

or sea. Few of these individuals exist in the hungry countries at present.

In the fourth and final chapter the need for improved staffing, equipment, status and influence of nutrition research centres in the Far Eastern countries is stressed, and the establishment in each country of a strong committee representing health, agriculture, education, economics and social welfare, capable both of advising the Government and stimulating action along effective lines, is recommended.

Clearly visible through all the cautious phraseology of this report is the general agreement that a significant improvement in most of the Far Eastern countries depends on influencing governments to give indigenous efforts toward the achievement of

such improvement both high priority and adequate funds. These efforts would include the far closer correlation of agricultural, economic and nutritional policy, and the training forthwith of adequate numbers of indigenous technologists in these fields.

Truly, the improvement of national diets in the hungry countries is a problem which must depend for its solution on indigenous effort, with, especially in the early stages, specialist assistance, 'know-how' and finance from United Nations agencies and other outside sources. The technical knowledge required is already available in the world; if it is adequately applied, very few indeed of the hungry countries need remain so.

H. D. KAY

TEACHING BIOLOGY IN AMERICAN HIGH SCHOOLS

EARLY in 1959 the American Institute of Biological Sciences, an association of forty-seven societies with an aggregate membership of 84,000, set up the Biological Sciences Curriculum Study under the chairmanship of Prof. Bentley Glass of the Johns Hopkins University. Arnold B. Grobham, of the University of Florida, agreed to serve as full-time director of the project, and space for a permanent headquarters was obtained on the campus of the University of Colorado. With financial support assured by the National Science Foundation, the aim of the Biological Sciences Curriculum Study was to examine the defects of present biology teaching at all levels and the provision of specific programmes and materials to bring biology curricula up to date and to focus them more sharply on what a consensus would hold to be the major objectives of biology teaching.

At the outset, it was decided to begin by tackling the problem of biology at the high-school level. Although the defects of biology teaching in the elementary school or in the colleges may be fully as great, it is in the secondary schools that greatest choice of occupation is made; it is here that one finds the last opportunity to teach the sciences, and specifically biology, to nearly every future citizen. Clearly, much of the difficulty in interesting students in the study of biology at more advanced levels derives from the failure of high-school biology teaching to awaken the interest commensurate with its importance.

A steering committee was formed, comprising some thirty persons, who included not only college and university biologists recognized for their research as well as their interest in education but also high-school teachers of biology, writers of text-books and teachers' hand-books, and high-school administrators. During the course of the first year, the steering committee formulated a general plan of procedure and discussed the problems posed by the existence of an antiquated biology curriculum in the secondary schools. There was general agreement on several key points. Some of the findings of the committee are outlined in a recent issue of the *American Scientist* (49, No. 4; December 1961).

The biological sciences are at present advancing at so rapid a rate as to double the amount of significant knowledge every 10–15 years. While this fact makes it imperative to revise courses and methods of teaching at more and more frequent intervals, it also makes it increasingly impossible to 'cover' in any course all that is significant and that a general citizen

might profitably know. Most high-school text-books are twenty years behind the advancing front of knowledge, and in some very significant matters, because of social or religious opposition, fully a century in arrears. Appropriate scientific treatment must be accorded such 'controversial' subjects as organic evolution, the nature of the individual and racial differences, sex, reproduction in the human species, and the problems of population growth and control.

Even worse than the failure to keep biology for the class-room up to date is the prevalent fault of teaching the life sciences (and indeed all others) as constituting essentially a body of established 'true' information, knit by concepts and laws of nature assumed to be unalterable and prescriptive. That observations are always limited, that laws of Nature are mere summations of experience, and that science consequently is for ever adding new observations, modifying its concepts, and refining or replacing its laws of Nature, are principles honoured in the breach. The conception of science as a body of methods of inquiry—involving accurate and confirmable observations, quantitative treatment of data, and controlled experimentation—gets lip service, but rarely, if ever, enters into the experience of the student at the high-school level. In particular, so-called laboratory work has become a travesty of genuine scientific activity.

It is the essence of the life sciences that they are diverse in point of view and methodology. In consequence, there is no single best way to organize a biology course. There is a vast difference between the analytical, physico-chemical approach of the biochemist or biophysicist and the organismal approach of the student of behaviour and the supra-organismal view of the ecologist who must deal with communities and ecosystems. It is both valid and necessary to explore a variety of ways of approaching and organizing the subject-matter of biology.

Whatever the approach and whatever the organization, the essential character of scientific activity and the great biological themes must permeate the treatment. On one hand, the nature of science as an increasingly important element of human history must be stressed. On the other, the warp and woof of the treatment of the subject-matter must consist of the great biological themes such as the interdependence of structure and function, regulation and homeostasis, the genetic continuity of life, its evolution, diversity of type bound up with unity of pattern, and the relation of organism to environment. These

must be treated at all levels of organization, from the molecular level to that of the ecosystem, and at all levels of process, from the chemical reaction through the growth and development of the individual to the evolutionary changes with time.

General education must provide each citizen with an understanding of the nature of the scientific process that has become the source of the most radical social changes and the principal strength and resource of every modern nation. This is of the gravest importance in a democracy, where every ultimate decision rests with the people. This conclusion calls for a thorough and radical change in the nature of most up-to-date science teaching.

A sound understanding of biology is the educational right of everyone who in later years will have to cope with individual problems of health and nutrition, with family problems of sex and reproduction and parenthood, and with the citizen's problems of the wisest management of natural resources, the biological hazards of nuclear radiations in peace and war, and the extent of Governmental support of science as the primary source of national strength and wealth. It was agreed by the steering committee that biology in the high school curriculum might best remain at the tenth grade level, where it is now conventionally taught and where the great majority of students take it, rather than be shifted to a later year where it would have the advantage of following instruction in physics and chemistry but would be taken by a small minority of high school students.

The steering committee adopted the objective of preparing materials for a biology course that would be suitable for all high-school students, irre-

spective of ability or future plans. This choice did not exclude the possibility of preparing, in addition, biology courses designed either for selected groups of younger students or for those more advanced.

During the summer of 1960 the first drafts of three distinct biology courses, including text-books, laboratory manuals and teachers' guides, were prepared by three teams of writers and supporting staffs to produce the 'yellow', 'blue' and 'green' versions, short names for courses on the respective genetic and developmental, biochemical and physiological, and ecological and evolutionary approaches. In the summer of 1961, a revision of the texts and laboratory work was made.

These books are supported by a teachers' handbook, a set of volumes which includes, among numerous other aids to the teacher, a discussion of the background, emphases, and the aims of the Biological Sciences Curriculum Study, and the distinctions between the three versions and conventional high school courses.

The separate volume of *Biological Investigations for Secondary School Students* presents 100 biological problems at present unsolved, selected and edited for the use of the truly gifted student, from hundreds of suggestions submitted by research biologists in the United States. Each problem is outlined with sufficient detail for the student to begin a long-term project. Copies of this volume, the text-books, laboratory manuals, teachers' guides and the teachers' handbook are obtainable from the American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C.

YOUTH SERVICES IN BRITAIN

IN opening a debate on the youth service in the House of Lords on February 21, Lord Stonham, while critical of the scale of the Government's contribution of less than £1 million to be distributed among nearly 5 million young people during the year, congratulated the Minister of Education on the action taken to implement the recommendations of the Albemarle report. The National College for Training Youth Leaders was opened at Leicester in January 1961; 84 students completed the course last year, 140 more had started, and there was already a waiting list for next year's course. The Youth Service Development Council had met 14 times since it was founded, usually with the Minister of Education in the chair; the requirements for the status of qualified youth leaders were announced last July and a salary scale ranging from £680 to £1,000 a year was agreed. For the period 1960-63 the Minister had authorized starts on building projects to a value of £7 million, including furnishing and equipment, four-fifths for local authorities and one-fifth for voluntary bodies, and £535,000 had been paid to voluntary organizations in each of the past two years.

For the Government, the Lord Chancellor, Lord Kilmuir, stated that direct financing of the Youth Service by the Exchequer had increased from £229,000 in 1959-60 to £775,000 in the current year. Under the building programme some 750 new and expanded youth clubs and centres were being provided and there was good reason to believe that the Albemarle target of 1,300 full-time qualified youth leaders would be achieved by 1966. Besides the

National College, there were full-time courses of training at University College, Swansea, and West Hill Training College, Birmingham, and 10 teacher-training colleges had introduced training for youth leadership as an optional part of their three-year course. Proposals to a value of about £14 million had been submitted in respect of building programmes and because of this the Minister had had to introduce a system of local priorities, irrespective of whether the jobs were to be undertaken by local educational authorities or by voluntary bodies. There had been two conferences of senior Government experts on youth questions: one in Paris, in March 1960, and the other in Brussels, in March 1961; and there would be a third in Strasbourg in March 1962; as well as one at Leicester in April on training full-time leaders. A continuous exchange of information and technical assistance was developing on all matters connected with the youth service and there was the prospect of establishing at Strasbourg in the next two years a European Youth Centre concerned with training senior youth leaders, organizers and administrators, through courses of six months, as well as providing shorter courses and research activities.

In replying on the debate, Lord Newton added that the Youth Service Development's Council publication *Youth Service* had now a circulation of 23,000 and that the grants to national voluntary organizations for 1961-62 totalled £236,000 for 35 organizations. Grants for special developments in experimental work amounted so far to £57,000 and included grants to the Youth Theatre, to the Council for Nature, for