am glad to say, is characteristic of all scientists in general.

The search for truth, through a period of years, fascinates the worker and he learns to love his subject, and consequently, he pursues it with ever-increasing vigor.

Up to recent years, the chemists, imbued with these ideals, preferred to enter the teaching profession, to secure the opportunity to continue fundamental research in the search for truth and the advancement of our science, to lead the ideal life, offered only by the academic atmosphere, and to follow a career of service, not only to science, but, to the rising generation, chemists, as well as man in general.

There is no more noble profession, in my mind, than that of a teacher, with its marvelous opportunities for character building and training the minds of the younger generation. But, in science, research must accompany teaching to prevent him from becoming a mere pedagogue—to keep his own mind from being relegated into that of a mere machine and from losing touch with the advance in his profession.

[1] Presidential address delivered before the meeting of the American Chemical Society, Cleveland, Ohio, September 10, 1934.

The teaching profession was, up to the establishment of organized research in industry, the only means of earning a livelihood open to the young doctor of philosophy to continue his studies and advancement in his profession. The limited field in our colleges and universities, where time and facilities were available to allow this professor to do research work, drove many chemical idealists either into secondary schools or isolated colleges, with no scientific colleague to consult, or stimulate his mind, and he led a life of isolation, which produced scientific dry-rot.

The only thing which saved such men was the semi-annual attendance at the meeting of such scientific societies as the American Association for the Advancement of Science, where they could make contact with men prominent in all fields of science, including his own profession, and then, later, the meetings of his own Chemical Society. He receives, even to-day, stimulation from the acquaintances made with the leaders in science, generally, in the former society, and his own science, in particular, in the latter.

Men located in such isolated or small institutions, in those days were said to be in "Pordunk" and they frequently occupied what were called "settees"—where they were required to teach, not only chemistry, but also other sciences, such as physics, mineralogy, geology, physiology or anything else. Is it any wonder that well-trained chemists, full of their ideals as scientists, hungry to do research work, were professionally without time to think? Thank God, I do not believe such conditions exist to-day, to any great extent. Is there any wonder that men imbued with true scientific spirit sought relief in industry or manufacturing pursuits?

To revert to the "science settee"—this is probably a relic of the early days, when scientists were not only chemists, but also physicists, geologists, mineralogists and in the early nineteenth century physicians as well, and the professors of science, in the best of our institutions, held such "settees."

Professor J. Norman Collie, in his lecture, "A Century of Chemistry at University College," made an interesting statement about Professor Thomas Graham, who succeeded Professor Turner in 1841 as the second professor in chemistry at University College in London and became later professor of practical chemistry. As an expression of Professor Graham's loyalty to his ideals, he says:

> The temptations of technical chemistry, by yielding to which, he would soon have secured a fortune, he disregarded. He dedicated his life to the nobler object of advancing the bounds of natural knowledge, and so, adding to those truths, which must ever remain for the good and the furtherance of humanity. He was one of the founders and first presidents of the Chemical Society of Great Britain, and was also the founder of the science of colloid chemistry.

In 1845, George Fownes became his colleague in practical chemistry. George Fownes's principal contribution was his "Manual of Chemistry," published in 1844, which went through eleven editions, and which is of interest to me, because this was my first textbook in chemistry, under Dr. John W. Mallet, at the University of Virginia.

Mallet, the seventh president of our society and probably the only British subject to have held that office, was Irish by birth and was born in Dublin in 1832. He took his degree at Trinity College and his doctor's degree in Göttingen, under Wöhler in 1853. Coming to this country, that same year, at the age of twenty-one, he later became chief chemist for the Confederacy, and manufactured their gunpowder. He was famous as an analyst and for his determination of the atomic weight of gold. He was a gentleman and a chemist of the old school. He lectured on physics, as preparatory to chemistry, on organic and inorganic chemistry, and also gave a course of lectures on industrial chemistry, covering the reaction and machinery used in practically every industrial process, involving chemistry, known at the time, from heavy chemicals, metallurgy, alloys, down to beer, wine, glass and every known substance related to chemistry at that time, and even to bread-making. His lectures were illustrated not only from the finest collection of industrial products I have ever known, from all parts of the world, but he also had the most remarkable facility for making the most beautiful, accurate drawings of industrial equipment, in colored chalk, on the blackboard.

This, I believe, illustrates the character of practical chemistry which was taught primarily during the first three quarters of the nineteenth century.

Dr. Remsen, the first professor of chemistry in the Johns Hopkins University, well known to many of you, was thoroughly imbued with the ideals of promoting and teaching only pure science and would have nothing to do with the practical or industrial side of the profession. It was only with great difficulty that he was persuaded to allow a course of lectures to be given by one of his assistants on industrial chemistry, such as was given by Mallet and his British teachers. But, on one occasion, however, Dr. Remsen admitted that he had fallen from grace, by assisting a brewer, pointing out that his difficulty was due to polluted water. After his retirement, he became consultant for a great oil company.

I know, however, no professor of chemistry, in this country, who did more to inspire his pupils with scientific ideals, to promote fundamental research, or who trained more competent professors of chemistry,

to be found to-day at the head of chemical departments of many of our universities and colleges. Many of the more recent graduates have, perhaps, fallen from grace and entered the industrial field, heading to-day industrial research, and even becoming executives, vice-presidents or presidents of industrial corporations.

Owing to easy profits made in the chemical industry, on up to the early eighties, there seemed to be no call for chemists, except for analytical work, but increasing competition and price-cutting made it necessary to find means to reduce costs, improve products and make new products, for the service of mankind.

These considerations caused certain industrial executives in 1900 to conceive the idea of establishing a central organized research chemical laboratory or department, with a dual purpose—one of studying existing processes, improving yields, and, thus preventing waste, to improve products in quality and cheapen them; the other to develop new and improved products, either in their own line or even to develop new industries. This broad program called for research of a high order and a considerable organization, which soon grew to be an important division of the concern. The wisdom of the step soon demonstrated the value of the idea. It resulted in much reduced costs to both producer and consumer, at the same time giving them many improved products. It has also, since that time, enabled them to branch into and establish many other industries of the greatest importance to our country, and led to the employment of thousands of men, not only wage-earners, but of scientists, engineers and office men.

It is interesting to note that the U. S. Bureau of Standards, well known to all of you, was established in 1901. It has grown into an institution of pure and fundamental research of the greatest importance to the country and its people, as well as to its industries. Here, not only official standards of weight and measure are established, but scientific standards as well as physical units. Through their large staff of trained scientists, many of them taught and trained within its own walls, it is called upon by all divisions of the government to make specifications for its purchases and tests, to see that the specifications are lived up to. Even states' and city governments call upon the bureau for work, without charge, but its activities have, of late, been curtailed, by the economies of the government, through loss of valuable and experienced personnel.

The U. S. Bureau of Standards may be classified as a publicly owned and great fundamental research laboratory, where all the physical sciences are represented, including chemistry, which has kept pace with industrial laboratories, and has been of great assistance to them.

The opening of the twentieth century may be considered as the date of birth of a new era in the growth and development of the chemical and allied industries of this country. This development put us into a position to meet the exigencies brought about by the world war. The growth and multiplication of industrial research organizations caused an increase in the number of students entering the profession and also stimulated increased activity in our colleges and universities.

This outbreak of the war and the depredations of submarine warfare, together with our entry into the war, created a tremendous demand for more and more well-trained chemists. The country can well be proud of the manner in which professors of chemistry, in our universities, stepped into the breach. They provided chemists for the industry, as well as by offering their own services to the government. In the Army and Navy, in the great laboratories created by the government, not only this, but the entire Chemical Warfare operation, including the great chemical manufacturing arsenal at Edgewood, headed by the late Colonel Walker, from the Massachusetts Institute of Technology, were manned by professors, students and industrial chemists and chemical engineers of the country. At the same time, it enabled us to establish the great industry that provided synthetic drugs and medicines, which, before the war, came mostly from Germany, to continue their supply of medicines, much needed, independent of foreign supply.

It also enabled us to establish a dye industry, which to-day supplies the country with a complete line of dyes, of all kinds, including the fast dyes. This accomplishment was brought about by American chemists thoroughly imbued with the ideals of science made possible through the seizure of German patents, by the enemy property custodian, Mr. Francis P. Garvan, lawyer, but one of the best layman friends the American chemist has had. Through his office, as president of the Chemical Foundation, by his determination to advance the sciences and the industry and stabilize it in our country, he is the greatest chemical idealist not a member of the profession.

The teaching and industrial leaders have always been in close touch in supplying and employing well-trained workers, and this close contact in war work brought them together, personally, as do the meetings of our great society, so that there is a close personal contact and friendship between most of them.

Many professors are employed as consultants by the research organization in industry, to the mutual benefit of both, in their own particular line of work and, I am sure, with no detriment to either. These

men and their coworkers are all actuated by the same ideals of the search for truth and honesty of purpose, for, after all, they are of the same breed. No scientist in industry could be of any other type, or he certainly would be a failure.

Some of our well-organized industrial laboratories are in a sense universities and trainers of men, and some of them maintain divisions devoted entirely to fundamental research for the advancement of human knowledge, in conjunction with their divisions for industrial and practical work, employing chemists, physicists, engineers and chemical engineers, patent lawyers, mechanics and laborers.

The following information is taken from the Bulletin of the National Research Council on Industrial Research Laboratories of the United States, as of January 1, 1933: There were 1,575 industrial and consulting laboratories against 1,625 reported in 1931. There are no personnel statistics in the fourth edition of 1931, but from the fifth edition of 1933 one can roughly calculate the personnel reported. These figures show 23,743 in 1933, with a loss of 12,847 from the 1931 figures, with a total of 36,590 in 1931.

In the publication of the National Research Council entitled "Profitable Practise in Industrial Research," Donald C. Jackson states:

> It is estimated that there are now (1932) in the neighborhood of thirty thousand research workers directly attached to technological problems, and that only about five hundred investigators are supported in the less restricted research of university laboratories and research foundations. The ratio is disquieting. Multiplication of the five hundred is a need. The fertility of industry is likely to wane unless new knowledge may continue forthcoming at a rate which is in suitable keeping with the rate of industrial application; and, unless new means for making the applications are constantly in review.

This was a revelation to me, if it is true, since I was of the impression that the figures were more nearly equal. When we consider the number of research fellowships and graduates doing research, working in our universities and colleges, and done under the supervision of our professors, the number of university workers must be larger. But Professor Jackson seems to forget the ever-increasing amount of scientific literature, from the entire world, evidenced by the growth of our chemical journals. Far from me to decry, however, the need of more work of this character, in our own country. But science is, fortunately, universal and up to date, it knows no bounds of nationality, its results are a free gift to humanity.

From the same book, to which I have already referred, Mr. William Spraragen, of the Research Council, in a chapter entitled "Trade Association Research," lists thirty-eight such associations, carrying on industrial research and spending annually, approximately, one and one half million dollars.

This work is being conducted in 24 of their own laboratories, in 24 universities and 22 government laboratories, separately or in collaboration.

It will thus be seen that a large amount of industrial research is actually being carried on in university and government laboratories—seventy laboratories being involved in all.

This work is doubtless of value to the universities, the professors as well as the associations. But, of course, such results must be made public. It doubtless broadens the professors' view-points and brings up countless fundamental problems, which should be solved, to add to human knowledge. Such work is done through fellowships, making it possible for the universities to secure equipment, which they could otherwise not provide, and is also done at government laboratories, by a system of research associates maintained by the industries.

Most of our institutes of technology also carry on industrial research, mostly of a fundamental character, and have accomplished much in improving and creating most efficient industrial chemical equipment. They have aided industry to a remarkable degree on such operations as distillation, filtration, grinding, and so forth, known as unit operations to the chemical engineer.

Practically all industrial research is founded upon the vast amount of fundamental work accomplished by the hosts of professors, throughout the world, who have gone before and who have created our sciences, as well as by those who are now with us.

Much honor to them, for man can but marvel at the progress of our sciences, during the past and since the discovery of the common elements and the introduction by Lavoisier of the quantitative factor, which destroyed the alchemistic fallacy.

May I be pardoned if I mention some of those who were instrumental in bringing about the "New Era" in the chemical and allied industries or who were leaders in organized industrial research.

One spontaneously thinks of our beloved Willis R. Whitney, formerly president of our society, founder of and director for many years of the General Electric Company's research laboratory, at Schenectady, and now one of their vice-presidents; a man of high order of vision, but, coupled with it, much common sense; a true scientist, even carrying scientific methods into his hobbies.

I do not know the date of establishment, but it did not antedate the first decade of the twentieth century by many years.

The accomplishments of this laboratory need no

comments, as they are well known to most of you. It is interesting to know, however, that many of their most valuable accomplishments are due to men like Langmuir and Coolidge, as a result of purely fundamental research, men who, through their work, are known and honored throughout the world.

Arthur D. Little, also one of our past presidents, has done much to advance the chemical industry, with his commercial industrial laboratory, where the work is of the highest scientific order, actuated by all the ideals of the search for truth. Any one visiting the museum in his laboratory can obtain some idea of what he has accomplished, even to the famous silk purse, made from a sow's ear.

I will pass over the organized research departments of the du Pont Company. It was, however, started in the first year of the present century and its growth and accomplishments stand for themselves, so I will leave that for others to comment upon.

The Messrs. Mellon founded the Mellon Institute with a rich endowment. Under the leadership of the present director, Dr. Edward R. Weidlein, its success has been phenomenal. It offers free space and ordinary equipment to any industry wishing to take advantage of its laboratory and organization, for the mere salary of a fellow. It is a non-profit-making institution, but work accomplished there has created or at least started on its way one of the largest and most successful chemical industries in the country and many smaller ones.

I am sure that Dr. Weidlein's leadership and genial personality has had much to do with the success of that institution. The new laboratory of the Mellon Institute, soon to be dedicated, is itself a noble monument to the donors and to industrial research.

It will be impossible to mention all, but such men as F. B. Jewett, organizer of what is, perhaps, the largest industrial laboratory in the world; the late Herbert Dow, who founded and built up a great industry based entirely on research; C. E. K. Mees, of the Eastman Kodak Company; E. C. Sullivan, of the Corning Glass Works, whose research products in glass are so important to the chemist and the cook; George D. McLaughlin, of leather fame; F. C. Kettering, of General Motors Corporation, and others, whom I would like to mention and praise, must be mentioned with the highest respect. Such men were called "industrial explorers" by Maurice Holland, in his work by that title.

Progress can not continue, in this material world of ours, any more than spiritual progress can be attained, without the eternal search for truth, constant endeavor to open the vistas of nature, through, not the work of the individual, but rather by the coordinated work and thought of many.

Love of the beautiful, in nature and art, the love of music, of thought expressed in art and architecture, or in literature and poetry, are the evidences of God in man, and so I feel that the man or woman who devotes his life to the search for truths in nature has the spirit of God in him. It is only by such spirit that we can possibly approach the laws of nature, which has brought order out of chaos in the universe, has made man and given him the power to think.

RELATIONSHIP OF VETERINARY SCIENCE TO ANIMAL BREEDING AND PUBLIC HEALTH—LEGAL PROTECTION OF THE PRACTISE OF VETERINARY SCIENCE.[1] II

By Dr. JOHN R. MOHLER

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LEGAL PROTECTION OF THE PRACTISE OF VETERINARY SCIENCE

For the extension of its usefulness to humanity in all ways, legal protection of the practise of veterinary science is an important consideration. The advancement of veterinary science in the United States has been measured in large degree by the protection and encouragement afforded through enactment of laws relating to education, practise and civil service.

Being a union of states, our governmental system provides for a distinct division of powers between the federal and state governments. There are, accordingly, certain laws applicable to the country at large and others which are limited in their operation to the confines of individual states. It is the function of our Congress and of state legislatures to enact laws, and while certain acts of our national Congress have been far-reaching in their influence upon the veterinary profession, due credit must be given to the various state legislatures for the helpful laws which they have enacted.

LAWS RELATING TO THE PUBLIC SERVICE

The first legislation in the United States materially affecting veterinarians developed as the result of the existence of contagious pleuropneumonia of cattle.

[1] Address by the president of the Twelfth International Veterinary Congress, Waldorf-Astoria Hotel, New York, N. Y., August 13 to 18, 1934.