Certain aspects of food structure and microbial interrelations were dealt with by Mr. F. Baker and Mr. H. Nasr (Rowett Research Institute). They showed how comparisons can be made, chiefly by direct microscopy, of the relative importance of microbial agents and gut secretions in the digestion and assimilation of various food materials, special attention being given to starch. The nutritional consequences have been studied in a variety of animals and have been found to depend on the anatomical structure of the alimentary tract, the structural organisation of the food material and the growth and activities of specific micro-organisms. Detailed study of microbial digestion of starch in the cæcum of the pig has been carried out. The organism chiefly responsible for the breakdown has been isolated and typed as *Cl. butyricum*. This organism is capable of producing an alpha amylase in cell-free filtrates. The kinetics of the enzyme and its action on twenty-three starches have been studied. *Cl. butyricum* is capable of synthesizing a polysaccharide and some members of the vitamin B complex. They include riboflavin, nicotinic acid, pantothenic acid, pyridoxine and folic acid. Whether and to what extent the vitamins synthesized by microbial agents are available to the animal is being studied. The solution of the problem has a direct practical bearing on the relative nutritional value of cooked and uncooked potatoes in diets fed to pigs.

Dr. I. McDonald (Institute of Animal Physiology of the Agricultural Research Council) spoke on some aspects of the role of microbes in the digestion of proteins by ruminants, and pointed out that the special usefulness of the ruminants to mankind is largely to be found in their capacity to act as converters of plant proteins to specific animal proteins. Curiously enough, although a great deal of effort has been devoted to the estimation of the apparent digestibility of the proteins of feedstuffs by ruminants, comparatively little attention has been paid to the physiological processes underlying the digestion, absorption and utilization of nitrogenous substances.

The activities of ruminal microbes may lead either to a net gain or loss of nitrogen to the host animal. Digestion of cellulose is the primary function of the rumen, and hence the supply of nitrogen for the growth of cellulose-splitting organisms becomes an essential requirement for ruminal function. The microbes are able to utilize nitrogenous substances, other than amino-acids, for their growth, and the subsequent digestion of the microbes yields protein to the host animal. Ammonia occupies a key position in ruminal metabolism; it is probably the chief source of nitrogen, apart from amino-acids, for bacterial growth; it is formed by hydrolysis of urea (from saliva or feedstuffs) and by deamination of protein, and may accumulate to high levels in the rumen fluid. Ammonia is absorbed from the rumen and converted into urea by the liver, thus establishing a nitrogen cycle via the saliva, rumen and liver; excess of absorbed ammonia would be excreted as urea in the urine. When the microbes use protein as the source of nitrogen for growth, a new assemblage of amino-acids is presented to the host animal for digestion; this change may either enhance or reduce the biological value of the feed proteins. The microbes synthesize not only protein but also a variety of other nitrogenous substances, especially nucleic acids, which probably represent waste products for the host.

In their discussion on vitamin synthesis in relation to requirements, Drs. K. M. Henry, S. K. Kon and J. W. G. Porter (National Institute for Research in Dairying) pointed out that microbial synthesis of vitamins of the B-complex and of vitamin K takes place in the intestine of most animals. In ruminants, synthesis occurs mainly in the rumen, which precedes the main digestive and absorptive tracts; thus conditions for the release and absorption of vitamins are specially favourable. Such synthesis supplies all or most of these vitamins needed by ruminants. In non-ruminants, synthesis proceeds mainly in the large intestine. Conditions for absorption are less favourable, since vitamins within microbial cells excreted intact are not available to the host, and vitamins present outside the cells are poorly absorbed. Nevertheless, non-ruminants derive some benefit from this microbial synthesis.

Dr. J. Tosic (Unit of Chemical Microbiology of the Medical Research Council) wound up by referring to the data he had collected while at the Rowett Research Institute for certain of the constituents of rumen contents during a digestion cycle in sheep. These indicate some of the environmental conditions under which rumen micro-organisms attain their great density and chemical activity; these in turn are associated with the transformation and digestion of the ingested food in the rumen. In discussing the anabolic cycle of rumen micro-organisms, mention was made of their ability to assimilate cobalt and other 'trace elements' from their external environment, and the available figures were briefly discussed in relation to some possible mechanisms of cobalt and other 'trace element' deficiencies in the ruminant.

In the discussion which followed, Dr. E. C. Owen (Hannah Dairy Research Institute) pointed out that this symbiotic phenomenon is of very general occurrence in the animal kingdom, and instanced the bacteria in the intestines of wood-eating insects such as the termites and wood wasps. He also mentioned Florkin's recent reference to the cellulose-splitting activities of bacteria in the digestive tract of snails and slugs.

Miss M. I. Chalmers (Rowett Research Institute) indicated the extent of loss of nitrogen which may occur in the urine when a protein such as casein is introduced into the rumen of the pregnant sheep held on a plane of nutrition such as would have been expected to induce a definite retention of dietary protein.

D. P. CUTHBERTSON

OBITUARIES

Dr. J. N. Keynes

DR. JOHN NEVILLE KEYNES, who died at his home in Cambridge on November 15, at the age of ninety-seven, was born at Salisbury on August 31, 1852, to John Keynes and his wife, Anna Maynard Neville. After studying at University College, London, he went up to Cambridge as a member of Pembroke College. He took the Moral Sciences Tripos, which at that time included political economy, and was Senior Moralist in 1875. In the following year he became Fellow of Pembroke. In 1882 he married Florence Ada, daughter of the Rev. John Brown. His wife, who survives him, has played a prominent part in the municipal life of Cambridge and has been mayor of the town. They had two sons and one daughter. The eldest son, who became Baron Keynes of Tilton, was perhaps the ablest and most many-sided Englishman of our time; and his death, in what should have been

the prime of life, was a great loss to his country and to the science of economics.

Dr. Keynes was university lecturer in moral science in Cambridge during 1884–1911, and registrary of the University during 1910–25. He had been chairman of the Special Board of Moral Sciences (1906–12) and of the Special Board of Economics and Politics (1908–20). After his retirement, at the ripe age of seventy-three, he enjoyed another twenty years of mental and physical health and happiness. He played golf until an advanced age, often with his colleague in moral science, the late Prof. Sorley, and he was interested to the last in his collection of stamps.

Keynes's most important contributions to science were in formal logic and in the logic and methodology of economics. His work "Studies and Exercises in Formal Logic" was first published in 1884. It was several times re-written and enlarged and was last reprinted in 1930. It is far and away the best textbook that exists on the old-fashioned formal logic. Keynes settled a number of ancient and troublesome controversies by drawing certain important distinctions. In this respect his contributions to the discussion of connotation and of existential import, and his distinction between conditional and hypothetical propositions, were particularly valuable.

The one book which Keynes published on economics, "Political Economy, its Scope and Relations", has the same kind of merits. It remains the most important contribution made by an Englishman to a topic which has been much neglected in Great Britain, though studied intensively by German economists. Keynes supplemented this book by contributing a number of important articles on allied topics to Palgrave's "Dictionary of Political Economy". His main interests are well indicated by the following titles: "Analytical Method", "A posteriori Reasoning", "A priori Reasoning", "Deductive Method".

The large and distinguished congregation at the memorial service in Pembroke College Chapel, and the moving brief address by the Master, bore witness to the affection and respect in which Keynes was held. It was a fitting tribute to an eminently useful, unpretentious life of clear honest thinking and hard efficient work in the service of science and of the University of Cambridge.

C. D. BROAD

Dr. Frank B. Jewett

FRANK BALDWIN JEWETT, whose death has recently been reported, was born at Pasadena, California, on September 5, 1879, son of Stanley P. and Phebe (Mead) Jewett, and graduated A.B. at the Throop Polytechnic Institute (now the California Institute of Technology) and the University of Chicago, from which he obtained the degree of Ph.D. He married Fannie C. Frisbie, who was herself a science graduate.

His professional work began when he was appointed in 1901 to be research assistant to Prof. A. A. Michelson at the University of Chicago, where he met R. A. Millikan, with whom he formed a close friendship. In the following year he went as instructor in physics and electrical engineering to the Massachusetts Institute of Technology. His association with industry began in 1904, with the American Telephone and Telegraph Co; later he was with the Western Electric Company (1912–25), of which he became vice-president. He was made vice-president in charge of development and research of the American Telephone and Telegraph Co. in 1925, and president of the Bell Telephone Laboratories (1925–40) and chairman of the board of directors until 1944.

During the First World War he saw military service in the U.S. Signal Corps, and was also appointed a member of the State Department Special Committee on Cables. He was awarded the Distinguished Service Medal. In the Second World War, he was a member of the U.S. National Research Council and the National Defense Committee, and received the Medal for Merit.

As might be expected, many honours came to Jewett. He received honorary degrees from several American universities. Among the medals awarded to him were the Edison Medal of the American Institute of Electrical Engineers, of which he was president during 1922–23, the Franklin Medal of the Franklin Institute, the John Fritz Medal of the United Engineering Trustees, and the Hoover Medal of American Societies of Civil and Mechanical Engineers (1949). In 1935, he was given the Faraday Medal of the Institution of Electrical Engineers in Great Britain. The American Telephone and Telegraph Co. established in his honour the Frank B. Jewett Fellowships in the Physical Sciences.

An assignment of work brought him early under John J. Carty, when in 1908 he was made leader of a research team dealing with part of the large problem of how to extend telephony so as to cover the whole of the United States. This problem was solved when in July 1914 New York spoke with San Francisco, and commercial service began early in 1915. His success in this brought him increased responsibilities and culminated in the establishment of the famous Bell Telephone Laboratories, of which he was president for sixteen years. After he retired as president of the U.S. National Academy of Sciences he was in a position to assist in the formation of the National Defense Research Committee.

Jewett had been well prepared educationally for the great work he was to do. He showed a keen intellect, honesty in thought, integrity, sincerity, a pleasant manner, a respect for the personality of others and a voice which charmed. All these gave him an amazing talent for friendship, to which I can testify from some forty years association with him. Those working under his direction did so, not only because his direction was good, but also because it was a labour of love for the leader. He gave an extraordinary example of how to manage men and how to weld together teams of persons (even difficult personalities) into efficient units. For many years he suffered from defective eyesight; but he never allowed this to reduce his wonderful output of work.

Jewett showed more than the minimum requirements of justice, mercy and humility, and all who knew him will feel regret at his passing, but thankful for their remembrance of him.

FRANK GILL

WE regret to announce the following deaths:

Prof. Alfred S. Barnes, formerly professor of electrical engineering in the University of Manchester, on November 11, aged eighty-one.

Mr. George Moores who, with the late Mr. J. H. Lester of Manchester, was jointly responsible for the beginning of the movement which led to the founding of the Textile Institute in 1910, aged eighty-seven.

Mr. Frank Stevens, director of the Salisbury, South Wilts and Blackmore Museum, on November 14.