

possess actions like it if the test objects are properly chosen. Not so much because a similar molecule such as tryptamine has the activity, but because something far removed such as 2,4-dichlorophenoxyethylamine does, the problem about specificity seems urgent.

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OBITUARIES

Prof. Carl Störmer, For.Mem.R.S.

WE regret to announce the death, on August 13, of Fredrik Carl Mülertz Störmer, renowned for his observational and theoretical studies of the aurora borealis. He was born on September 3, 1874, at Skien, Norway. He attended the University of Oslo (then Kristiania) during 1892-98. Later he studied at Paris, 1898-1900, and also, as a *Privatdocent* on leave from Oslo, at Göttingen in 1902. In 1903, at the early age of twenty-nine, he became the professor of pure mathematics at Oslo; this post he filled for the remainder of his official career. Between 1895 and 1903 he had published numerous mathematical papers, on series, the theory of numbers, and the theory of functions.

But in the year of his professorial appointment, his colleague, Prof. K. Birkeland, showed him a series of beautiful experiments on the movements of cathode rays in magnetic fields, particularly in the field of a magnetized sphere or magnetic dipole. This event permanently diverted Störmer's thoughts and research interest from pure mathematics to auroral theory. He knew that Poincaré had integrated the equations of motion of a charged particle in the field of a magnetic pole. This, and the experiments by Birkeland, impelled him to study mathematically the motion of a charged particle in the field of a magnetic dipole.

In 1904 he published the first of a series of papers on such trajectories. He found first integrals of the equations of motion, from which he was able to draw valuable and illuminating inferences. The complete solutions required numerical integration. Over many years he made or organized such calculations, and found a great variety of paths; his papers on this subject were continued until 1950, and constitute a major part of his life's work.

A second major part of Störmer's contribution to science began in 1909. He wished to compare his results with observation. For personal reasons he had mastered the photographic art, and he decided to apply his knowledge to auroral observation. His object was to determine the form and the position of auroras in space—namely, their height and their location in plan. This required simultaneous photography from two or more well-separated sites, connected by telephone. The Norwegian postal authori-

ties gave him special facilities for telephonic communication, and he gained the aid of distant assistants. Thus he placed our knowledge of the situation of auroras on a firm foundation. Most of our present knowledge of this subject is due to him, though his example stimulated his Norwegian colleagues Vegard, Krogness and Harang to add further valuable contributions. In 1913 Störmer made an expedition to Bossekop in northern Norway for such work near the auroral zone. Later, until almost the end of his life, he made similar studies in southern Norway.

His observational and theoretical results are part of the permanent structure of auroral science, though an adequate theory of the aurora is still lacking. Störmer's theoretical studies, being mainly concerned with the motion of a single particle, ignored the essential interactions between the positive and negative charges that must together be involved in the production of auroras. Happily his theoretical studies found an important and unexpected field of application—to cosmic rays. His speculations on radio echoes of long delay, which he associated with a supposed ring current beyond the Moon's orbit, cannot be regarded as established.

He was quick to recognize new auroral features revealed by his photographic syntheses. The most outstanding of these was the remarkable special character of sunlit auroras. He made valuable contributions to auroral spectroscopy, in which field his colleague Vegard was long the chief pioneer. He gave credence to reports of auroral sounds heard by some of his most reliable colleagues. He himself was a born observer, a true naturalist of wide interests. These included botany, the zodiacal light, mother-of-pearl clouds, and meteor trails; to all these subjects he made substantial contributions.

His multitudinous papers were written in Norwegian, Swedish, French, German and English, and were published in many journals and countries. He also wrote a popular work, the content of which ranged from astronomy and astrophysics to atomic physics: it appeared with much success in six languages.

In 1912, after Hale's discoveries of solar magnetism, Störmer visited Pasadena as a research associate of the Carnegie Institution of Washington. This led him to write on solar vortices and the structure of the solar corona. He gave many distinguished

lectures on the aurora in foreign countries, for example, at the opening of the Rice Institute, Houston, Texas, in 1918; at the Toronto meeting of the British Association in 1924; and at various British universities in 1930 and 1947. After his Halley Lecture at Oxford in 1947, the honorary degree of D.Sc. was conferred on him; he received a like honour from the Sorbonne. His last long journey was to the auroral conference at London, Ontario, in 1951. In that year he was elected a foreign member of the Royal Society.

In 1955 Störmer published "The Polar Aurora", largely devoted to a valuable connected account of his own observations and theoretical studies on the subject. It is dedicated thus: "To my wife Ada, who never ceased to encourage me to work hard till this book was safely finished". His happy marriage, during more than half a century, was blessed by many children, grandchildren and great-grandchildren.

SYDNEY CHAPMAN

Mr. M. F. W. Holland

THE announcement of the death of Michael Holland in north-west Greenland comes as a shock to many of the younger group now active in the lively borderland between geology, physical geography and glaciology. Brought up in the Pennine hill country near Macclesfield, Holland entered for a time at Birmingham and later at Oxford, where he became a most active member of St. Peter's Hall. A graduate in geography, he was, like many of the post-war generation, strongly attracted to the physical side, and under the direction of Dr. K. S. Sandford proceeded to research and to present his thesis on the geology of

north-eastern Spitsbergen, based on the results gained in three summer seasons. In 1956, he organized and led a party to the Sukkertoppen ice cap in west Greenland, some of the results of which are in course of publication. As a consequence of his work there, he was invited to join the International Geophysical Year expedition from Denmark, carrying out glaciological studies on the ice cap of Inglefield Land, under the leadership of Dr. Børge Fristrup. His last letters describe with much verve the active programme of survey and pit studies on which he and a younger Dane, Carsten Velsboe, were engaged at the time of their death, about July 18. On this day the weather maps show an unusually deep depression developing over the region, no doubt accompanied by an exceptional blizzard on the ice cap. It appears likely that in this region the local winds became abnormally strong.

Holland was an extremely fine mountaineer and rock-climber, of wide experience; a natural leader, he had original qualities of mind, perception and elegance. Like Watkins, his energy, organizing ability and unusual capacity as a field-investigator would undoubtedly have brought him to the forefront as an exploratory scientist. His death in the service of international science is indeed a loss, the more so as the conduct of expeditions in the field now demands high standards of technique and scientific accomplishment as well as exploratory hardihood. At the time of his death Holland had several papers in active preparation, and his friends hope to be able to assemble some of his material for publication. As a university teacher his attractive personality and his work as Tutorial Fellow in Bedford College were greatly appreciated.

GORDON MANLEY

NEWS and VIEWS

Soil Microbiology at Rothamsted:

Dr. H. G. Thornton, F.R.S.

DR. H. G. THORNTON, head of the Soil Microbiology Department, Rothamsted Experimental Station, is retiring on September 30. He was educated at Radley and New College, Oxford, and was appointed to the Rothamsted staff in 1919, becoming head of the Bacteriology Department in 1921; he has held his present post since the amalgamation of the Departments of Bacteriology and General Microbiology in 1941. Dr. Thornton has made many notable contributions in soil microbiology, a field which during this period has come to recognition as a distinct subject, and which owes much to his own researches and to his influence upon the large number of microbiologists who have worked at Rothamsted under his direction. Among the earlier investigations in soil microbiology were those on counting techniques, for which Dr. Thornton developed special media and methods and in which he pioneered, in collaboration with R. A. Fisher, the application of modern statistical methods to the elucidation of results. The study of the symbiosis of nodule bacteria and legumes was Dr. Thornton's special interest and has been notably advanced by his work on nodule anatomy and cytology, the concept of strain effectiveness in nitrogen fixation, and on various aspects of nodule origin and development. The results were applied to practical problems of seed inoculation,

particularly of lucerne, and prior to 1929 cultures were issued to the farmers direct from his department. Other fields in which Dr. Thornton has worked have been the serology of nodule bacteria and the ecology of soil micro-organisms. He was also concerned in the original work on the selective toxicity and microbial degradation of the phenoxyacetic acids and their derivatives which led to the development of the hormone weed-killers. Dr. Thornton was elected to the Royal Society in 1941 and became foreign secretary of the Society in 1955; he is an active member of a number of scientific societies and national and international committees concerned with microbiology.

Dr. P. S. Nutman

DR. P. S. NUTMAN has been appointed head of the Soil Microbiology Department, Rothamsted Experimental Station, in succession to Dr. H. G. Thornton; he will take up his duties on October 1. Dr. Nutman took his degree in botany at the Imperial College of Science and Technology, London, in 1937, afterwards carrying out research under Prof. F. G. Gregory on the vernalization of cereals. He went to Rothamsted in 1939, and during the War took a leading part in the discovery and early study of the selectively phytotoxic action of 2,4-D (2:4-dichlorophenoxyacetic acid), which resulted in the practical use of this important group of selective weed-killers. In 1953 Nutman was seconded for three