and as papers were read at meetings of the scientific societies, presenting the problems that had been met, their solutions through applied research and the value of the outcome to the public, scientists in general came to realize that there was a tremendously worth-while job for science to do in promoting the nation's industrial progress.

At the same time, I think, the supercilious aversion on the part of some scientists to industrial contacts faded out. It was at one time a very real thing. Hardly a quarter century ago, thirteen or fourteen years after our laboratory was started, there was another General Electric laboratory in another city which was headed by a scientist obsessed with that aversion in extreme form. His laboratory had accumulated some data which might be helpful in a development of ours, so a letter was written asking for them. His reply was that he feared we contemplated making use of those data in some commercial development, and in that case he would be unwilling to give them to us. I don't know whether he had time to change his attitude toward commercialism, for his association with industry was rather brief.

If there is a scientist to-day who regards industry as barren of interesting problems or contaminating in its contacts, he must be a rare bird, for I do not know one of his species.

Meanwhile industry's attitude to science has been undergoing a change equally profound. During the first fifteen years of our laboratory's existence, the relatively few companies maintaining research laboratories were accumulating proof of their value, but it took the experience of the last war to bring home to American industry what industrial research really means. When the British fleet took its strangle-hold on German commerce, our industries were forced to realize how dependent they had become on the output of German laboratories. Dyes, anesthetics and other essential drugs, optical glass, chemical reagents, magnesium metal and powder and many special alloys were no longer obtainable. American research mobilized to supply the lacks, and, when the United States entered the war, made very important contributions to the national defense. Had it not been for the few industrial research laboratories then in existence, and the university scientists who volunteered or were drafted for the emergency, American industry would have been in worse straits and our Army and Navy would have lacked some of their most effective defense facilities.

While the lessons of the war were fresh in the American mind, the National Research Council undertook to drive home the implications of those lessons, to make industry research-conscious, and to advise in the organization of research, both by the larger individual companies and by industries when the companies composing them were small.

In consequence there are now nearly two thousand industrial research laboratories, and organized research has come to be accepted by industry as an essential activity, as necessary for progress and prosperity as financial control and accounting.

A comparison of conditions to-day with those of forty years ago reveals a change which is fairly revolutionary. The leaders in the revolution were those companies which pioneered in research. But their leadership would have been ineffective, if they had not been able to demonstrate to science and industry alike that industrial research could be a plentiful source of both scientific and industrial progress. The creation of the research era of American industry required more than the fiat—let there be industrial research. Laboratories had to be so organized and directed that the scientist would find in them opportunity for the full exercise of all his ability, and problems calculated to arouse his enthusiasm and inspire his best efforts, while at the same time the industrialists must be able to derive from them products which would increase business and profits. To accomplish such a fusion of the scientific spirit with the profit motive, to inspire enthusiastic team-work within the laboratory, while knitting the laboratory's work, through full cooperative effort, into the company's organization with its diverse activities of engineering, manufacture and sales, required leadership of a new and different kind. The success of an industrial research laboratory in its early years depends almost wholly on the quality of its leadership.

Those of us who have been long in the laboratory and can remember the difficulties under which we often labored in its early years, the frequent failures and disappointments, remember also the sympathetic encouragement, the infectious enthusiasm, the resourceful suggestions and the unflagging assistance we derived from our leader.

And so to-night, thrilled as we have been by the kindly tributes to our laboratory and its achievements, we realize with gratitude and affection how much of the credit should go to our laboratory's founder and builder, Dr. Whitney.

OBITUARY

RAYMOND PEARL

RAYMOND PEARL possessed, to an exceptionl degree, knowledge, originality and an intellectual drive which were a stimulus to all who had contact, either directly or indirectly, with the products of his mind. A pioneer in the application of quantitative methods in

biology, he gave great impetus to the development of this field, both through his own extensive research and through the training of students. His sudden death on November 17 cut short an extraordinarily productive career, the influence of which has been world-wide.

Born in Farmington, New Hampshire, June 3, 1879, Raymond Pearl received his undergraduate training at Dartmouth College with the class of 1899, and his graduate training at the University of Michigan, obtaining his doctorate in biology in 1902. He was married in 1903 to Maud M. DeWitt of Sandusky, Ohio, who was also a biologist and became an active collaborator in Dr. Pearl's work. Two daughters, Ruth DeWitt (Mrs. G. P. Jencks) and Penelope Mackey, were born to them.

Dr. Pearl remained with the University of Michigan as instructor in zoology for four years after taking his degree, the last year of this period being spent in study at Leipzig, the University College at London and the National Zoological Station at Naples. In London he studied with Karl Pearson at the Galton Laboratory, and this contact with the new field of biometry and the active minds that were developing it had a profound effect on the future direction of Dr. Pearl's career. His interest in quantitative studies in biology had, however, been evidenced before his London experience, for as early as 1901 he had done research on variation of fishes while working with the U. S. Fish Commission on a biological survey of the Great Lakes.

Returning to this country, Dr. Pearl spent one year as instructor in zoology at the University of Pennsylvania and then became biologist and head of the department of biology at the Maine Agricultural Experiment Station, a position which he held until 1918, when he came to The Johns Hopkins University. His principal studies at Maine were in connection with poultry and they covered many problems of fundamental importance in genetics, disease, and population aggregates. Two books written during this time (with F. M. Surface and M. R. Curtis), "Poultry Diseases and Their Treatment" (1911) and "Diseases of Poultry" (1915), greatly advanced the concepts in this field and have served as a guide to subsequent work along this line.

Following the war, in which Dr. Pearl acted as chief of the statistical division of the U. S. Food Administration, he became a professor at The Johns Hopkins University where he remained until his death. In 1918, the School of Hygiene and Public Health was established at this university and Dr. Pearl was appointed its first professor of biometry and vital statistics, a position which he held until 1925. The breadth of his academic activities is indicated by the fact that he served the university in the following positions: As director of the Institute of Biological Research and as research professor in the School of Hygiene and Public Health from 1925–30; as statistician for The Johns Hopkins Hospital from 1919 to 1935; as professor of biology in the School of Medicine from 1923 until his death; as professor of biology in the School of Hygiene and Public Health from 1930 to his death.

His greatest interest through this career at The Johns Hopkins University was in the quantitative approach to the biology of man and of other animals in population aggregates. A vast amount of material collected by Dr. Pearl and his coworkers through field studies, hospital records, experimental studies, vital statistics reports and other published works, were analyzed for their quantitative relationships in inheritance, longevity, reproductive patterns, growth, population size and vitality. It is impossible to cover in a brief space the colossal amount of work Dr. Pearl accomplished in both the collection of data and their analysis during the past twenty years. Seven of his books, written during this period, present some of the results of this endeavor, and their titles indicate the range of his interests: "The Biology of Death" (1922); "Studies in Human Biology" (1924); "The Biology of Population Growth" (1925); "Alcohol and Longevity" (1926); "The Rate of Living" (1928); "Constitution and Health" (1933); "The Ancestry of the Long-Lived" (with Ruth D. Pearl) (1934); "The Natural History of Population" (1939). In addition to these books in the field of human biology, Dr. Pearl also wrote a text-book entitled "Introduction to Medical Biometry and Statistics," the first edition of which was published in 1923, and the third, a complete revision, in 1940. All of these books, as well as his numerous contributions to scientific journals, contained new ideas which were out of the general pattern, and were provocative of thought and discussion. As is always the case with the output from such a mind, his work challenged and met opposition, and thus demanded careful evaluation of data, and clear statement of hypotheses. Its value lies, therefore, not alone in the share it has given to the present accumulation of scientific knowledge, but also in the spur that it has been to the thinking of workers in science.

The two scientific journals which Dr. Pearl established, *Quarterly Review of Biology* and *Human Biology,* fill a very unique place in the scientific literature. His editorial work in these journals had been shared by Mrs. Pearl, who is now assistant editor of the former and managing editor of the latter. Dr. Pearl also had acted as associate editor of seven other journals in this country and abroad.

The recognition which Dr. Pearl received throughout his career came from so many sources that it is not possible here to present a list of the numerous honors accorded him. He was a frequently sought lecturer, the recipient of honorary degrees from three

institutions, a member and fellow of many scientific and honorary societies in this country and abroad. He served at some time as president of a number of these societies, on the council of the National Academy of Sciences and on the executive board of the National Research Council.

One of the founders of the International Union for the Scientific Investigation of Population Problems, Dr. Pearl served as its first president. He gave a great impetus to a movement that has turned serious thought to problems of the utmost importance to students of social trends.

Dr. Pearl was a very wide reader, and the enjoyment and profit which he found in his general reading was evidenced in his book "To Begin With" (1927) in which he made an appeal, particularly to graduate students in science, to discover for themselves the satisfactions to be gained through reading.

In music, also, Dr. Pearl found especial satisfaction, devoting much of his meager leisure to it. Brought up in a musical family, he had at one time or another played most of the wind instruments, and after coming to Baltimore in 1918, he undertook to master the difficulties of the French horn. He became very proficient and for many years had played in two amateur musical clubs of which he was a member.

For a person of Dr. Pearl's enormous activity, it is perhaps fitting that he should stop in the midst of things. His work, however, has not come to an end, for within the university which he served, to the students whose minds he stimulated and in the scientific world to which he made such vast contributions, his influence will continue indefinitely.

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SCIENTIFIC EVENTS

DAMAGE FROM BOMBS TO THE ROYAL BOTANICAL GARDENS AT KEW[1]

IT is so long since I have heard anything from you, or you from me, that I know you will be very grieved to hear how greatly Kew has suffered from enemy action.

Several high explosive bombs have dropped in the Gardens, as well as oil bombs and incendiary ones. Until recently we had not suffered very much damage, as the big bombs which fell were in the far parts of the Gardens. One fell at the north end of the Rhododendron Dell, where it only rooted up a few ordinary Rhododendrons and, of course, made a huge crater. The others fell in grassy spots in the Queens Cottage Grounds and made craters some 25 feet across, but did no damage otherwise, and the oil and incendiary bombs fell on lawns in various places and did no particular harm. A few days later some 6 smaller bombs were dropped near the Isleworth Gate and some were also dropped in the Sion House Meadows across the river. These damaged a good many trees. Some three weeks ago, however, a bomb fell on a house in the Kew Road, close to the Cumberland Gate, and very much glass was broken in Museum No. 1 and in the Orchid Houses, the Sherman-Hoyt House and other places. A bomb which fell on the other side of the river, at Brentford, caused a good deal of damage to the Herbarium, as the blast broke about 100 panes of glass in the middle wing, and a bomb which fell at the foot of Kew Bridge, on our side, broke much glass in No. 4 Museum and in most of our houses along the Kew Road.

Our worst damage unfortunately took place about a week ago when a bomb fell in the early morning in front of a house in the Kew Road, near the North Gallery. The blast from this blew down some 60 yards of our boundary wall and did much damage to the North Gallery and the two adjoining houses in the Gardens. The pictures in the North Gallery, however, had all been removed some time previously to a place of safety. The blast from this bomb also smashed thousands of panes of glass on the east side of the Temperate House, and I fear it will be impossible to repair the damage and should there be a bad winter, no doubt many of the fine specimens will perish. About the same time another bomb fell between the Palm House and the Azalea Garden and destroyed a number of interesting trees in the Ash collection and the blast smashed many hundred panes of glass in the Palm House itself and in the Water Lily House. Here again it will be very difficult to effect repairs and save some of our unique plants, but I am hoping that we shall be able to make sound the southern end of the Palm House, where magnificent Cycad specimens are housed. On the evening of the same day, three bombs fell again near the Temperate House, one in the Heath Garden to the West of King William's Temple, where many interesting Chinese Rhododendrons, Arbutus and other plants were smashed to atoms, and the blast from this bomb broke much more glass in the northern end of the Temperate House. An oil bomb fell close to the Temperate House, but as this smashed a water main, no particular damage was

[1] Dr. E. D. Merrill, Director of the Arnold Arboretum, submits this private letter, recently received from London, indicating the extent of damage to the Royal Botanic Gardens at Kew from indiscriminate bombings. The Director of the Royal Botanic Gardens is Sir Arthur Hill, recently honored by being awarded the George Robert White Medal of the Massachusetts Horticultural Society.