kind of problem which must be faced in relating man with the environment.

Of particular interest to people studying population dynamics of animals was a report showing that calcium-45 implanted in an adult female can be identified in her offspring up to a year later. This technique will overcome many of the problems inherent in such studies and permit collection of results unbiased by trapping, marking, or other techniques currently in use. Other papers described the use of operations research techniques, identification of root distribution, and prediction of decay characteristics of neutron-activated soil.

Rodents and lizards are subjects often used in testing effects of radiation on animal populations. One project which was initiated as a study of radiation effects on mice became a study of effects on predators after these same predators had consumed the mice of the initial project. Results of this modified experiment tended to show that radiation damage to wild species is quite comparable with that of domesticated animals of comparable body size. Attention was drawn to the need for special dosimeters to evaluate absorbed dose and to the difficulties of interpreting results of field exposure to radiation. Irradiated lizards showed a substantially different growth pattern as compared to the pattern observed in control areas. However, it could not be conclusively shown that the change was not due to changes in the environment independent of the radiation. Acute exposure to doses of 450 roentgens was shown to cause a significant decline in lizard natality the year following irradiation.

An intense interest exists in how radiation affects trees. This interest derives from the initial observation at Brookhaven that conifers are affected by relatively small doses of radiation. In some studies a stimulation of growth, germination of seeds, or other specific responses was observed with low radiation doses. Lethal doses vary with species, but for x-rays or gamma rays doses of about 5 kilorads were required. With fast neutrons, however, doses as low as 250 rads produced observable effects on growth and viability of needles. Moisture stress was shown to significantly increase the damage to trees from exposure to radiation. Whether this effect is in any way related to the well-known relationship of moisture in seeds and radiation sensitivity was not indicated. Recovery from large doses of radiation occurs largely by new sprouts arising from subsoil and stem areas of trees. Rate of growth of such sprouts was proportional to the radiation exposure.

Two papers presented results which superficially appear to be widely opposing. In one, effects of background radiation dose rates of 0.5 mr/hour were observed in the highly sensitive plant *Tradescantia* when other environmental features were adequately controlled. In the other, doses of 4 to 6 kr appeared to be of less consequence to die-back in desert shrubs than the intense dust deposited on the foliage.

The symposium was sponsored by the U.S. Atomic Energy Commission and the Battelle Memorial Institute, Pacific Northwest Laboratory.

The proceedings will be published as the December 1965 issue of *Health Physics*. It will also be available in bound form from Pergamon Press.

F. P. HUNGATE
Pacific Northwest Laboratory,
Battelle Memorial Institute,
Richland, Washington

The Education of Professional Physicists

An international conference on the Education of Professional Physicists was held in London 15–21 July 1965. This gathering was the third in a sequence initiated by the Commission on Education of the International Union of Pure and Applied Physics. The Institute of Physics and the Physical Society arranged the conference, which met at the Imperial College of Science and Technology.

The aim of the conference was to illuminate problems arising in the education of physicists who will pursue careers in pure or applied research. The discussions were organized under the headings: the needs of industry; mathematics for physicists; technical universities; the purpose of practical work; first-degree courses; graduate or postgraduate training; films; and relations between government or industrial research establishments and universities. Papers on these topics were presented by speakers from the United Kingdom, France, the Soviet Union, the Netherlands, the United States, Belgium, South Africa, and Poland. Seventeen other countries were represented. Most of the approximately 90 participants were drawn from universities, but several distinguished industrial scientists attended and played a significant role in both the scheduled program and the discussions.

Was it accident that brought together the site and the theme of this meeting? For a display of crosscurrents in British educational thought was an unannounced but dominant feature of the affair. The "brain-drain" is only the most visible symptom of troubled waters. A number of traditional attitudes and practices, the growing abstractness of physical concepts, and the needs of present-day industry all cross each other at deeper levels. A long-standing aloofness between academics and industrialists has led to charges that sometimes take extreme form. On the one hand, a doctoral degree has been held to be valueless to an industrial physicist, being merely an award for time spent on a confining, irrelevant detail. The countercharge is that the uses to which industry puts young physicists disregard not only their education but also the personal characteristics that led them to study physics. Within the universities there is self-criticism of the traditional gap between theoretical and experimental studies. The opening of new universities and the conversion of erstwhile technological colleges into universities are regarded as an opportunity to develop broader educational patterns. This dialogue among the hosts was lively and provided most of the spice of the meeting.

A canonically correct amount of time was given to instructional laboratory courses, but the central problem for at least one participant, that is, the amount of time a student *should* spend in the laboratory, was not mentioned by any speaker. Perhaps there is no generally acceptable answer, but the problem is worth discussing at an international meeting, if only to offer perspective to countries endeavoring to finance physics curricula. Who among us can give a closely reasoned quantitative justification of his department's laboratory requirements?

A United States representative participating for the first time at one of these meetings was struck more than he had anticipated by the comparative diversity in our higher education. Thus, it appears possible for a speaker from almost any other country to characterize his nation's physics curricula fairly accurately and in a reasonably brief time; the audience knows the

levels of preparation and ability of the body of students for whom the curricula are intended, and the compatriots of the speaker appear to sit at ease. How can our system (or chaos) be as fairly presented? A description of the curriculum possible for one of our most selective institutions is inspiring and for this reason valuable. However, it does not answer the question asked in corridors afterward, what is typical in the United States? A proper answer to this question is important too; it is difficult enough to bridge the gaps between the United States and other countries.

For the purposes of this summary, it is noted that even an international conference supposedly devoted to the techniques for producing specialists in physics cannot get off the ground without a characteristic digression. Lord Beeching, in the opening talk, made a plea that physics take care to retain its role as a liberalizing subject. This theme, recurring in all physics curriculum conferences in the United States, was taken up by many commentators. Perhaps it is inaccurate to term it, or to think of it as, a digression.

The conference approved a number of resolutions. Education ministries and universities were asked to encourage further the interchange of students and teachers and to liberalize the formal requirements governing appointment of professors. Universities and their physics departments were asked to insure that broad education in science and mathematics precede specialization, that the attitudes characterizing recent developments in physics teaching, and science teaching more generally, be considered in the modernization of curricula, and that measures be taken to increase the contact between university physics departments and industrial and government laboratories. Finally, the conference called for a meeting of physicists and mathematicians to examine ways of using recent mathematical developments in all levels of physics education.

The circumstances surrounding the conference were handled with thoroughness and grace. The Organizing Committee, with M. R. Gavin as chairman, and Miss P. N. Boston as secretary, deserves the thanks of all, as does the group of British scientific and industrial organizations that provided financial support. In view of the large representation from the United States, and the well-known interest of

our scientific and educational agencies in promoting gatherings of this kind, one could not help but note the absence of United States sponsors.

The full proceedings of the conference are being compiled and edited by S. C. Brown and N. Clarke, and publication has been promised for 1966.

RONALD GEBALLE
Department of Physics, University of Washington, Seattle

Forthcoming Events

January

4–7. **Solid State Physics**, conf., Manchester College of Science and Technology, Manchester, England. (S. F. Edwards, Dept. of Physics, Victoria Univ. of Manchester, Manchester 13)

5–8. National Soc. of **Professional Engineers**, winter mtg., Bal Harbour, Fla. (NSPE, 2029 K St., NW, Washington, D.C. 20006)

6–7. Society for **General Microbiology**, 45th general mtg., London, England. (P. H. Clarke, Biochemistry Dept., University College, Gower St., London, W.C.1)

6–10. International Council of **Scientific Unions**, 11th general assembly, Bombay, India. (Intern. Council of Scientific Unions, Via Sebenico 2, Rome, Italy)

7–8. **Surgical Research** Soc., winter mtg., London, England. (A. P. M. Forrest, Cardiff Royal Infirmary, Newport Rd., Cardiff, Wales)

10–13. **Radioactive Isotopes** in Clinical Medicine and Research, 7th intern. symp., Bad Gastein, Austria. (R. Hofer, Second Medical Univ. Clinic, Garnisongasse 13, Vienna 9)

11–12. Man's Extension into the **Sea**, symp. on SEALAB II, Washington, D.C. (T. Evans, Conference Management Organizer, Colonial Bldg., 105 N. Virginia Ave., Falls Church, Va. 22046)

12–14. **Medicinal and Aromatic Plants in India**, symp., Central Indian Medicinal Plants Organization, Lucknow, India. (S. C. Datta, CIMPO, 4 Sapru Marg, Lucknow)

12–20. International **Fertility** Assoc., Latin American mtg., Acapulco, Mexico. (M. Roland, 109-23 71st St., Forest Hills, N.Y. 11375)

13–14. **Body Fuel Utilization**, conf., Boston, Mass. (F. D. Moore, Dept. of Surgery, Harvard Medical School, 25 Shattuck St., Boston, Mass. 02115)

13–14. Institute of **Mathematical Sciences**, 4th Matscience anniversary symp., Madras, India. (C. P. Ramaswami Aiyer, Inst. of Mathematical Sciences, Madras)

13–16. Indian Institute of **Metals**, 19th annual mtg., Hyderabad. (The Institute, 31 Chowringhee Road, Calcutta 16)

16–21. American **Chemical** Soc., winter mtg., Phoenix, Ariz. (ACS, 1155 16th St., NW, Washington, D.C. 20036)

17–19. **Labelled Proteins in Tracer Studies**, conf., Pisa, Italy. (Euratom, La-