biological, microbiological and physico-chemical. Each has its difficulties and is being subjected to intensive study by teams working in collaboration. Although results in some cases leave something to be desired, important advances have been made, and it is now possible to assay with some degree of accuracy the most important members of the complex.

The application of such methods to brewing materials and processes is a recent development, and it is now known that several members of the vitamin B complex are to be found in beer, in amounts which may have some dietary significance. Detailed investigation has so far been devoted to aneurin, riboflavin and nicotinic acid. Other members of the vitamin B complex are under examination, and findings are likely soon to be published. These include pantothenic acid, pyridoxin and biotin; but their position with reference to human nutrition in general still needs some clarification.

In the case of aneurin, there is some loss when barley is malted, but little change in mashing and boiling. In fermentation, however, a remarkable change takes place, most of the aneurin in the wort being taken up by the yeast at the expense of the beer, which cannot therefore be regarded as a very good source of the vitamin. The amounts reported, in μgm. per pint, range from about 7 to 35, and contents as high as 85 have been found in certain strong ales.

With regard to riboflavin, there is increase both in malting and in fermentation, many yeasts having the power of synthesizing riboflavin, with the result that the beer contains appreciable amounts and the yeast crop is greatly enriched. The riboflavin content of beers ranges from 200 to 800 μgm. per pint, the higher limit being attained only by some strong ales.

Nicotinic acid is also present in appreciable quantity; derived like the others from the original barley, there is some increase in malting, after which the subsequent processes involve slight losses. Yeast appears neither to synthesize nor take up significant amounts of the vitamin. Finished beers contain from 2 to 11 mgm. per pint, with an average of 5 or 6 mgm.

The three vitamins discussed above are known to have important relations to carbohydrate metabolism in that they are constituents of enzymes concerned. It should be remembered in this context that the carbohydrates (and nitrogenous substances) in beer make their own demands on these vitamins, and only after such demands are met will the balance of the vitamins make a positive contribution to the general diet. It is difficult accurately to assess such contribution; but it is safe to suggest that a moderate consumption of beer increases the vitamins generally available, at least so far as riboflavin and nicotinic acid are concerned.

The antiseptic and other constituents of hops, while important as agents which give beer some of its pleasing characteristics, are of no direct nutritional significance; but it should be mentioned that the presence of these substances and the conditions of manufacture render beer, from the microbiological point of view, one of the safest of our beverages.

There would seem to be a case for a systematic study of the constituents of beer in relation to modern views on nutrition. While the results of this would be interesting and even important, it has to be admitted that in this case—as in many others—the public consumes the product primarily because it likes it.

OBITUARIES

Dr. F. W. Lanchester, F.R.S.

Dr. F. W. Lanchester died at his home in Birmingham on March 8, and the world of engineering lost a figure of the type which is perhaps only just beginning to be appreciated—a great physicist who applied his knowledge and critical mind to engineering problems. He was born on September 23, 1868, was educated privately and received his scientific training at the Royal College of Science, South Kensington. His earlier days were devoted to the automobile world, and he is generally credited with having produced the first motor-car driven by an internal combustion engine in 1895–96. He certainly founded the Lanchester Motor Co., Ltd., in 1899, and the firm's first product contained many unique features typical of his genius and unorthodox views. He was afterwards associated with the Daimler and B.S.A. companies, and then took up the compression ignition engine with Messrs. Beardmore, which activities lasted up to 1930.

Since 1930, Lanchester has been a free-lance consultant, and has often surprised those who were privileged to know him by the breadth of his interests. Unfortunately, he was attracted only by the academic interest of problems, and it usually fell to others to reap both the credit and the financial rewards of his original thinking. Lanchester had too big a mind to allow this to deter him, although the unfairness of it sometimes led him into controversies that have often caused him to be labelled 'difficult'. It has been said of him that "his brilliance blinded those around him and some never recovered from their blindness". An extremely sensitive nature made it impossible for him to fight even for his just rewards, still less to accept anything that carried a suggestion of charity, and consequently he died really poor.

Lanchester's name will be honoured, perhaps more than anywhere else, in the world of scientific aeronautics. He presented papers to the Birmingham Natural History and Philosophical Society in 1894, and to the Physical Society in 1897 on the subject of aerofoil theory, the concepts of which are to-day firmly established as the theory of lift and drag. His two volumes, "Aerial Flight, Aerodynamics and Aerodonetics", published in 1907, laid the foundations of the theory of flight that remain uncontradicted and accepted everywhere to-day. This work, afterwards elaborated by Dr. L. Prandtl of Göttingen, is to-day known as the Lanchester–Prandtl theory, and this circulation theory is accepted universally as the basis of modern aerodynamic science. In 1916 he published a book entitled "Aircraft in Warfare", which was a reprint of a series of articles contributed by him to *Engineering* before the outbreak of the First World War. Many of the precepts that he laid down there have since become the commonplaces in warfare. Some of these, notably the airborne torpedo and the use of the naval aircraft carrier, only received their full recognition and development in the Second World War. During late 1939 and early 1940, *Flight* published what was probably some of his last scientific writing, entitled "Exhaust Efflux Propulsion", laying down a scientific basis of jet and rocket propulsion. The trend of development in these matters is already showing that his pioneering thought upon this subject is likely to prove as fundamentally correct as his other aerodynamic work.

In addition to the writing of books and articles, Lanchester was a member of the original Advisory

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Committee for Aeronautics, the forerunner of the present Aeronautical Research Council, during 1909–20, and it is impossible to measure the full extent of his advice and guidance in that body. He was a past-president of the Institution of Automobile Engineers, and held all three medals, the bronze, silver and gold, of the Royal Aeronautical Society. He delivered the Wilbur Wright Memorial Lecture to that Society in 1926.

Perhaps only those who were privileged to be intimate with Lanchester knew that he was also a poet, and had published two volumes of verse under the name of 'Paul Netherton Herries'.

The debt that the world of science, particularly aviation, owes to Lanchester has never been fully acknowledged, and it is a melancholy fact that we have had to wait for his death to prompt some of his associates to suggest the institution of some form of memorial to his memory. F. T. HILL.

Mr. Alfred Lucas, O.B.E.*

'BENCH-MARKS' established by Lucas are to be found in such various fields as the study of ancient and modern Egyptian materials and industries, the soils and waters of the Nile, the preservation and reconstruction of Tutankhamun's treasures, trials and courts-martial, and the route of the Exodus. He was a pioneer of modern science in Egypt, alert and precise, applying the severe discipline and manipulative skill of analytical chemistry with so deep a comprehension of essentials that he was neither dilettante nor don. Kindly to ignorance but merciless to fraud, he made even his smallest contributions into facts of historical importance for students of the many subjects which he illuminated. His encyclopædic local knowledge was conspicuously useful to England on the Scientific Advisory Committee to G.H.Q., M.E.F., especially during 1940–42, when Service supplies had often to be improvised locally. At the age of seventy-eight, while about to attend a commission on the state of the Theban tombs, he died in Luxor on December 10.

Lucas was born at Manchester on August 27, 1867, and went from private schools to the Royal College of Science and School of Mines in London. After eight years as assistant chemist at the Government Laboratory in London, he went to Egypt in 1897 for reasons of health. Egypt's climate arrested his tuberculosis, and in May of 1898 he joined the Salt Department as chemist under Mr. A. H. Hooker. A year later he left voluntarily when this department became the Salt and Soda Company, to be chemist to the Survey Department under Captain (later Colonel Sir Henry) Lyons in March 1899. Lyons built a small three-room laboratory in the garden of the Public Works Ministry, to which the Survey then belonged, and put Lucas in charge. The laboratory grew rapidly beyond its original purpose of analysing minerals; in 1912 it took over and re-organised the Assay Office, becoming a separate department called the Government Analytical Laboratories and Assay Office, with Lucas as director. Later it became the Chemical Department. Lucas resigned voluntarily on reaching the minimum age limit in March 1923. For help given by these Laboratories to the military authorities during 1914–18 he was awarded an O.B.E.; from Egypt he received the third order of the Nile, and the fourth of the Osmania.

Retirement meant only that Lucas continued his favourite pursuits with renewed vigour, and in the following months he was attached to the Antiquities Department, as chemist, until 1932. His services were lent to Howard Carter for cleaning and preservation work on the wealth of objects which had been found in the tomb of Tutankhamun, and for nine winters Lucas lived and worked at Luxor on them. The rest of each year was spent on other work at the Museum in Cairo. He helped to put the seventeen hundred objects on exhibition and, years afterwards, to store them against possible bombing and to bring them back to the exhibition rooms. His diplomatic abilities were freely exercised during those nine years. In 1932 his contract was not renewed, so he remained at the Museum doing voluntary work until December 1934, when he was given official status again with a small salary, after which he became honorary consulting chemist.

Apart from numerous contributions to chemical and archæological journals, Lucas published three books which are in steady demand. "Antiques, their Restoration and Preservation", in two editions, incorporated his practical experience and many devices. "Forensic Chemistry and Scientific Criminal Investigation" ran to four editions and a reprint; it revises several accepted beliefs, especially in ballistics. He had a wide experience as an expert witness, and during most of the Second World War he averaged two courts-martial a week, British or American, in spite of long-standing angina pectoris; he was not a witness to browbeat, for in pursuit of truth he would be outfaced by no man.

The third book, which is proceeding to a post-humous third edition, is perhaps Lucas' most important one. "Ancient Egyptian Materials and Industries" is amazing in its accuracy, fully documented with reference to every detail (though he was his own secretary) and gives short shrift to any archæological mis-statements. The direct experimental work which he had done for checking purposes ranged from mummification to the re-discovery of faience manufacture.

A small book on the "Route of the Exodus" is interesting as an example of close reasoning on topography, meteorology, and probability applied to the account given in the Old Testament. Two delightful little booklets on the history of Egypt and Libya were printed and distributed free to military clubs and hospitals during the War.

Scarcely any learned man did more for the troops in the Middle East during the War, showing them the interests which exist behind the unattractive modern façade of Egypt, by broadcasts, lectures, and demonstrations. All this was done at his own expense, and he told with glee how, for one appointment at a far-off camp during the early days, he was fetched in a loaded lorry but sent home in a staff car. His first broadcast lecture had been when the trumpets of Tutankhamun were heard by the world in April 1939. Taking parties of 'other ranks' through the Cairo Museum after it re-opened was one of his chief pleasures, with willing answers to every possible kind of question.

The scope, volume, and quality of his scientific work is realized by only a few of us, but it will be many years before research workers can afford to overlook any of his careful results and his balanced opinions.

W. L. BALLS.
The late R. ENGELBACH.
D. S. GRACIE.
H. E. HURST.
L. F. MCCALLUM.

* See also *Nature*, Jan. 26, p. 98.

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