J. Grimond urged the increase of Government aid to such organizations as Voluntary Service Overseas, while recognizing that this was no substitute for technical aid. However, in replying on the debate the Secretary of State

for Industry, Trade and Regional Development, Mr. E. Heath, made little reference to either technical assistance or voluntary service and Mr. Wilson was the only speaker to refer to overseas research.

AIDS TO TEACHING UNIVERSITY PHYSICS

THE university teacher of physics at present is having to cope not only with a rapidly growing and much expanded subject, but also with the increased demands on his time, on apparatus and on accommodation, because of larger numbers of students. The many new text-books dealing with the advances during recent years are very often limited to narrow fields, and invaluable though they are to the postgraduate student embarking on research or to the specialist, they are of little help to the undergraduate teacher. Because of financial stringency he may not be able to purchase what he requires of these new texts, and even with access to the books, he will find it most difficult to devote adequate time to their detailed study. He needs assistance in the appropriate selection of material not only for himself, but also in order to advise his students how to avoid the inessential so that the student may still get a good grounding in basic classical physics and yet also become acquainted with recent investigations and problems. Little or nothing so far has been done in Britain to help the university teacher in his attempts to modify and improve the content of undergraduate courses, but in the United States the Association of Physics Teachers has a committee under the chairmanship of Prof. Arons which, with the support of the National Science Foundation, is actively engaged on this work.

The committee publishes a series of "Resource Letters", which are initially printed in the *American Journal of Physics*. These have included Letters on plasma physics (PP-1, July 1961); polarized light (PL-1, October 1961); the Mossbauer effect (ME-1, January 1963); kinematics and dynamics of satellite orbits (SO-1, April 1963) and quantum and statistical aspects of light (QSL-1, May

1963). Each Letter consists of a list of references to books and articles on the subject, divided into sections according to particular aspects and introduced by explanatory notes. The Letter always includes references to, or descriptions of, laboratory experiments and demonstrations and how the appropriate apparatus may be made or where it may be obtained, together with the titles of films or other illustrative material suitable for use by the teacher or students. No Resource Letter is meant to be exhaustive and complete, and in time there may be more than one Letter on some of the main subjects of interest.

To save time in reference to periodicals, and to assist those who do not have easy access to libraries, a series of reprint books each dealing with one of the subjects of the Letters and containing a copy of the Resource Letter together with reprints of a selected few of the articles listed in the Letter have now been published for purchase by the American Institute of Physics*. The set of booklets have already received a warm welcome in the United States, and indeed a second printing of one of them has been required. They will be equally welcomed in Britain and no university physics department should be without several copies of them for use by the staff engaged in undergraduate teaching. The American Association of Physics Teachers is to be congratulated on this valuable pioneering effort and for its foresight in tackling an important and urgent problem in present-day higher education.

S. WEINTROUB

* *Plasma Physics—Selected Reprints*. Pp. 119. *Polarized Light—Selected Reprints*. Pp. 103. *Mossbauer Effect—Selected Reprints*. Pp. 127. *Kinematics and Dynamics of Satellite Orbits—Selected Reprints*. Pp. 108. *Quantum and Statistical Aspects of Light—Selected Reprints*. Pp. 92. (New York: American Institute of Physics. Published for the American Association of Physics Teachers, 1963.) 2 dollars each.

IODINE-131 FALL-OUT IN MILK

"IODINE and milk don't mix": so read the placard carried by a schoolgirl protesting against the proposal to build a nuclear plant in California. So familiar are we with the problem of contamination of milk with iodine-131 from fall-out that there is no need to emphasize the importance of any new assessment of the effect of nuclear-weapon tests on levels of iodine-131 in milk and on the consequent radiation dose delivered to the thyroid glands of those who drink fresh milk. Such assessments inevitably begin by treating the relationship between the amount of fall-out deposited and subsequent levels of iodine-131 in milk. A direct investigation of this relationship in the field ideally requires a situation such that deposition of radioactive material takes place at either a constant rate or over a short period. The latter condition is met within the area of local fall-out from a nuclear test. Dr. H. A. Knapp has endeavoured to make use of measurements made in connexion with the *SMALL BOY* low-yield, ground burst of 1962*.

The investigation is retrospective and hence has inherent limitations. Milk from two dairies 50-100 miles from ground zero and from an area in north-east Utah some 300 miles downwind had been analysed for iodine-131. The fall-out pattern had been followed by measuring

levels of γ -radiation over the ground surface although not in the immediate locality of the areas grazed by cattle. By making assumptions with regard to the mode of decay of activity, Dr. Knapp has developed an empirical relationship between the level of γ -radiation from fission products deposited at 24 h after detonation and the maximum concentration of iodine-131 in milk and has then extended this to cover the radiation dose received by the thyroid glands of people drinking fresh milk. Unfortunately the γ -radiation measurements were made with relatively insensitive survey instruments which, although quite adequate for the purpose of overall evaluation of external exposure to γ -radiation—for which they were intended—are insufficiently accurate to give a true indication of the ground deposition: examination of the readings listed in the report reveals that many were only a few times the assumed average background-level. For this and other reasons, Dr. Knapp's interpretation of the data has been under fire from an expert committee convened to review his report. The committee's—somewhat adverse—opinions are included as a preface. The fact remains that the relationship obtained by Dr. Knapp accords remarkably well with what might be expected on theoretical grounds and that, where it was possible to compare predicted thyroidal iodine-131 burdens with actual burdens measured *in vivo*, when allowance is made for more recent information than was available to Dr. Knapp on the

* *Iodine-131 in Fresh Milk and Human Thyroids Following a Single Deposition of Nuclear Test Fallout*. By H. A. Knapp. U.S.A.E.C. Document No. TID-19266. Pp. 106. (Washington, D.C.: Office of Technical Service, Dept. of Commerce, 1963.)

uptake of iodine by the human thyroid gland, agreement is again reasonably good. It is difficult to see how, within the limits set by the *SMALL BOY* data, Dr. Knapp could have come up with any better conclusions.

The relationship between the level of γ -radiation measured above the ground surface and the amount of iodine-131 per unit area of that surface varies enormously with the composition of the deposited material. The transfer of iodine-131 to milk is affected by such diverse factors as the chemical and physical form of the fall-out, which govern the behaviour of the deposited material on herbage and the biological availability of the iodine, and the animal management practised by local farmers. Unless allowance can be made for divergence of these and other variables from Dr. Knapp's norms, extrapolation of his relationship to other situations, although tempting, is not admissible. Dr. Knapp is aware of and discusses these sources of error particularly in the context of some of the earlier Nevada test firings made at a time when milk was not analysed for iodine-131. Although he does not say so explicitly, Dr. Knapp strongly hints that

children in the area surrounding the Nevada test site could have received much higher radiation doses to their thyroid glands from iodine-131 in milk than had been suspected. This surmise is supported by independent investigations carried out by the University of Utah and, as might be expected, the report has aroused considerable public interest in the United States. However pessimistic Dr. Knapp's deductions, they must leave the responsible authorities with an uncomfortable feeling that all doubts might have been resolved had milk been examined. Milk is now well recognized as the predominant vehicle for transfer of many nuclides, including iodine-131, to man in the Western countries. Dr. Knapp's report points the moral that, although estimation of levels of iodine-131 on the ground surface—or in the air—allows prediction of levels in milk, it does so only inaccurately and that it is wiser and more profitable to examine milk itself. This is a lesson, let it be said, that does not need to be taught to those responsible for surveys for radioactivity in the environment in Britain.

R. J. GARNER

ABORIGINES IN AUSTRALIA

A SPECIAL issue of *Australian Natural History* (14, No. 8: The Australian Museum, Sydney, 1963) is devoted to the history, culture and present status of the Aborigines. According to W. R. Browne, changes in climate during the Quaternary period, the effects of which are so conspicuous in the northern hemisphere, extended to all parts of the world. When the accumulations of ice around the poles were at their maximum the level of the oceans was lowered 300 ft. or more with corresponding extensions to the land areas. It was under such conditions that the first human beings reached Australia, perhaps about 20,000 years ago. The climate then was cooler and wetter than it is now, and giant forms of marsupials were in the country, but which have now become extinct.

N. W. G. Macintosh believes that the migrants came from south-east Asia, but that they must have been seafaring people since they had to cross both Wallace's and Weber's lines, which have marked areas of deep water for at least 75 million years. The evolutionary history of these people remains an open question. The most likely view is that they have descended through types like *Pithecanthropus*, *Homo soloensis* and *Homo sapiens wadjakensis*, remains of which have been found in Java. There are also suggestions that a certain amount of admixture with Negritoid, Caucasian, and pre-Dravidian stocks may also have occurred. In confirmation of such views, up to the present, finds of fossil evidence have been scanty, and their precise dating has proved difficult.

The Talgai cranium was discovered in Queensland in 1886, the Cohuna skull was found in Victoria in 1925, and in 1960 the Mossgiel skeleton was discovered, in New South Wales. This last-mentioned find closely resembles *H. soloensis*, and while massive, all three skulls differ only in minor details from those of modern Aborigines, and all possess certain primitive characteristics. A more problematic variant is the Keilor cranium, found near Melbourne in 1940. In shape and structure it is distinctly more modern than the others. So far, it has not been dated with certainty, but it would seem to go back for about 13,000 years, a fact which raises difficulties in attempts to fit it into any line of hominid evolution. Blood group tests indicate that Australian Aborigines differ on significant points from present-day Melanesians; and investigations of their dermatoglyphics show that while some similarities exist between those of the Aborigines and Melanesians, the patterns differ markedly from European, Ainu and African Pigmy types; their closest affinities are to be found among the Mongols.

According to Thérèse Belleau Kemp, the number of original native inhabitants of Tasmania was small. Archaeological evidence reveals that almost certainly they reached the Island by way of Australia. They suffered at the hands of the European settlers, who drove them from their hunting places and best sources of food. In 1829 those who remained were removed to Flinders Island, where, six years later, they numbered 200. By 1847, the total was reduced to 40, and the last of them died in 1876. The industries and culture of these people were similar to those on the Australian mainland; but while the people on the east coast and midlands lived by food-gathering and hunting, groups on the west coast fed mainly on land marsupials and sea mammals. They were highly skilled in fashioning stone tools. Why they died out so rapidly remains a matter of opinion. It might seem as if they were poorly endowed with natural defences against diseases, like tuberculosis, brought in by people from overseas.

The prehistory of the Australian Aborigines is reviewed by F. D. McCarthy. While fossil human remains are scarce, evidence of aboriginal industries and ways of life is relatively abundant, indicating that, as a whole, cultural practices were comparable with those in Europe at the time of overlap between the upper Palaeolithic and Neolithic periods. In sites along the Murray River, some of the characteristic stone tools in order of antiquity were the *tula*, a flake with a convex working edge, and the *pirri*, a spear point chipped on one surface; and in eastern New South Wales, *Bondi* points, elegantly made for spears and barbs, and the *elouera*, a ground edge used for knives and axes. Some of the tools were hafted. An industry based on finely worked microliths was once widely spread, but eventually it died out altogether. As a whole, however, the industries display only slight variations, and middens provide evidence that some sites were occupied by Aborigines for generation after generation, perhaps for as long as 10,000 years, with a minimum of change in the general way of life.

A considerable number of rock engravings have also been discovered. They are most common in the Sydney-Hawkesbury district of eastern New South Wales, the Flinders Ranges of South Australia, the Carnarvon and other ranges in south-eastern Queensland, and many localities in north-western Australia. A beginning has been made in their recording and classification. Of engravings, probably the oldest phase consists of grooves rubbed into the rock surface, forming simple parallel