Seeger, the force does not make itself felt in these planes until rather low temperatures (lower than 100° K.) are reached, where the internal friction of the metal rises up to the 'Bordoni peak'. In the face-centred cubic metals, we scarcely ever see slip on planes other than close-packed ones, except possibly at high temperatures; similarly, in close-packed hexagonal metals, only the basal slip system has a flow stress that is insensitive to temperature, and the high sensitivity of other systems to temperature is strongly suggestive of a large Peierls–Nabarro force. It now seems probable that the sensitivity of the yield stress in iron is due at least partly to a large Peierls–Nabarro force, which may help to account partly for some of the observations on delayed yielding in iron that were reported to the conference by Dr. D. S. Wood.

In the discussions of solid-solution hardening and radiation hardening, the point was brought out from the work of Prof. R. W. K. Honeycombe and Dr. T. Blewitt that the yield stress of such materials is quite a sensitive, parabolic, function of temperature. Dr. H. Suzuki offered an explanation of the solid solution case in terms of the impurity yield-point mechanism, and several views were expressed about radiation hardening. Dr. J. Friedel suggested that vacancies agglomerated into large voids along dislocations, Dr. T. Blewitt considered that aggregates of point defects formed in the lattice would produce a type of precipitate hardening, while the present writer explored the possibility that the absorption of point defects by dislocations would cause the latter to climb out of their glide planes and thereby give them a large Peierls–Nabarro force.

The discussions of work-hardening were centred mainly around the nature of the obstacles responsible for work-hardening. Dr. A. Seeger showed that slip dislocations escape from their barriers in the slip planes by undergoing cross-slip and he proposed a variant of the Lomer–Cottrell barrier in which slip dislocations in screw orientation would become locked against barriers formed from two secondary slip systems. Prof. N. F. Mott raised the question of the behaviour of such systems on unloading. It seemed to the writer that the back-stress from its own piled-up group of dislocations could not be the reason why a given dislocation source ceased to act during unidirectional straining; for if this were the case, the stored elastic energy in the system would be nearly equal to the total work done, and most of the plastic strain would be recovered during unloading. The hardening of the Frank–Read sources must originate in some other way, perhaps from the internal stresses due to other nearby dislocation groups, as in the theory suggested a few years ago by Prof. Mott.

The problem of understanding fatigue failure still appears very difficult. The idea that vacancies are formed during the glide of dislocations has met with difficulties, mainly because we are still not sure how dislocations can produce vacancies; in fact, when gliding screw dislocations intersect they are more likely, if they produce any point defects at all, to produce interstitials rather than vacancies. Prof. Mott proposed a new mechanism whereby a gliding screw, oscillating to and fro with the applied stress, jumps cyclically from one plane to another by means of cross-slip at the ends of its path; this causes the material between these planes to be squeezed out of the crystal, leaving behind a void in the slipped region. This ought to be just the type of process that could be examined directly by the new experimental techniques mentioned above.

Interest has grown rapidly in recent years in the mobilities of various types of defects in solids, particularly at very low temperatures. Prof. J. S. Koehler, Dr. T. Blewitt and Dr. W. Boas summarized recent work on the annealing of point defects in quenched, irradiated and cold-worked metals, and Dr. G. Leibfried concluded that zero-point motion may contribute to the mobility of point defects at very low temperatures, but is unlikely to be important in the motion of dislocations because the vibrational modes useful for helping dislocations over barriers have long wave-lengths and low Debye temperatures. Dr. Blewitt showed that copper crystals can be work-hardened in liquid helium up to yield stresses greater than one per cent of the elastic constant, and that at these high stresses it is possible to pull partial dislocations away from one another, so forming stacking faults and deformation twins. Prof. C. S. Barrett described some recent work by Dr. P. Haasen and Dr. A. Kelly which showed that nickel and copper crystals develop yield points after plastic straining, unloading and reloading, in liquid helium, and Dr. Blewitt mentioned that internal friction experiments have shown that dislocations can become pinned as a result of neutron irradiation at 17° K. Certainly, one of the most fascinating developments of the subject in recent years is the discovery of so much evidence for atomic movements in crystals at temperatures of a few degrees above absolute zero.

A. H. COTTRELL

OBITUARIES

Mr. H. N. Ridley, C.M.G., F.R.S.

MR. H. N. RIDLEY died in his one hundred and first year at his home at 7 Cumberland Road, Kew, on October 24. On the occasion of his hundredth birthday (December 10, 1955), Mr. J. W. Purseglove contributed to *Nature* an appreciation of Ridley's many-sided activities in Singapore and Malaya, and the reader is referred to this for a fuller survey of his life and work.

He was born at West Harling, in Norfolk, son of the Rev. Oliver Matthew Ridley and Louisa Pole (Stuart). He was proud to count among his ancestors Nicholas Ridley (Bishop of London, 1550–55), William Penn, and the third Earl of Bute, who was botanical adviser to the Princess Augusta, founder of the Royal Botanic Gardens, Kew.

Ridley took all Nature for his province. In his boyhood he was interested mainly in birds and insects; after studying natural science at Oxford he was awarded a scholarship in geology; he came finally to an intensive study of botany almost as an accident when, having failed to obtain a zoological post, he applied in 1880 for a post in the Botany Department of the British Museum (Natural History). In the following eight years he specialized in the study of tropical Monocotyledons, but did not neglect other groups of plants; and he maintained an active interest in animal life, especially in the relations between plants and animals, in insects as pollinators and pests, and in birds and mammals as distributors of plants.

He thus went to Singapore in 1888 (as director of Gardens and Forests, Straits Settlements) well equipped to make the pioneer investigations of plant and animal life which were then needed, and to them he devoted the next twenty-three years of his life. In addition to the wide scope of his knowledge and interest, his other prime characteristic was the intensity of purpose with which he applied himself to everything that he did. With small financial resources, and little help from others, he achieved original pioneer work of a variety and scope such as few men have accomplished in a comparable period of time.

By his investigation of the tapping of Para rubber trees, and his persistent advocacy of the need for, and possibility of, a plantation rubber industry, he was largely responsible for making possible the development of modern Malaya. He was a wonderful field botanist, because he knew and could recognize such a great range of plants; he knew at once if he was looking at something new and interesting, when another collector might pass it unnoticed. He took every opportunity of travelling, and made by far the largest single contribution to our present knowledge of the Malayan flora. Several species of plants are still known only from his original specimens.

In addition to Para rubber, Ridley cultivated experimentally many other useful plants from outside Malaya. He wrote reports upon these plants, and on the techniques of handling them for local use. He also investigated, and reported upon, the many kinds of timber trees and other useful plants of the Malayan forest. His zoological papers were numerous and varied.

But because he had so many interests, and attempted such a wide range of work, and because he had so little help, everything he did was done in a hurry, and there is frequent evidence of this in Ridley's published papers and books. One thing he apparently had not the ability (or the patience) to do was to correlate his observations with those of other people; and through the habit of hasty work he apparently lost the ability of making careful and methodical records of his own observations. But it is not as a finished worker one must judge him; he was a pioneer, and showed the way for others who came afterwards, each to deal with only a fraction of the field he tried to cover.

Among those who travelled with him on his expeditions (as some of them have told me) Ridley had the reputation of being a good companion, always cheerful and resourceful. In his later years he had an inexhaustible fund of stories of his life in Malaya, and greatly enjoyed recounting them; from them one could appreciate his zest for life. He had a fine scorn of those with whom he disagreed, but a warm heart that made him beloved by many, especially by those to whom he quietly and generously gave practical help in time of need. One of his larger benefactions, which (at his own request) was never publicly announced, was a considerable gift towards the cost of A. F. R. Wollaston's expedition to New Guinea in 1912–13 (see *Geographical Journal*, **43**, 248–268).

At the age of eighty-two, Ridley married Lily Doran, who, with her sister, most devotedly cared for him during his later years and in his final illness.

R. E. Holttum

Prof. Doris L. Mackinnon

After an illness lasting almost three months, Prof. Doris Livingston Mackinnon died on September 10, at the age of seventy-two. She was the eldest of five talented children born to Lachlan Mackinnon, advocate of Aberdeen, and Theodora Mackinnon, *née* Thompson, of London, and she was born on September 30, 1883. Doris could draw skilfully, she had a good knowledge of music, and she had a great literary gift. Why then did she choose science as a career? Her father, who was a lover of animals, as well as an ardent amateur botanist, ornithologist and astronomer, would take the children for rambles in the country, to observe Nature in all its forms. Another influence in Doris's life was that of the late Mrs. Ogilvie Gordon, a noted geologist, who encouraged her to take up science seriously. She took her B.Sc. at the University of Aberdeen with the subjects botany, zoology and geology, graduating with distinction in 1906 and being, as I believe, the second woman to be capped in that University. A Carnegie Scholarship then enabled her to spend one year in the laboratory of Richard Hertwig at Munich, some months at the Biological Station at Roscoff, collaborating with M. F. Vles in protozoological research, and a further period in the Quick Laboratory at Cambridge under the supervision of Prof. G. H. F. Nuttall.

During 1908–9 Miss Mackinnon acted as personal assistant to Prof. J. Arthur Thomson at Marischal College, Aberdeen, and in 1909 she was invited by Prof. W. D'Arcy Thompson to become his assistant at University College, Dundee. She remained in Dundee until the spring of 1916, and was then granted leave of absence to undertake war-work. During these years she established her reputation both as a brilliant lecturer and a protozoologist. In addition to her academic work, she gave a number of popular lectures in Dundee, Perth and Aberdeen, and by 1914, when she gained the degree of D.Sc. at Aberdeen, she had published fourteen papers, most of them dealing with the parasites of insects. In May 1916 she came under the influence of Clifford Dobell, who trained her at the Wellcome Bureau in matters relating to the study of amœbic dysentery. Another potent influence was that of her father's first cousin, Sir Patrick Manson. She then took up a War Office appointment as protozoologist attached to military hospitals. At the 1st Western General Hospital and at the School of Tropical Medicine, Liverpool, and later (1917) at the University War Hospital, Southampton, she collaborated with a number of colleagues in the publication of several important papers and reports concerned with *Entamoeba histolytica* and amœbic dysentery.

In 1918, when D'Arcy Thompson accepted the chair at St. Andrews, the Council of University College, Dundee, obtained her release from war-work, and she returned in April, running the Zoology Department single-handed. A year later she was appointed Prof. Arthur Dendy's senior lecturer at King's College, London, and in 1927 she became professor of zoology in the College.

Prof. Mackinnon's contributions to the original literature on her subject, most of which were concerned with the parasitic Protozoa, numbered about forty papers. Her sound knowledge of German was utilized in the translation of J. von Uexküll's "Theoretische Biologie" (1926) and in a translation of a musical book by Paul Mies, "Beethoven Sketches,