that amorphous preparations contain traces of a substance which inhibits trypsin and so prevents the autocatalytic reaction. As soon as this inhibitor is removed by crystallization the most minute trace of trypsin starts the activation reaction, which then proceeds autocatalytically. This reaction agrees quantitatively with the theory for a simple autocatalytic reaction. The velocity is affected by acidity and temperature in the same way as is the activation of chymotrypsinogen or hydrolysis of other proteins by trypsin. At pH 5.0 and 8° C. the value of the constant is 14.6, *i.e.*, with unit concentration of trypsinogen the active trypsin would increase 14 times per hour. This reaction evidently has a formal resemblance to bacteria growth curves. The addition of trypsin inhibitor to such solutions causes the production of a long lag period, and the curves obtained under these conditions are very similar to the usual bacterial growth curves. As in the case of chymo-trypsin there is no evidence for the splitting off of any part of the molecule during this activation reaction nor is there any marked change in chemical composition so that the change from the inactive protein to the enzyme is probably due to some internal rearrangement in the structure of the molecule. However, the work on this question is still in the preliminary stage. The autocatalytic nature of this reaction was correctly described by Vernon but subsequently denied by Bayliss and Starling and others.

Kunitz has recently found that trypsin is formed by trypsinogen at pH 5.0 by a proteolytic enzyme secreted by a mold (Penicillium). Trypsin is inactive at this pH, so that the activation curve is no longer autocatalytic but simply logarithmic as is the activation of chymo-trypsin. Trypsin obtained in this way is identical with that formed by autocatalytic activation. The mold enzyme, therefore, must attack the molecule at the same place as does trypsin.

Pepsin from pepsinogen: Langley showed that pepsin existed in gastric mucosa in a form which differed from the active enzyme in that it was much more resistant to alkali. Herriott has recently succeeded in isolating and crystallizing this substance. It has no proteolytic activity, but in slightly acid solution becomes converted into active pepsin. The reaction at pH 4.65 is autocatalytic and hence is caused by pepsin itself. About 15 per cent. of the nitrogen is split off during this reaction. So far as is known, pepsin attacks only peptide linkages so that there is reason to believe that the rupture of one or more peptide links in the precursor leads to the formation of the active enzyme. If swine pepsinogen is activated by chicken pepsin, swine pepsin is formed. The structure responsible for the species specificity of the enzyme therefore is present in the precursor.

Kinetics of the formation of bacteriophage: Bacteriophage, in common with the other viruses, possesses the property of increasing in the presence of living cells. In the case of bacteriophage the phenomenon may be quantitatively described under certain conditions by assuming that the percentage increase in the concentration of bacteriophage is proportional to the percentage increase in the number of bacteria per cc and that when the ratio of phage to bacteria passes a certain critical value the bacteria dissolve.

Under the usual conditions no increase in phage occurs without increase in bacteria, and it was thought at first that the multiplication of bacteria was a necessary condition for the increase of phage. Krueger has recently shown that the phage does increase under certain conditions without a corresponding increase in the number of bacteria. The formation of phage is, therefore, formally at least, analogous to the autocatalytic formation of trypsin from trypsinogen. The analogy extends even to the presence of a phage inhibitor in bacterial suspensions (Burnett, Levine) corresponding to the trypsin inhibitor in crude trypsinogen solutions. This inhibitor is responsible for the difficulty encountered in producing autocatalytic activation of trypsin in crude trypsinogen solutions. Krueger has recently shown that this phage inhibitor also interferes in the production of phage in cell free extracts and that when the inhibitor is removed a small increase in phage may be noted in such cell free extracts.

The assumption that phage produces itself autocatalytically from a precursor present in normal cells appears to fit the facts at present. This assumption is far simpler than the complicated series of assumptions involved in the idea that the phage is a living organism and avoids the difficulty of accounting for the necessary energy, if it is assumed that the phage synthesizes itself from simpler compounds.

OBITUARY

EDWARD LEAMINGTON NICHOLS

EDWARD LEAMINGTON NICHOLS was born in Leamington, England, on September 14, 1854, of American parents. After his graduation from Cornell in 1875 he studied in Leipzig, Berlin and Göttingen; and from the latter university received the degree of doctor of philosophy in 1879. During the year 1879–80 he held a fellowship in the Johns Hopkins University and in the following year was one of the assistants of Edison in his famous Menlo Park Laboratory. In 1881 he became professor of physics and chemistry at Central University in Kentucky; in 1883, professor of physics and astronomy in the University of Kansas. In 1887 he returned to Cornell, where he remained as head of the department of physics until his retirement from active teaching in 1919. He died on November 10, 1937.

Nichols's activity as an investigator began when he was still a student and extended to within only a few years of the time of his death. Neither lack of facilities nor pressure of other work could lessen his interest or greatly reduce his activity. During his first year as a college teacher, many miles from a railroad and with no provision for apparatus or laboratory equipment, he carried on a difficult and dangerous experimental investigation on the undercooling of vapors. When for a period of two years he served not only as head of the department of physics at Cornell but also as dean of the College of Arts and Sciences, he still continued his experimental work on luminescence. Nichols was a firm believer in the value of scientific research to humanity. But he also greatly enjoyed his experimental work for its own sake. One might almost say that his belief in the value of science was as much the justification as the cause of his scientific activity. In my long association with him I was again and again impressed by the vigorous and almost joyous way in which he met and overcame experimental difficulties and by his enthusiastic welcome of new and unexpected results. His attitude was that of a young athlete engaged in a game which called for all his energy and skill, and which for that very reason he thoroughly enjoyed. No one could be associated with him long either as student or colleague without acquiring in some degree this same attitude toward scientific work.

In his work as an investigator he contributed to almost every branch of the physics of his day and was a pioneer in several important fields, such as illumination, physiological optics and luminescence. In recognition of this pioneer work he was awarded the Ives Medal of the Optical Society, the Elliott Cresson Medal of the Franklin Institute and the Rumford Medal of the American Academy, and was made an honorary member of the American Optical Society and of the Illuminating Engineering Society. In the case of the latter society Nichols and Edison were for many years the only recipients of this honor.

Nichols's enthusiasm for his subject and his friendly and sympathetic interest in the problems and difficulties of his students made him a most inspiring teacher. Not long after he became head of his department in 1887, it was my good fortune to spend a year as a graduate student under his guidance and I can well understand the reason for the respect and affection which all his students since have felt for him. Later as a junior member of the department I saw how he was able to inspire the whole staff with his own enthusiasm; encouraging us to develop our own ideas and methods, while protecting us by friendly comments from the serious blunders of inexperience, and giving us finally far more than proper credit for the results accomplished. Later still, for nearly twenty years, we did our experimental work together and published the results in joint articles. During these years Nichols's attitude toward our experimental work was a continual revelation to me of the scientific spirit at its best. The same spirit was shown in his treatment of matters outside the field of science, and his wise and altogether unprejudiced approach to the general educational problems of the university made him a most valuable member of the faculty.

In these days of rapid progress and widespread interest in all branches of science it is hard to realize how insignificant was the contribution of this country to the physical sciences sixty years ago. In only a few universities was scientific investigation actually under way, or even regarded as a proper function of the college teacher. Industrial research laboratories were not even mentioned as a possibility. Nichols contributed more than any other physicist of his generation to change this situation, and he was almost the last remaining member of that small group of men who kept physics alive in this country during the last two decades of the last century and prepared the way for the remarkable progress of the last twenty years. His enthusiasm and untiring activity as a scientific investigator served as an inspiration to others. As president of the Physical Society, of Sigma Xi and of the American Association for the Advancement of Science, he kept continually before the public the importance of scientific work. He was one of the most active of the small group who organized the American Physical Society in 1899. The *Physical Review*, founded by Nichols in 1893 and conducted for the first twenty years under his editorship, was the first journal of physics in this country and was an important factor in stimulating scientific activity.

Almost equally important was the indirect influence which Nichols exerted through the students who had received their inspiration from him and who later entered the field of college teaching or industrial physics. At the time of his retirement the heads of the departments of physics in thirty-five colleges, fifteen of them state universities, were men who had received their physics training from him. Add to this list the large number of his students who held important posts in government and industrial laboratories, or who were college teachers but not department heads, and we get some idea of the extent of his indirect influence on American physics.

For one who was as successful as he in a special field Nichols's interests and information extended over a surprisingly wide range. He was by no means a narrow specialist. Undoubtedly this breadth of knowledge and interest was an important factor in making him so successful as a teacher. He was an enthusiastic traveler and although his sabbatical leave was usually spent in Europe had visited at some time each of the six continents. He was a most delightful companion on a journey, whether in fair weather or foul. A sincere and active church member, Nichols saw no conflict between science and religion, but merely two different aspects of that search for truth to which his life had been devoted. He will be held in affectionate remembrance by all who knew him, but especially by those of us who as his students and associates received encouragement and inspiration from his life and work.

ERNEST MERRITT

RECENT DEATHS

PROFESSOR T. NELSON DALE, formerly professor of geology at Vassar College and Williams College and for twenty-eight years—1892–1920—geologist of the U. S. Geological Survey, died on November 16. He would have reached the age of ninety-two years on November 25.

DR. CHARLES B. LINDSLEY, professor of mathematics at the University School, Cincinnati, Ohio, died on November 17 at the age of fifty-six years.

SCIENTIFIC EVENTS

ERADICATION OF THE DUTCH ELM DISEASE

FEDERAL forces made gains during the past summer in the fight on Dutch elm disease. The number of diseased trees found this year dropped twenty-five per cent. below last year in the territory where the infection is known to be of a serious epidemic character—an area extending fifty miles radially from New York City into Connecticut, New York State and New Jersey.

The disease has spread to no new territory this year, nor has it recurred in Baltimore, Brunswick and Cumberland, Md., Norfolk, Va., or Cleveland and Cincinnati, Ohio, where seventy-eight infected trees had been found in the past. Apparently they were discovered and removed in time to keep them from becoming sources of new infection. The only new centers of infection brought to light this season were one diseased elm at Athens, Ohio, and five diseased elms at Wileys Ford, W. Va. These trees have been destroyed. New infections along the boundaries of the major zone were limited to single trees in Alexandria Township, Hunterdon County, N. J.; Cornwall Township, Orange County, N. Y., and the town of Redding, Fairfield County, Conn.

There were 3,100 workers in the field from May 29 to October 1, and three examinations were made in the major area of infection and two in the 10-mile wide protective zone around it. Investigations in Indianapolis, Ind., where the disease has been present since 1934, showed an increase this year. Laboratory cultures of twig specimens from suspected trees proved the presence of the infection in 31 trees. All have been removed. As the campaign advances, it is necessary to look more closely for evidences of the disease and samples of all elms showing any symptoms of abnormality were collected. Twig samples from more than 75,000 elms with yellowed or wilting leaves and signs of brown streaks beneath the bark were sent to the laboratory for the culturing that proves the presence or absence of the disease.

An autogiro observer investigated 11,000 miles of railroad rights of way, over which the imported logs that brought the disease to this country traveled inland to be made into veneer for the cabinet makers. A follow-up ground crew visited points marked on his map. Three other autogiros were used to carry investigators over inaccessible areas in and around the major zone.

Winter activities will center on the removal of dead and devitalized elms, not necessarily infected with Dutch elm disease, but which furnish breeding places for the elm bark beetles that spread the fungus from infected to healthy trees. All elms will be removed from some areas of heavy infection and from certain swamp or mountain areas where summer work is particularly difficult and dangerous. This will make it impossible for the fungus to persist and for insect carriers to survive in areas where all diseased trees have been destroyed. In summarizing the season's activities for 1937, Lee A. Strong, chief of the Bureau of Entomology and Plant Quarantine, commended the aid given by WPA labor.

THE FINNEY-HOWELL RESEARCH FOUNDATION

AT the death of the late Dr. George Walker, of Baltimore, his will provided for the formation of a corporation to be known as the Finney-Howell Research Foundation, the purpose of which was to be the support of "research work into the cause or causes and the treatment of cancer." The will directed that the surplus income from the assets of the foundation together with the principal sum should be expended within a period of ten years to support a number of fellowships in cancer research, each with an annual stipend of two thousand dollars, "in such universities, laboratories or other institutions, wher-