SCOTTISH LURGI PLANT

ONE of the outstanding problems in present-day utilization of coal is that of using economically inferior fuels of high ash and moisture content. A most interesting development in this respect is the project undertaken by the Scottish Gas Board for the building of a gasification plant, costing ultimately some £6,500,000, to produce, from low-grade open-cast coal, towns' gas for distribution over long distances.

The process to be used is known as the Lurgi pressure gasification process, and the final capacity will be some 30 million cubic feet of gas a day. The Lurgi process has emanated from Germany, the gas being generated in the first stage of a series of operations by complete gasification of the coal in producers, pressurized to 25 atmospheres, in a continuous stream of oxygen and superheated steam. The gas produced in this way has a calorific value of 300 B.T.U. per cubic ft.

The heat in the crude gas will be used to raise steam in waste-heat boilers. Tar, oils and ammonia in the effluent will be recovered. Benzole, a valuable by-product, will also be recovered from the crude gas. The oxygen required for the process will be obtained from two air-separation plants, which also produce nitrogen. The nitrogen will be used for adjusting the combustion characteristics of the gas at the end of the process stream.

The Lurgi gas contains rather a higher content of carbon monoxide than is desirable for towns' gas purposes. Accordingly, the Lurgi gas will be subjected to a catalytic conversion of the carbon monoxide and water vapour in the gas to carbon dioxide and hydrogen. This reaction is carried out at high temperature and pressure in the presence of an iron oxide catalyst. The carbon dioxide is then washed out in a plant in which this gas and hydrogen sulphide, arising from the sulphur in the coal, are absorbed in a hot solution of potassium carbonate.

In the interim stage of the development, this gas, to the extent of 15 million cu. ft. a day, now having a calorific value of 400 B.T.U. per cu. ft., will be enriched with butane before distribution, thus raising its heating value to within the requirements of the gas grid. The final desulphurization of the gas, in order to meet the Gas Referees' Standards, will be made in pressurized oxide purifiers.

The subsequent development of the process will include an oil hydrogenation enrichment of the gas to a calorific value of 700 B.T.U. per cu. ft., the final dilution to the normal calorific value of 450 B.T.U. per cu. ft. being effected by means of nitrogen from the oxygen plant.

The site of the plant is to be at Westfield in Fife. The plant will be the seventh large-scale plant of this type in the world. It will take five years to complete the construction of the plant and to lay the associated high-pressure and medium-pressure grid mains. These will distribute the gas over an area extending from Angus and Perthshire in the north through Kinross, Fife and Stirlingshire to Lanarkshire and the Lothians.

This undertaking is a bold venture, which has many novel features in comparison with existing practice in gas manufacture. It is timely because it may well serve to demonstrate to industrialists the inherent potentialities of coal, and of its better use, at a time when an over-sanguine conversion to oil for heating purposes may be fraught in the future with possible economic dangers. R. J. SARJANT

TEACHING ZOOLOGY IN BRITAIN

THE Association of British Zoologists held its annual meeting in January in the rooms of the Zoological Society of London, and heard a series of papers on "The Natural Resources of the Country and their Value for Teaching and Research". Dr. J. H. Mundie (Freshwater Biological Association), speaking on the freshwater environment as a field of study, outlined the facilities which exist in Britain for studying freshwater ecology. He attached great importance to good ecological teaching in providing a map of the subject as a whole, and thought that present-day teaching is too factually detailed and passive, so that it tends to stifle the speculative and creative abilities of students. These abilities are found mainly in young people, upon whom the future of research largely depends. He thought that aquatic ecological research, which is essentially a field pursuit, is hampered by university regulations, by which postgraduates are obliged to spend most of their time in college. Commenting on applied problems, Dr. Mundie said that these lie mainly in the fields of water supply and water pollution and are, of course, directly related to human activities. He thought that there is a definite limit to satisfactory modification of the environment in the face of expanding industrialism, and that the best hope of securing conditions of reasonable living lies in adjusting the human rather than the environmental situation.

Speaking on the resources of the sea and the shore, Mr. G. M. Spooner (Marine Biological Association, Plymouth) stressed the great wealth and diversity of the British marine fauna, and gave figures showing the number of zoological specimens supplied each year from some of the marine laboratories in the United Kingdom. He also discussed some of the facilities available for research on marine animals, and the use made of them in fields not strictly concerned with marine biology, such as the important work on nerve physiology carried out on cephalopods. The exhibition of marine fauna in aquaria has, in the main, an educational purpose of considerable value. Under the heading of field study he stressed the importance of the intertidal zone, and mentioned that some areas showing interesting ecological conditions were threatened by the requirements of Service departments. He wondered whether in time the Nature Conservancy would not have to take into its care the intertidal zone in Great Britain.

Mr. T. H. Savory (Haberdasher Aske's School, Hampstead) spoke on the value of land invertebrates for teaching. He suggested that many advantages follow if young zoologists, even before they reach the stage of the Ordinary Level of the General

Certificate of Education, can be persuaded to interest themselves in, say, a group of common land invertebrates. He instanced earthworms, woodlice, grasshoppers and many others as examples of animals that are everywhere available, are still imperfectly studied, and of which the species native to Britain number less than fifty. These conditions provide a pupil with a manageable amount of material in which he may become a specialist. Mr. Savory believed that in this way a boy obtains more than fun from natural history; he can have a degree of satisfaction and even of pride in the work he is able to do. He is, moreover, taken away from the formal pages of the text-book, and makes his own acquaintance with the nature of zoology and with a zoologist's way of thinking. This is most apparent when, *en route* for scholarship honours, he enters a sixth form. "Scholars are bred in sixth forms", and despite the undeniable disadvantages of specializing, this early training may well supply one of the stepping-stones to success.

Speaking on the initial training of field workers, Mr. F. J. Bingley (Flatford Mill Field Centre) said that this forms one of the most important functions of the field centres run by the Field Studies Council. There are now five such centres, each with qualified staff, laboratories and student accommodation, and with courses in all branches of field biology. As an example, he described how, at the Flatford Mill Field Centre at the head of the Stour estuary on the Essex–Suffolk border, courses for biology students are run at three academic levels, including general ecology courses for those with no previous experience; specialized courses, for example, a freshwater biology course, where the students spend three or four days studying animal communities in different types of freshwater habitat followed possibly by a detailed survey of a stream and, on the last day, investigate some small problem on their own; and advanced courses for undergraduates and teachers, when the most modern field methods are taught by specialists. On all these courses attention is paid to fauna, flora and habitat, and emphasis is laid upon training in observation and the quantitative approach. Research workers also make use of the excellent facilities offered by the centres, and their results add materially to the teaching potential of the resident staff.

Dr. A. d'A. Bellairs (St. Mary's Hospital Medical School), speaking on the reptiles as a field of study, said that reptiles seldom figure prominently in the teaching of elementary zoology in Britain and, despite the fact that there are only six British species, much greater use might well be made of them. With their dry scaly skins and amniote eggs, the reptiles illustrate a more advanced stage in the colonization of the land than do any of our amphibians. Moreover, three British species are ovoviviparous, and can serve as a valuable source of living embryos. The slow-worm and the snakes are of further interest from a different point of view, for they are good examples of a particular type of extreme specialization, and provide an instructive contrast with the rather generalized animals which comprise most of the 'types' studied in courses of elementary zoology.

As a field of research, the reptiles present many problems in anatomy, physiology and behaviour. The recent observations of American herpetologists have shown the value of field studies, comparable with those which have been made for many years by ornithologists. Detailed and accurate observations on the territorial behaviour and the patterns of courtship in British reptiles would be of great interest; so also would studies of their temperature tolerances, following the work of C. M. Bogert and others in the United States. Many anatomical problems, for example, the possible presence of vestigial limb–nerve plexuses in snakes, also seem well worth investigating, even by comparatively simple techniques.

H. G. Vevers

PHOTOBIOLOGICAL INVESTIGATIONS

A MEETING of the Photobiology Group was held in Bedford College, London, on the afternoon of March 27. Three papers were presented and afterwards discussed. Dr. C. A. Parker (Admiralty Materials Laboratory) described "Recent Advances in Spectrofluorimetry and Chemical Actinometry". The ferri-oxalate actinometer recently developed by Dr. Parker is several hundred times more sensitive than the uranyl oxalate one used until recently, as well as having other useful features, such as linearity to light intensity over a factor of 10^6 and effectiveness from the far ultra-violet to the green. Its sensitivity permits its use for measuring spectral distributions, with narrow band pass filters, of daylight, discharge lamps, etc., and for calibrating spectrometer – photomultiplier set-ups, particularly in the ultra-violet region where other methods are very difficult. An instrument properly calibrated in this way can be used to measure the true shapes of fluorescence spectra. An even more valuable analytical method is to use a calibrated light-source spectrometer combination to excite fluorescence to determine a true 'action spectrum'; this should normally reproduce the absorption spectrum of the fluorescent substance even though the concentration is far too low for ordinary absorption spectroscopy. Examples were shown of the use of this method for analysing rubber extracts.

Dr. R. S. Spencer (Food Investigation Laboratory, Hull) read a paper on "The Biology of Luminous Bacteria". He showed that luminous organisms are widely distributed within the animal kingdom but less widely so within the plant kingdom, only certain bacteria and fungi being luminous.

Luminous bacteria would appear to have one main habitat, the seas and the creatures living in the seas, and several minor ones, namely, fresh water and certain terrestrial animals on which they are parasitic. They are frequently present in enormous numbers on spoiled and spoiling fish, where they are responsible for the luminosity of such fish, a phenomenon noted long before the bacteria themselves were discovered.

Many different species of luminous bacteria from marine sources have been named but it is possible that a critical study will show the actual number of species present in this habitat to be quite low.

Fish, of diverse species, harbour luminous bacteria on their surface and in their intestines, frequently in very large numbers. Current work with fish caught around the British Isles and in the Arctic