book is itself more than a field guide, giving fuller information about behaviour and reproduction than is necessary merely for identification; the authors reasonably excuse its substantial bulk on the ground that travel in the desert anyhow necessitates a vehicle. The book gives a general account of all the bird species, resident and migratory, found in North Africa above about 21° N. latitude, including the Canary Islands. The translation very closely follows the original text, which the authors have not revised except to incorporate information from one recent source. They have, however, redrawn a dozen of the species distribution maps which are a feature of the work. The admirable illustrations by Paul Barruel, mostly in colour, are, of course, repeated.

LANDSBOROUGH THOMSON

OUTSIDE THE NUCLEUS

The Plastids

Their Chemistry, Structure, Growth and Inheritance. By John T. O. Kirk and Richard A. E. Tilney-Bassett. (A Series of Books in Biology.) Pp. xvi + 608. (London and San Francisco: W. H. Freeman and Company, 1967.) 110*s*.

IN recent years the investigations of the fine structure and function of plastids by electron microscopists and molecular biologists have confirmed what has long been apparent to those pursuing the more conventional approaches of cytogenetics and physiology, namely, that plastids have a dual role. They are both the seat of photosynthetic activity and the bearers of extrachromosomal hereditary information with its associated protein synthetic activity. *The Plastids* is a timely and comprehensive account of both of these activities in which the old and the new are fairly balanced, carefully assessed and put into historical perspective.

The book is divided into four parts: the first is a short general description of the nature of plastids; the second is concerned with the inheritance and genetic autonomy of plastids illustrated by reference to the classical experiments on mutant and normal plastid differences in higher plants. An understanding of the nature of variegations and of the structure of chimeras is essential for a full appreciation of the significance of the breeding experiment and the observations on somatic segregation. The authors endeavour to provide this in the early chapters of the second part, although the combination of exhaustive detail, short sections and extensive cross-referencing makes heavy reading. Nevertheless, these are important chapters because the facts they contain provide the key to understanding how the separation of the chromosomal and extrachromosomal contributions to the determination of the plastid phenotype has been achieved. But while we are spared none of the details of the origin and structure of variegations and chimeras, the authors' explicit desire "not to burden the reader" leads to a vague account of the mathematical properties of the sorting-out from cells containing a mixture of two kinds of plastids, which is devoid of the simplest statistical expressions, formulae and concepts. The binomial and hypergeometric distributions which are the theoretical basis for all models of sorting-out are not even mentioned.

The third part of the book gives the biochemical basis of plastid autonomy and plastid growth and accounts of the more recent evidence from electron microscopic and biochemical investigations. It contains a particularly good account of the genetical approach to the elucidation of the biosynthetic pathways which are involved in plastid development and in photosynthesis. Although every aspect of plastid structure and function in *Chlamydomonas reinhardi* is referred to somewhere in the book, the evidence for post-meiotic reassortment and recombination of extrachromosomal determinants of the plastid phenotype in this species has been omitted, even though it has an important bearing on some of the speculative discussion in the third part.

The final part of the book is a short summary of the contents of the first three parts followed by speculations about the possible future developments in the field of plastid research. Similar summaries at the end of each chapter or part would have been invaluable in a book of this size and complexity. Unfortunately only three of the fifteen chapters and none of the parts have a concluding summary and many chapters end with a miscellany of material that could not find a place in their principal sub-sections. The book ends with three excellent indices for subjects, taxa and authors, respectively. These supplement the extensive references at the end of each chapter.

Taken as a whole, this book is an impressive work, beautifully illustrated and an invaluable source of references. Its publication is a landmark in the acceptance of the extrachromosomal contents of the cell as a partner of the chromosomal system in the heredity, growth and differentiation of green plants.

J. L. JINKS

OBITUARIES

Professor H. J. Muller

HERMANN J. MULLER, professor of zoology in the University of Indiana, Nobel laureate in 1946, died in Bloomington, Indiana, on April 5, 1967. He was born in New York City in 1890, and graduated from Columbia College in 1910. Here he had been influenced by the cytologist Edmund B. Wilson and the embryologist Thomas Hunt Morgan, who was beginning his studies of the genetics of the vinegar fly, *Drosophila melanogaster*. Muller began the experimental analysis of heredity at Columbia with the first group of graduate students to devote themselves to work with *Drosophila*, and in the same year, 1915, he obtained his Ph.D. with a dissertation on "The Mechanism of Crossing-over", and became co-author of the book which initiated the new era in genetics, *The Mechanism of Mendelian Heredity*, by T. H. Morgan, A. H. Sturtevant, Muller and C. B. Bridges. While at Columbia he made two discoveries which determined the course of his future work: the recognition of what became known as cross-over suppressors, later shown to be caused by inversion of gene order in part of a chromosome, and this in turn led to the discovery of the first balanced lethal system which provided the clue to the explanation of the recurrent "mutations" which de Vries had discovered in the evening primrose *Oenothera*.

The insights thus provided into the nature of the genetic system led Muller to invent ingenious breeding systems for the quantitative study of the mutation process. Much of this work was carried out at the University of Texas, where he was professor of zoology from 1920 to 1933. His paper on "The Problem of Genic Modification" provided the chief excitement at the Fifth International Congress of Genetics held at Berlin in September 1927. It brought convincing experimental proof that the mutation rate of genes of *Drosophila* could be increased 150-fold and more by treatment with X-rays. What set genetics on a new path was not merely the technical achievement of inducing mutations, both those with lethal and with visible phenotypic effects, in measurable quantitative rates. There was, in particular, the application of these methods to the problems clearly envisaged and pointed out by Muller of the analysis of the chemical and physical structure of the hereditary

material and of the process of evolution. Behind Muller's achievement lay the primary disclosure of the chromosome mechanism of heredity by E. B. Wilson (to whom Muller gave chief credit), T. H. Morgan and his students; after it came the detailed development of cytogenetics and the molecular basis of heredity. Muller participated actively in both the practical experimental and the theoretical development of genetics for more than fifty years, and left on it the indelible stamp of his ideas and vigorous personality.

He left Texas for Moscow in 1933 (he had taken the first cultures of *Drosophila* there in 1922), but abandoned the Soviet Union in 1937 to work first at the University of Edinburgh until 1940, then at Amherst College until taking up his professorship at Indiana in 1945.

Muller made important contributions to human genetics and to evolutionary theory through development of the classical theory of population structure (genetic load of mutations), and devoted increasing attention and enthusiasm to proposals for human betterment through control of human reproduction.

Throughout his work there runs a pattern of persistent use of mechanistic interpretations of biological phenomena. The success of these interpretations in genetics, as in physics and chemistry, led to an attitude of confidence which in Muller's case became overt optimism regarding the prospect of ultimate control by man over his own destiny.

L. C. DUNN

Professor F. A. Vening Meinesz

FELIX ANDRIES VENING MEINESZ, former professor of cartography and geodesy, and later also of geophysics, at the University of Utrecht from 1927 to 1957, and professor of geodesy at the Technological University, Delft, from 1939 to 1957, died in Amersfoort on August 10, 1966. He had been in hospital for six weeks after a fall at his home which caused a fractured hip; he was 79.

Vening Meinesz obtained his degree in civil engineering from the Technological University at Delft in 1910. Soon afterwards he was appointed engineer of the Netherlands Geodetic Commission and was commissioned to carry out pendulum observations in the Netherlands. This was a turning point which was to influence his whole career. On land he did pioneering work in this field, which he later repeated at sea. He was able to eliminate the disturbances caused by the irregular movements of the weak soil of the Netherlands by the so-called "two-pendulum method", and in 1915 he published the theory of his method in the thesis for his doctorate, entitled "Bijdrage tot de theorie der slingerwaarnemingen", after which he received his doctorate *cum laude*. In 1923 his "Observations de pendule dans les Pays-Bas" were published, describing the application of this method for fifty stations in the Netherlands. At this time Vening Meinesz was beginning to wonder whether this two-pendulum method could be applied with sufficient accuracy at sea as well. Tests made it clear that it would be difficult to fulfil the conditions of this method (equal amplitude and opposite phases of the pendulums) even in a submerged submarine. Vening Meinesz then realized that, independent of amplitude and phase, the difference in the angle of elongation of two isochronous pendulums, swinging in the same plane, was insensitive to horizontal accelerations, and that this angle could be regarded as the angle of elongation of a fictitious pendulum with the same period as the original pendulums. This method was worked out theoretically and instrumentally in his "Theory and Practice of Pendulum Observations at Sea" (1929), and it was used during the many submarine voyages which made him so well known. The results of all these voyages were published in the four volumes of *Gravity Expeditions at Sea*.

In the meantime Vening Meinesz published, in 1928, "A Formula Expressing the Deflection of the Plumbline in the Gravity Anomalies and some Formulae for the Gravity-field and the Gravity-potential Outside the Geoid", which became familiar to geodesists. His extensive gravimetric observations in the Indonesian Archipelago made it possible for this method to be applied for the first time at sea by Dr J. E. Baron de Vos van Steenwijk in his "Plumbline Deflections and Geoid in Eastern Indonesia as derived from Gravity".

Vening Meinesz continually emphasized the relationship between geodesy and geophysics. As a convinced supporter of isostasy, he tried to gather all possible information on the deviations from the state of equilibrium in the Earth. Combining this information with geological and seismological data, he always tried to make the geodesist better acquainted with the background to his science. He paid special attention, however, to trying to explain the reason for the irregular form of the Earth's crust. He considered that convection currents in the Earth's mantle were mainly responsible for the movements and consequent displacement of the continents. He was always able to express very difficult physical problems mathematically, as he had already done with the pendulum theory.

All those who knew Vening Meinesz were impressed not only by his great scientific knowledge, but also by his friendliness and hospitality, and his readiness to exchange ideas. He was awarded many Dutch and foreign decorations, honorary doctorates and the membership of many learned societies. One of his most important Dutch decorations was the "Eremedaille in Goud voor Voortvarendheid en Vernuft van de Huisorde van Oranje".

G. J. BRUINS

George Smith

GEORGE SMITH, who died on March 29, 1967, at the age of 71, started his career as a chemist. He graduated from Manchester University in 1916 and obtained his M.Sc. and A.I.C. in 1918. As chemist to a cotton manufacturing firm he met early the problem of mildew on cotton goods, and this led to the study of moulds, which was to become his chief work. In 1930 he joined Professor H. Raistrick at the London School of Hygiene and Tropical Medicine, where he remained till his retirement in 1961. Here he began with studies of the biochemistry of mould products, but become more and more involved in the taxonomy and care of the fungal cultures. During the Second World War he investigated the tropic proofing of military and naval equipment and thus became one of the first specialists in the field of bio-deterioration of materials. On retirement he continued his work on moulds at the Commonwealth Mycological Institute.

In 1939 he produced the first edition of *An Introduction to Industrial Mycology*. This book, with its magnificent photomicrographs, gathered together the information, much of it original, which hitherto scientists working in industry had found difficult to obtain. It is now generally used as an introduction to mycology for all those interested in moulds and moulding. Besides many short papers on the taxonomy, particularly of *Penicillium* and *Aspergillus* species, he produced monographs on the genera *Paecilomyces* and *Scopulariopsis*. All his work was undertaken with painstaking care and a meticulous attention to detail.

He enjoyed field work and was foray secretary of the British Mycological Society for some years, and was president of this society in 1946.

He was a quiet retiring man, kind and considerate, with diverse interests, covering all branches of science and philosophy. His favourite relaxation was music and he was an accomplished performer.

AGNES H. S. ONIONS