sphere of such small diameter as that of a virus, is therefore inapplicable to viruses of the size of the vaccinia group—about 150 millimicrons. The existence of these free-living organisms raises the hope that means may yet be found for growing some of the pathogenic viruses in artificial culture.

Analysis of some recent studies of nutrition in Great Britain has shown the relative constancy in the distribution of calories between protein, fat and carbohydrate eaten by people in different towns: in particular, the percentage of protein eaten is constant, at 10–11 per cent in St. Andrews, Cardiff and Reading. In spite of this, the types of foodstuffs eaten are widely different: in fact, the constant percentage intake of protein and the similar calorie intake of people living far apart, are obtained independently of the type of foodstuff eaten and seem to represent the result of some kind of instinct. As regards the daily calorie intake, a recent investigation of the diet of more than a hundred women students showed the daily intake to be 2,035 calories per person. This intake is considerably less than the usual standard of 3,000 calories, which has itself been considered by some workers to be too low. The analysis of these diets led to the conclusion that few can be considered really poor: on the other hand, many of them, particularly with reference to their content of 'protective' foodstuffs such as milk, green vegetables and fruit, leave much to be desired. The remedy is the education of the average housewife in the relative nutritive value of different foodstuffs.

Epidemic diseases still remain one of the greatest enemies of mankind, although some have been partially or even completely conquered. Problems relating to the spread of epidemics have been studied by field investigations of epidemics naturally occurring among human beings; but there are still many problems which have resisted field investigation because the difficulties of collecting statistical evidence prevent the assessment of the

importance of inter-related factors. The experimental study of the spread of epidemics in a population of mice, as carried out for many years at the London School of Hygiene and Tropical Medicine, has provided answers to certain of these problems. Thus it appears that in large herds living under conditions favourable to the spread of epidemic disease, and receiving regular additions of healthy animals, the disease will persist indefinitely. The form of the mortality curve and the size of the herd are determined mainly by the rate of immigration. In epidemics initiated by virulent organisms, the rate of mortality during the early days of herd life is high, reaching a low level between the fortieth and sixtieth days of cage life. The expectation of life from the twentieth to the thirtieth day rises continuously but never reaches that of normal healthy mice. It is considered that both selection and natural immunization play a part in the increased average resistance displayed by surviving animals, the latter being the more important.

Another important subject which is discussed in the report is the problem of the prevention and treatment of puerperal (or childbed) fever. Summing up the present position, the report states that modern investigation suggests two lines of prevention, with a reserve line of treatment if the first two lines of defence are broken down. First, childbirth should be so conducted that access of pathogenic organisms to the birth-canal is rigorously excluded, especially streptococci from the throats of medical attendants, friends or the patient herself. Secondly, the diet should be of such a nature as to raise the resistance to infection to the highest possible level; this means an ample consumption of milk, green vegetables and other protective foods. Finally, if infection does occur, there is evidence that the new chemotherapeutic compounds, 4-sulphonamido-2-4 diaminoazobenzol and *p*-aminobenzene sulphonamide, will reduce both the mortality and the incidence of complications.

Obituary Notices

Prof. W. M. Wheeler

IN the death of Prof. William Morton Wheeler, the United States loses an outstanding personality in the biological world and a man whose reputation spread far beyond the confines of his native country. The first intimation of his death received in England was a telegram from Dr. T. Barbour of Harvard University to Prof. J. Stanley Gardiner, on April 21. He died suddenly in Harvard Square, Cambridge, Mass., on the evening of April 19, after having only very recently returned from a journey in Mexico.

Born at Milwaukee (Wisconsin) on March 19, 1865, Wheeler graduated from the German-American Normal College in that city in 1884. In June 1885, he became a teacher of German and philosophy in the High School, Milwaukee, under George W. Peckham, a well-known student of spiders and social insects. In 1887 Wheeler became custodian of the public museum in his native city, and gave up this post in 1890 on being made a fellow of Clark University, under G. O. Whitman. He graduated Ph.D. there in 1892 and, in the same year, became instructor

in embryology at the University of Chicago: in 1897 he was assistant professor. While at Chicago, Wheeler went on study leave to Europe (1893-94), working under Boveri at Würzburg, and at Liège; he also occupied the Smithsonian table at the Naples Zoological Station. In 1899 he became professor of zoology at the University of Texas; in 1903 he was made curator of invertebrate zoology in the American Museum of Natural History, New York, and from 1908 until 1935 he was professor of entomology at Harvard University. In addition to the last-named post, he was dean of the Bussey Institution of that University from 1915 until 1929.

Much of Wheeler's early researches were in the domain of general zoology—especially morphology and embryology. Mention may be made of his work on the development of the urino-genital system of the lamprey (*Zool. Jahrb.*, 13, *Anat.*; 1899): his contribution on the peculiar Annelid *Myzostoma* (*Naples Mitt.*, 12; 1896) and his large treatises on insect embryology (*J. Morph.*, 3; 1889: 8; 1893) besides several articles written in German and contributed to the *Zoologischer Anzeiger*. Wheeler's work on insect embryology, it may be added, is still important to-day. This kind of occupation, however, failed to satisfy him: "My association with Peckham, Whitman and Patten," he wrote, "had converted me into a hard-boiled morphologist." Henceforth he devoted himself to the insect world and developed his predominant interest in ant life. On this subject alone he must have published more than a hundred and fifty papers, covering most aspects of their economy. On the systematic side he has left a great output of high-class work, but it was the living creatures which attracted him most and especially the peculiar relations of ants to other insects and to the plant world. In addition to his great text-book on ants (1910), in the Columbia Biological Series, the treatise of more than 1,000 pages on the ants of the Belgian Congo (1921-1922) is a monument to his industry and to the other workers who collaborated with him. Wheeler's lectures given at the Lowell Institute, Boston, in 1922 formed the basis of his book "Social Life among the Insects" (1923). This work was greatly amplified in the elaborately documented "Social Insects, their Origin and Evolution" (Paris, 1926; London and New York, 1928). In 1928 there were also published his books "Emergent Evolution and the Development of Societies" and "Foibles of Insects and Men". In 1931 there appeared the book "Demons of the Dust: A study in Behaviour"—an attractively written study of parallelism in evolution as revealed by two widely divergent insect types. His last book was "Colony Founding among Ants", published in 1933, but I believe that he left material for at least one other book at the time of his death. He was active to the very end, and some of his latest papers only came to hand a few weeks ago.

All who knew Wheeler—and his friends are scattered in many lands—will feel a sense of personal loss, for he inspired genuine affection and regard. Many will recall his keen sense of humour as revealed in his published addresses and other writings, or in

telling a good story. During his teaching career, at the Bussey Institution, each year brought its quota of students who came to work under him. Many who have now made distinguished careers owe their start to Wheeler's counsel and guidance. His interest was mainly in the research man rather than the undergraduate. Having discussed a programme of work with a student, the latter was usually left to his own devices, for Wheeler rarely visited his students in the laboratory. All who brought their difficulties to him, however, found him both helpful and sympathetic. Wheeler possessed the faculty of inspiring confidence in his men and succeeded in stimulating their best efforts.

Wheeler was a man of simple tastes and with the mind of a scholar. Besides a knowledge of the classics, he was thoroughly familiar with several European languages. His favourite reading for a number of years past covered many aspects of philosophy, psychology and sociology, written in several tongues. With this background, ripened by extensive travel and first-hand observation in the tropics and other lands, he brought to bear a penetrating insight into his interpretation of the evolution and behaviour of social insects. As expositions of such phenomena his writings are unsurpassed.

Wheeler belonged to most of the chief scientific societies of America. He held the degrees of Sc.D. of Harvard and Chicago Universities and of LL.D. of the University of California. He was an honorary member of the Entomological Societies of France and Belgium and was one of the twelve honorary fellows of the Royal Entomological Society of London. His first visit to Europe was in 1893 and he last visited England in 1935, when he attended the British Association meeting of that year. He married Miss Dora Bay Emerson of Rockford, Illinois, in 1898, who survives him together with a son and a daughter.

A. D. IMMS.

Prof. L. Mangin

LOUIS MANGIN, former director of the Museum national d'Histoire naturelle in Paris, died at Orly on January 27 last. Born at Paris on September 8, 1852, Mangin was of Lorraine origin. He first studied botany under Le Monnier at Nancy and then with van Tieghem at Paris. He became professor of natural sciences at the Lycée of Nancy when twenty-one years of age, and at Louis-le-Grand when twenty-nine. His first researches showed the influence of his teachers and were concerned with plant anatomy and physiology; his thesis for his doctorate was on the adventitious roots of Monocotyledons. In collaboration with Gaston Bonnier he undertook research on respiration, transpiration and carbon assimilation, with results which are of interest in the historical developments of these subjects. This was followed by investigations on the physiology of Basidiomycetes, pioneer work which has not been much added to in the fifty years which have since elapsed.

Mangin then turned his attention to the structure of cell membranes, and by his methods of micro-chemical analyses and differential staining laid the