observed will be the adiabatic susceptibility of the spin system. A measurement with a static or slowly varying field will yield the isothermal susceptibility. From these two quantities a simple thermodynamic relation leads directly to the magnetic specific heat.

Thus the method of paramagnetic relaxation complements the resonance experiments. Since the magnetic specific heat is a measure of the strength of the interaction between the magnetic ions, and this determines the lowest temperature available in adiabatic demagnetization, relaxation measurements give a useful guide to the choice of substances for demagnetization. For example, iron ammonium alum, with $CT^2/R = 0{\cdot}014$, needs at 1° K. the application of 30 kilogauss to reduce its temperature to 0·01° K., whereas cerium magnesium nitrate, with $CT^2/R = 7{\cdot}5 \times 10^{-6}$, reaches 0·003° K. from a field of 15 kilogauss.

The final paper was given by Dr. N. Kurti and dealt with the low-temperature aspects of nuclear orientation.

The object of this address was the description of methods that have been, or could be, used for orienting atomic nuclei in solids. Normally the elementary nuclear magnets point at random in all directions. Under favourable conditions and at very low temperatures, it is possible to establish preferential orientations with respect either to an external magnetic field or to a crystal axis.

Nuclear orientation was originally conceived as a possible method of producing temperatures of the order of one-hundred-thousandth or one-millionth of a degree absolute. The lowest temperature that can be obtained by means of the adiabatic demagnetization of paramagnetic substances (in which the electron spins are the elementary magnets) is of the order of a few thousandths of a degree. This lowest temperature is determined by the magnitude of the interaction forces between the electronic elementary magnets. With nuclei, which have a thousand times smaller magnetic moments, one could expect to reach much lower temperatures because the interaction forces are smaller. In order to carry out such a nuclear demagnetization experiment, the nuclear paramagnetic substance (say, a metal the nuclei of which possess magnetic moments) has first to be magnetized in a field of between 50 and 100 kilogauss at 0·01° K. This presents great difficulties, and no successful nuclear magnetic cooling has been carried out as yet.

At 0·01° K. and in a field of 100 kilogauss, the nuclei would be directed preferentially along the magnetic field. Such oriented nuclear systems can be of great use to nuclear physics. If we have a radioactive substance which emits γ-rays, then, even if the intensity of emission from one individual nucleus is anisotropic, the total radiation emitted from a piece of material will be isotropic in ordinary circumstances because of the random distribution of the nuclear axes. The behaviour of an assembly of oriented nuclei, however, would approximate more and more to that of an individual nucleus. Details of the importance of such experiments were given in Dr. Grace's paper later in the session.

If one wants to produce oriented nuclei for radioactive experiments, some experimentally simpler methods are also available. Instead of using an external magnetic field of 100,000 gauss, one can make use, in suitable cases, of the strong magnetic fields (of the order of half a million gauss) which the electron spin produces at the nucleus in paramagnetic ions. In such cases the nuclear spin sets itself parallel to this local magnetic field if the temperature is low enough (a few hundredths of a degree absolute). If, moreover, the electron spins which are responsible for these local fields are oriented parallel throughout the specimen, a high degree of nuclear orientation will result. The ordering of the electron spins is brought about either by the action of the electric field of the crystal lattice or by a relatively modest external magnetic field of the order of 1 kilogauss.

The former method was used in the first conclusive demonstration of nuclear orientation in an experiment carried out by Drs. Daniels, Grace and F. N. H. Robinson in September 1951 at the Clarendon Laboratory in Oxford. The anisotropy of the γ-rays emitted by radioactive cobalt-60 which was incorporated in a paramagnetic crystal and cooled to one-hundredth of a degree was clearly shown. Since then many more experiments have been carried out with both methods in Oxford and elsewhere, and in one of the Oxford experiments a degree of orientation of nuclei of more than 90 per cent was attained.

Although at present most of these experiments yield results of main interest to nuclear physicists, the situation will undoubtedly change when nuclear magnetic cooling experiments get under way and, possibly, temperatures of 10^{-5} or 10^{-6} degrees will be reached. It has been suggested, for example, that at these temperatures one might observe 'nuclear ferromagnetism'.

Dr. Kurti concluded by asking whether it is wise and indeed justified to classify these results according to whether they belong to nuclear physics or to low-temperature physics. It is more important, he said, to realize that they are the outcome of a combination of two fundamentally different and distant branches of physics.

F. N. H. Robinson

OBITUARIES

Prof. F. Wood Jones, F.R.S.

With the death of Dr. Frederic Wood Jones at the age of seventy-five on September 29, there passed an anatomist who was well known not only for his numerous contributions to human and comparative anatomy and anthropology, but also for his unusual versatility (his interests extended far beyond the confines of pure morphology) and his vigorous expositions of Lamarckian and teleological conceptions.

Wood Jones was born in London on January 23, 1879, studied medicine at the London Hospital, and graduated in 1903. During 1905–7 he was stationed on one of the Cocos-Keeling Islands as a medical officer of the Eastern Telegraph Co., and it was here that his scientific career may be said to have derived its initial inspiration. For, as he relates, his medical duties were so nominal as to allow him to spend much of his time exploring coral reefs and making observations on the local fauna. In 1910 he published a book on "Coral and Atolls" in which he ventured an original interpretation of atoll development, an interpretation which, even if it did not gain general acceptance, aroused considerable interest because of its very novelty. It was as a result of these studies that he was awarded the degree of D.Sc. of the University of London.

In 1907 he joined the late Sir Grafton Elliot Smith in anthropological studies on behalf of the Egyptian

Archæological Survey of Nubia, and in 1909 he was appointed lecturer in anatomy in the University of Manchester. His subsequent academic career was varied as well as distinguished, for he occupied chairs successively in the Universities of London, Adelaide, Hawaii, Melbourne, Manchester and the Royal College of Surgeons, and also (for one year) acted as director of anatomy at the Pekin Union Medical College.

A man of many and varied experiences, Wood Jones was imbued with a restless curiosity which found expression in several books of essays on a great diversity of subjects. His pleasing literary style and descriptive powers, combined with a certain originality of approach, made his writings singularly attractive and stimulating; this was particularly so with his lighter essays, but it was also true of his more serious expositions, even though the intrusion here and there of his personal prejudices against some of the well-established principles of evolution occasionally proved exasperating to those who allowed themselves to be too easily exasperated by such expressions of 'unorthodoxy'. In one of his earliest books, "Arboreal Man", published in 1916, Wood Jones elaborated in a series of anatomical essays the thesis (which he continued to emphasize in many of his later works) that, compared with other Primates, man is fundamentally primitive in many details of his anatomical structure. Indeed, it was this general conception which led him to suppose that man has occupied a rather unique position in the evolutionary series, for he argued that the retention of these primitive features could only be explained on the basis of a very prolonged period of evolutionary independence. In a more comprehensive work on "Man's Place among the Mammals", published in 1929, he further elaborated these ideas, contending with considerable dialectical skill that man's relationship to other Primates is far more remote than is suggested by the evidence of comparative anatomy and palæontology. It is fair to say that, although the more extreme views put forward by Wood Jones made but little impact on biological thought, he certainly provoked his contemporaries by the very persuasiveness of his literary style to give more critical attention to the validity of the evidence on which he relied.

Apart from his essays and books, Wood Jones's most important contributions to anatomy are embodied in numerous papers which have appeared from time to time in the *Journal of Anatomy*, the *Proceedings of the Zoological Society*, and elsewhere, and which consist mainly of descriptive studies in the field of comparative anatomy. But he also made important contributions in the allied fields of embryology, physical anthropology and palæontology. All these papers are characterized by a refreshing originality and by illuminating interpretations of the relationship between structure and function. His most systematic study (and in some ways one of his best works) was his comprehensive survey of the mammals of South Australia, published in the series of handbooks issued during 1923–25 by the South Australian Branch of the British Science Guild. Like all his published works, these are illustrated entirely by his own drawings, which display particularly well the unusual skill and attractive style of his draughtsmanship. In his two books on human anatomy, "The Principles of Anatomy as seen in the Hand", first published in 1920, and "Structure and Function as seen in the Foot", published in 1944, Wood Jones showed a profound knowledge of topographical and morphological detail, and at the same time gave abundant evidence of the exceptional powers of observation which enabled him to contribute so much original information beyond the scope of the standard text-books of anatomy. They also display his intimate acquaintance with the history and literature of anatomical discovery, for he makes constant reference in them to observations of the older anatomists which seem too often to have been forgotten.

In temperament, as well as in his scientific work, Wood Jones was an individualist, and he was sometimes impatient of new orientations in anatomical teaching and research. But it would be difficult to over-estimate the service which he has done to his subject by his insistence on the comparative and functional approach to anatomical studies, by the cumulative importance of his many original observations, and by the inspiration which he gave to his contemporaries and his students through his lectures and essays.

Prof. Wood Jones is survived by his widow, Gertrude Clunies, daughter of the late George Clunies-Ross, governor of the Cocos-Keeling Islands.

W. E. Le Gros Clark

Sir Roderic Hill, K.C.B.

Sir Roderic Hill, rector of the Imperial College of Science and Technology, London, died on October 6 at the age of sixty.

In 1948, the Governing Body of the Imperial College appointed a committee to select a new rector, and also invited representative members of the academic staff to consult among themselves and make suggestions. The result was unexpected: both groups independently suggested Air-Chief Marshal Sir Roderic Hill. Seldom can an appointment have been so acceptable to all concerned or have proved so happy in its outcome.

From the moment he took office, it was clear that the new rector would prove a powerful leader, and that his personality and example would stimulate those who came in contact with him to give of their best to the College. A humanist by education, he had, during his long career in the R.A.F., showed judgment and experience in technological matters which many professional engineers and scientists might well have envied, and the appreciation by his colleagues that he possessed such ability lent added weight to his view, so often expressed, that the education of technologists must be broadened if they were to exercise their functions with a full sense of responsibility. His concern with this aspect of education led him to initiate general lunch-hour lectures twice a week throughout the session, covering a wide range of subjects, a particular example being the encouragement of College musical activities by the appointment of a distinguished musician as special lecturer and adviser.

The general scheme, of which this was part, was given the title 'Touchstone', which will remain one of many reminders of the ideals of its originator. Under this scheme, also, week-end study circles were held at Silwood Park, the College Field Station near Ascot, at which students, members of the staff, and experts from outside the College met to discuss social and political questions of the day.

While this and much more was being developed, Hill carried a heavy burden in connexion with the