

the Kennedy-Thorndike experiment showed that light (or, if hypotheses be introduced, a radiating atom) behaves as an ideal clock. This, of course, is highly figurative language, because it is a 'clock' which can neither tell the time nor be used to measure time intervals. The literal interpretation of the experiment is that Newtonian mechanics is peculiarly fitted for the treatment of light as a periodic phenomenon because the association of time and space measurements implied in Newton's first law is just that which makes λ and ν change by reciprocal factors, thus keeping the velocity constant.

Incidentally, two things may be noticed. First, the frequently heard statement that relativity has brought about a fusion of space and time has nothing mystical about it and it is not true. It is not mystical because the 'nature' of space and time is not involved; all that we are concerned with is the fitting together of measurements made in various ways. The statement is not true because the fusion of space and time, in the only sense in which it exists, was made by Newton when he chose, as a measure of time, the spaces covered by a freely moving body. What relativity has done in this regard is simply to show how that measure can be preserved in face of the experimental fact of the Fitzgerald space contraction.

The second point is that the conformability of light to Newtonian mechanics, established by the Michelson-Morley and Kennedy-Thorndike experi-

ments, makes it possible to define corresponding units of space and time in terms of light instead of Newton's hypothetical "uniformly moving body". This is, in fact, what Milne does in his theory of 'kinematical relativity'. In practice the two procedures are equivalent, at least to a high degree of approximation, as we know from experiment. Epistemologically, however, they differ profoundly, since Milne's definitions, being based on theoretically possible observations, are, in principle, rigorously realizable; whereas Newton's are ideal, and any observed departure of a moving body from uniformity of motion can be ascribed either to the time scale used or to the interference of a force. In other words, Newton's first law provides a language but says nothing; it cannot, therefore, be convicted of untruth, and the worst that can happen is that the language may be found inconvenient or incapable of providing expression for everything we find it necessary to say. Milne's postulates, on the other hand, are definite statements, and may be falsified by observation. The chance that this will happen is, of course, minimized by the fact that they are made to conform to all the experimental knowledge available at the present time. This safeguard was introduced by Milne when he modified his theory so as to identify the originally unspecified signals used by observers with light beams.

¹"Experimental Establishment of the Relativity of Time", *Phys. Rev.*, **42**, 400 (1932).

OBITUARIES

Mr. M. A. Bailey

THE scientific career of Maurice Armand Bailey ran its course to memorable achievement with what almost seemed to be predestined continuity. If circumstance played its part, a mind splendidly equipped for investigation, linked to a grand character, were the prime forces.

From Dulwich Bailey went up to Clare College, Cambridge, to read for the Natural Sciences Tripos and then for the diploma in agricultural science. After three years as a research student at the John Innes Horticultural Institution he joined the Royal Field Artillery in 1915, gaining in France the Military Cross and the rank of brigade major.

The appointment as senior botanist to the Ministry of Agriculture, Egypt, in 1919 turned the young geneticist into a plant breeder. For the next six years Bailey's studies of the cotton plant, recorded in a few excellent papers, developed a scientific attitude and procedure in practical breeding such as have rarely been achieved in that difficult art.

Transfer to the Sudan as plant breeder under the Empire Cotton Growing Corporation (attached to

the Sudan Government) gave Bailey a great problem and a grand chance. In that country cotton governs prosperity. A great irrigation scheme in the Gezira makes cotton-growing possible where rainfall is too scant and uncertain for any normal agriculture. But the soil is commonly recognized as the most intractable clay in the world, and climatic peculiarities in many seasons check the growth of cotton despite irrigation.

Average yields of cotton of 3.5 kantars a feddan had become customary and were remunerative, but in 1923 a virus disease, leaf curl, was reported, the occurrence being exceedingly rare. It spread so swiftly that by 1929 the whole Gezira, involving 200,000 acres of cotton, was seriously affected. In the ensuing years cotton yield fluctuated dangerously, but search for causes in soil factors, in seasonal effects and in disease, was for a time in vain. Leaf curl evidently played a great part, and in one bad year yields dropped to 1.36 kantars. Sudan fortunes were gravely menaced, but an outstanding combination of research in plant breeding, in entomology, in mycology, and in crop husbandry gained a victory,

of which the remarkable speed and extent are shown by the cotton yields of the years 1935-38, which were 4.65, 3.72, 4.47 and 4.55 kantars per feddan respectively.

When Bailey retired from the Sudan in 1938, cotton growing in the Gezira had been rescued and initial plans had been laid for the wider agricultural development of the whole country, including the non-irrigated south. Hope that the ability and character by which the Sudan had profited would play a great part in the National Institute of Agricultural Botany, which Bailey came home to direct, was ended by his death in Cambridge on October 16 last at the age of forty-nine.

It was specially fitting that a scientific worker born and educated in England and provided by Egypt with great opportunities for studying cotton should do his culminating work in the Sudan, in which these two countries have a condominium. He played two parts there. For the first six years plant breeding occupied all his time: for the remaining seven he was director of agricultural research. It was Bailey's clear planning and quiet persistent influence which led to the complete reorganization of the research service. He infused into it the spirit which has made it remarkable for success in conjoint work.

Leaf curl was checked by two lines of action. The Entomological, Mycological and Agricultural Sections, by a series of fine investigations, identified the vector (the white fly, an Aleurodid) and found means of exercising a considerable degree of control over it in field practice. Meanwhile, the Plant Breeding Section set itself to examine the possibilities of obtaining, by selection or crossing, new varieties which, while equal in lint qualities to the customarily grown Sakel variety and adapted to the peculiar Gezira environment, had the further merit of specific resistance to leaf curl. Hybridization had to be discarded because of its inevitable slowness, and all effort was concentrated on selection. The field was ultimately narrowed down to plants resulting from a single selection out of a field crop of Sakel in the Gezira made by Mr. A. R. Lambert of the Botanical Section in 1926. There finally resulted two strains known as X 1530 and X 1730 which, showing in trials all the desired attributes, had spread to an area of 130,000 acres in 1937-38. Systematic plant breeding has nowhere produced a quicker or more significant result than this. F. L. ENGLEDDOW.

Prof. A. P. Orekhov

THE death occurred on October 19, at the age of fifty-eight, of Prof. Alexander Pavlovich Orekhov, member of the Academy of Sciences of the U.S.S.R.

Orekhov was one of the most eminent experts in the chemistry of alkaloids in the Soviet Union. Concentrating his main research on vegetable bases, he ascertained that most of the alkaloids were not specifically characteristic of definite vegetable species or families and that one and the same alkaloid or alkaloids of similar structure may be found in plants

of different families. Under his guidance more than eight hundred kinds of new vegetable raw materials were studied, found mainly in the southern republics and provinces of the U.S.S.R. During this research were discovered a hundred new alkaloid-bearing plants and ten new families, previously not known to possess alkaloid-bearing representatives.

Orekhov established the structure of anabazine, salsoline, salsolidine, convolvine and certain other vegetable bases. Many of the alkaloids he isolated were afterwards identified as substances already known and obtained by other investigators from quite different vegetable raw materials. From the point of view of scientific theory, of special interest is his elucidation of the structure of the alkaloids convolamine and convolvine, which have been proved to be ethers of veratric acid and tropine. It was thus ascertained that the derivatives of tropine are encountered in quite new families hitherto not held to be alkaloid-bearing.

A. P. Orekhov created his own school of research workers, and the laboratory which he directed at the Chemical Pharmaceutical Institute attached to the Commissariat of Health became the principal centre for the study of the chemistry of alkaloids. His work on "The Chemistry of Alkaloids" is the standard work on the subject in the Soviet Union. He was elected a member of the Academy of Sciences of the U.S.S.R. in January of this year.

Prof. C. F. Shaw

THE death of Prof. C. F. Shaw of California removes one of the most prominent of America's pedologists. Prof. Shaw gained a reputation from his studies in the field of pure rather than applied soil science, his name being especially associated with the question of soil classification. He spent several years studying Chinese soils, besides having a wide experience of American conditions. His revolving-disk method of measuring and specifying soil colour has been one of the more notable advances in the technique of soil physics in recent years. He was an ardent believer in the American binomial system of soil nomenclature, and had been engaged for some years prior to his death in collecting and collating a world list of 'soil-series' names, which was to serve systematic pedology as the Linnean system has served botany. G. V. J.

WE regret to announce the following deaths:

Mr. P. H. Grimshaw, formerly keeper of the Natural History Department of the Royal Scottish Museum, on November 14.

Dr. R. von Ihering, chief of the Servico Federal de Piscicultura, Rio de Janeiro, on September 15, aged fifty-six years.

Dr. T. L. Pranker, lecturer in botany in the University of Reading, on November 11, aged sixty-one years.

Sir William Prout, K.C.M.G., O.B.E., senior consulting physician to the Colonial Office during 1927-29, on November 18, aged seventy-seven years.