

Similarly, its outlook should at all times be realistic and practical, not merely bookish and academic. The students would learn a great deal if they could see at first hand something of modern research in progress and finding application in industrial processes; if they could talk about the realities of life with housewives and trade union officials; if they could discuss philosophy with probation officers and biochemists.

Mention of these requirements leads to the question of the actual content of the teaching course. The supply of available factual matter and related principle is enormous, and far beyond the powers of comprehension of even the most gifted students. At the same time, the contention that the course would amount to nothing more than a jumbled smattering of disconnected subjects would need to be squarely faced. The syllabus would have to be highly selective, concentrating on the contributions of each of the separate disciplines which in the context of the school would be thought to be most representative and significant.

The necessity for selection would present the teaching staff with a problem that is central to the understanding of the place of science in the modern world; and the fact that they would be compelled to give it consideration would be one of the primary consequences of the establishment of a school in Science Greats. At present, this problem is being given thought only on an individualistic basis; within the school it would become a matter of continuing group discussion in circumstances favourable to its deeper comprehension and to the spread of attitudes that deeper comprehension would tend to generate. For the other university disciplines and for the nation as a whole that would be all to the good.

What students would wish to take Science Greats? In response to this question, one thinks of the men and women whose ambition it is to take an active part in public affairs, in politics, international relations, the diplomatic and consular service, in local government, social and welfare movements, and in the higher Civil Service. In addition, there are now many people holding executive positions in industry and commerce who do not require specialized professional training, but who badly need a conspectus of the world as a going concern in all the various aspects. Are they to be squeezed out of the universities and be made to feel uncomfortable at the grammar schools, above ordinary level? That is why, with suitable adaptations, one hopes that the supply of students would be large enough to justify the establishment of schools of Science Greats in British universities.

An interesting move in this direction is the recent suggestion put forward by the General Board of the Faculties of the University of Cambridge for a new Tripos examination. The proposals, which involve a two-year course in Arts subjects, followed by a special course in either the biological or physical sciences, cannot be discussed here. They show, however, that university circles in Britain are aware of the problems of fitting students for life in the modern world, and are prepared to consider ways of meeting them.

ADVANCES IN NUCLEAR PHYSICS

Progress in Nuclear Physics

Vol. 5. Edited by Prof. O. R. Frisch. (Progress Series.) Pp. vii+325. (London and New York: Pergamon Press, Ltd., 1956.) 80s. net; 12.50 dollars.

THE fifth volume of O. R. Frisch's well-established series has appeared, containing seven authoritative articles on topics of current interest. The articles are on the determination of nuclear reaction energies by deflexion measurements, by W. W. Buechner; the inelastic scattering of fast neutrons, by Joan M. Freeman; new electronic techniques for the nuclear physicist, by K. Kandiah and G. B. C. Chaplin; the bubble chamber, by C. Dodd; the radius of a nucleus, by J. M. C. Scott; the neutrino, by B. W. Ridley; and organic scintillators, by F. D. Brooks. As in the previous volumes, the main emphasis is on experimental physics and several of the articles are devoted to experimental techniques. Scott's article on nuclear radii is the only one which gives a specifically theoretical treatment.

Two of the articles are concerned with 'low-energy' nuclear physics. Buechner reviews the ion optics of modern methods of producing mono-energetic beams and of analysing the charged reaction products, and discusses resolution, solid angle of acceptance, and calibration of the various electrostatic and magnetic systems employed in this specialized field, of which he is one of the principal exponents. Miss Freeman writes on a subject in which work of high precision is experimentally difficult, but which not only is important for nuclear spectroscopy but also has a practical bearing on the design of nuclear reactors. She reviews the experimental methods and results for the various inelastic processes which occur in fast neutron bombardment, and follows with a theoretical discussion.

Ridley's article on the neutrino is made topical by two events which occurred after it was written, namely, the discovery of free neutrinos and the excitement about the non-conservation of parity. He discusses the neutrino hypothesis in relation to beta-decay, *K*-capture, and meson and heavy meson decay, and reviews the experiments which have been performed and the theoretical background.

Scott gives a theoretical discussion of nuclear radii as determined by electrical methods, in which the charge distribution may in principle be obtained (mesic X-rays, electron scattering, isotope shift of atomic spectra, X-ray shift), considerations of the coulomb energy of nuclei (mirror nuclei and empirical formulae), and methods depending on nuclear forces (nucleon-nuclear collision cross-sections and barrier penetration). He concludes that the nuclear force radii are not, after all, much greater than the electrical radii when the finite range of nuclear forces is taken into account.

The remaining three articles are concerned with experimental techniques; a proportion of three out of seven is very reasonable in a series which has concerned itself mainly with experimental nuclear physics—major advances have been made in a diverse range of techniques, and further advances will be necessary if full advantage is to be taken of the new large accelerators. Kandiah and Chaplin present some recent developments in electronics, particularly in fast circuits and in simplified scaling systems. Appropriately, half the article is devoted to the transistor as a circuit element. Dodd

reviews the progress of bubble chamber development ; this elegant technique has been developed into an instrument of great power for high-energy physics, and is entering the realm of heavy engineering with the 72-in. chamber at Berkeley, California. However, commensurate effort is needed, and is beginning to be applied, on the problem of evaluating the mass of visual data produced with the bubble chamber, if the necessary good statistics are to be obtained ; Dodd's article does not review this problem. Brooks discusses the present state of knowledge of the mechanism of scintillation in organic materials, and reviews recent data on the properties of organic scintillators—including liquid and plastic scintillators.

The authors have again maintained the high standard set by previous volumes in the series, and again they are all active workers in the fields which they discuss. As usual the quality of production is excellent, but this time there has been a longer delay in publication. The articles do not set out to be exhaustive, but are intended for specialists in related fields. The same characteristic is evident in the choice of topics in the whole series so far ; no attempt is made to give frequent up-to-the-minute progress reports on all aspects of nuclear physics. In this way it has been possible to select topics in which a certain degree of stability has been reached, and the policy has been successful since the articles have not rapidly become out of date. However, rather few articles have so far been devoted to experiments in high-energy physics, in which much solid progress has been made during the past few years ; perhaps we may see one or more articles on this important subject in the next volume.

T. G. PICKAVANCE

A COMMUNITY OF PENGUINS

A Population Study of Penguins

By L. E. Richdale. Pp. iii + 195 + 2 plates. (Oxford : Clarendon Press ; London : Oxford University Press, 1957.) 42s. net.

THIS book is the record of part of a most careful and painstaking field research extending over nearly a score of years on the penguins of New Zealand. The studies described here mainly concern the yellow-eyed penguin, *Megadyptes antipodes*, a non-migratory species that is resident in the south-east of New Zealand and some of the adjacent islands ; the colonies situated on the Otago peninsula where the author worked lie at the extreme north of the breeding range. None of the breeding areas studied lies more than twenty miles from the city of Dunedin where the author lives, and consequently he was able to visit them 1,318 times in the course of his work.

The observations recorded and analysed in this research were made chiefly on just over 400 birds divided almost equally between the sexes, and the results of 819 separate matings during eighteen seasons are traced. "The history of the individual resident penguins was well known to me. Sometimes the acquaintance lasted only one season, after which the penguin disappeared, but five birds were still present in 1953-54, seventeen seasons after they were first found." Recognition of the birds, of course, meant that it was necessary to mark them ; "all adults and juveniles when first met were banded and footmarked, the latter device making it impossible to lose the identity of the bird should a band come off". But

it is astonishing to read that when the author started his work in 1936 he was "unaware that wild birds were being banded in America and Europe", and that inquiries from "authorities in New Zealand" on how to band or mark wild birds led to nothing. The bands he eventually obtained from Europe were unsatisfactory and so, since the end of 1938, he has made his own although it takes fifteen minutes to manufacture each one. Mr. Richdale analyses and discusses the results of his field work with equal patience and care, and presents the most complete account of the population dynamics that has yet appeared about any species of penguin.

The author found that there was considerable wandering during the first five years of the birds' lives, but after that the penguins rarely adopted a new breeding place. Linked with this is the length of the pair-bond ; there is a high rate of dissolution in youth, and in addition some older birds are unable to retain their mates because of incompatibility and the pressure of intra-sexual competition. "Once this period of instability is passed, 63 per cent of the pair-bonds on the average tend to remain intact in a succeeding season." It is not easy to sex living penguins, but one bird that was accidentally killed was dissected and, "because Yellow-eyed Penguins change their mates frequently it was possible by means of this one known bird to trace accurately the sex of every penguin that lived in that particular breeding area in the research period, both before and after the death of the bird".

As a result of his work the author was able to assess the precise composition of a penguin community and the proportions of juveniles, non-breeders and breeders, with, in many cases, their blood-relationship to each other, and the sex-ratio. Among many other matters, he also discusses the influence of age and other factors on breeding success, and the survival and mortality rates of juveniles and adults. A valuable chapter gives a detailed account of the process of moulting and compares that of the yellow-eyed penguin with what is known of the phenomenon in other species of penguin.

The book is produced according to the standards expected of the Press from which it comes and worthily presents an important contribution to ornithology.

L. HARRISON MATTHEWS

SOIL IMPROVEMENT AND BETTER CROPS

Soil Fertility and Fertilizers

By Samuel L. Tisdale and Werner L. Nelson. Pp. xxii + 430. (New York and London : The Macmillan Company, 1956.) 45s. net.

Farm Soils

Their Fertilization and Management. By Prof. Edmund L. Worthen and Prof. Samuel R. Aldrich. Fifth edition. (Wiley Farm Series.) Pp. viii + 439 + 5 plates. (New York : John Wiley and Sons, Inc. ; London : Chapman and Hall, Ltd., 1956.) 40s. net.

THE book by Tisdale and Nelson is essentially a product of North Carolina State College, which has a deservedly high reputation for its studies in plant nutrition and for its State advisory soil service. It is a presentation, for the student of soil fertility, of the fundamental principles of the subject, sup-