protein metabolism have been investigated, using carbon-14 amino-acids. Penicillin has been made active and its reaction has been followed in animals.

The future will see an expansion of the use of radioactive materials as bigger sources are used for irradiation purposes. At the moment work is in hand in examining chemical synthesis or changes happening under very strong radiations. At the same time, some progress has been made in trying to sterilize foods and penicillin by radiation. The dosages necessary for this are very big indeed. They are of the order of a hundred thousand or millions of roentgens, and in Great Britain it will be another year or two before facilities are available for this kind of research.

The Atomic Energy Research Establishment at Harwell and the Radiochemical Centre at Amersham are sending out more than nine thousand shipments of radioactive materials a year to some thirty-seven countries, including the United States, most South American countries, Africa, India, Australia and New Zealand. The majority are used in medical research, diagnosis and therapy.

In medical diagnosis very small amounts of activity are required and have been used successfully for blood circulation tests. Work is in hand in tracing tumours of the brain by tracer methods. In therapy, the greatest use is that made of radioiodine in the treatment of thyroid toxicosis. Some cases of thyroid cancer can be treated successfully with radioiodine. Cancer of the bladder can be treated with an active bromine solution in a rubber balloon. Colloidal gold is used as a palliative treatment of malignant pleural and peritoneal effusions. Radiosodium is used in plastic surgery. Radiophosphorus is used in polycythæmia vera. Big telecurie sources are used for general irradiation, and special beta-sources which only penetrate a few millimetres of skin are used in the treatment of some surface cancers. These are usually applied as radiophosphorus built into a plastic. The plastic is irradiated in the pile and, after irradiation, the radiotherapist cuts out the right shape of the plastic which he needs and applies it to the malignant tissue, leaving it a calculated time in order to give the exact radiation dosage.

In the early post-war days, people were apt to speak of isotopes as 'by-products' of atomic piles. This picture has changed now. Radioisotopes have helped industry in solving many problems, they have widened the field of research in many sciences and have helped the medical man to treat disease and, in some cases, to save life. They have become an important part of the atomic energy development, and I am convinced that we are only at the beginning of the development of 'isotopics'.

THE NATURE CONSERVANCY

SOME aspects of the work of the Nature Conservancy were the subject of discussion at a meeting of the Linnean Society on February 19. In his opening remarks, Captain C. Diver said that conservation and research, the Conservancy's two main functions, are necessarily very closely linked. He and Dr. Conway dealt with two ways by which scientifically valuable places might be safeguarded for study; Mr. Skellam and Dr. Ovington, who are each in charge of one of the half-dozen main research programmes now being carried out by the Conservancy, then outlined one or two of the problems on which they have been working.

The most effective means of conserving any special place is to acquire it or otherwise arrange for it to be managed as a Nature reserve. This is not always easy because of land requirements for forestry, agriculture, service training, and development of one kind or another. To exemplify these conflicting demands, twelve cases were mentioned where places of the highest scientific value have been lost or threatened; these included the requirement of Bilston Glen for dumping colliery spoil and the Arne heaths in Dorset for ball-clay working.

The Conservancy has, however, already declared nine reserves (two in Scotland and seven in England) totalling about 22,000 acres; and negotiations are proceeding satisfactorily in respect of at least seventeen more. Informal agreements have also been made with the owners of several other properties; and help is being given with the management of a few sites already held as reserves by other bodies. Two local authorities are using their new powers to establish local reserves.

The Conservancy has also acquired two properties—one in the Lake District and one in Dorset—which are being equipped as research stations; and field research facilities are being provided at Moor House Reserve (Westmorland) and at Beinn Eighe Reserve (Wester Ross).

Dr. V. M. Conway said that the making of Nature reserves can safeguard only a small fraction of the wild country that must be kept in something like its present state if reasonable stocks of the native flora and fauna are to be preserved. Power to conserve other interesting places rests largely with local authorities; but under Section 23 of the National Parks and Access to the Countryside Act, 1949, the Conservancy has the duty of notifying planning authorities about the areas which are of special scientific interest by reason of their flora and fauna, or geological or physiographical features. Local planning authorities are required to consult the Conservancy before giving planning permission for developments likely to affect areas so notified. The Conservancy can then put the scientific case for conservation, and can approach owners and other interested parties. One of the weaknesses of this arrangement is that changes in sylvicultural or agricultural methods do not constitute 'development' and might, therefore, occur without the Conservancy's knowledge, often to the detriment of the valuable characteristics of the area.

The choice of areas for notification under Section 23 rests primarily on the recommendations of the local committees of the Nature Reserves Investigation Committee which was at work during the War. These recommendations have been checked and revised since the Conservancy came into being in 1949—work which has been made possible only by a large amount of voluntary help. Notifications must be made with minimum delay because so many good places are being lost all the time, and planning authorities need information as quickly as possible. For this reason there are many gaps and inequalities in the existing lists; but by careful collection of information over the next four or five years it is hoped that these may be largely removed in time for the first revision of county development plans.

Passing from administration to research, Mr. J. G. Skellam said that the statistical analysis of observa-

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tional data enters into all aspects of the Conservancy's scientific work. In order to illustrate the mathematical approach, he selected just one topic, that of quadrat sampling. This subject is of considerable importance to the Conservancy because of the need to assess floristic and faunistic changes which may be taking place in the same locality with the passage of time and to measure the differences which exist from place to place; and in both cases to do so with known accuracy.

Mathematics can be applied to biological problems in two ways. In the first place, mathematical functions can be used for describing numerical results in a concise way. But such descriptions are often arbitrary and only acquire meaning when they can be related to the underlying causes. It is instructive in this connexion to construct simple models or idealized versions of the biological situation as suggested by observation and experiment and to deduce their consequences. In this way we not only discover functions which are suitable for description of numerical data, but we also construct standards which play the part of a basis for comparison against which the real complexities may be critically demonstrated.

Dr. J. D. Ovington then briefly described some of the woodland research carried out by the Conservancy over the past three years in co-operation with the Forestry Commission. Investigations are progressing at several widely different localities in Great Britain. Each locality contains a number of woodland plots of different tree species established on what were originally fairly uniform sites. The principal characteristics of the various woodlands and their dynamic relationships are being considered with particular reference to the climate, soil and ground flora. Tree canopies intercept precipitation and in so doing diminish and redistribute the rainfall reaching the soil. The irregular distribution of the precipitation pattern in woodlands can in part be attributed to the raindrops coalescing on the canopy and falling as large drops. Once established, the trees influence soil formation, and, after twenty years of afforestation, marked differences, particularly in the accumulation of surface organic material, soil *p*H and nutrient content, develop under different tree stands. The weight of the ground flora present in a woodland may be related to the age and closeness of the trees and to the type of woodland that has been established. The associated woodland floras differ considerably in their floristic composition and give some indication of the extent to which site conditions have been modified by the various woodland plantations.

Discussing Dr. Ovington's paper, Dr. J. Ramsbottom directed attention to the importance and specificity of the fungal flora in different types of woodland—facts which are frequently overlooked. Dr. Ovington confirmed that the species of fungi present in the plots he has worked on show differences like those described by Dr. Ramsbottom, and he thinks it is of primary importance to understand the part played by these species in the nutrient cycles. Replying to Mr. W. T. Stearn, he explained the technique used for measuring the size and dispersal of raindrops.

Speaking of the Midlands, Dr. A. Tindell Hopwood said some useful work might be done on the covering of slag-heaps with vegetation. Dr. Conway replied that one of the research students supported by the Conservancy is already working on this problem and that the Conservancy might take a direct interest in it when it has made sufficient headway with its primary task of conserving unspoilt areas of land. Prof. C. T. Ingold expressed the hope that the Conservancy will not get too departmentalized and will keep in close touch with local natural history societies and possibly issue a journal. Captain Diver said that he expected regular reports will now be issued. Mr. Stearn pointed out that many places are not in a static condition but are changing all the time, and asked what will be done about this. Captain Diver replied that when places are considered for reservation it is essential to know whether one wants to maintain them in a particular phase, for example, downland turf, or to study the natural sequence of change as in a prograding coast; and reserve management policy has to be directed to achieve the required result.

ELECTRICAL DEVICES FOR CONTROLLING THE MOVEMENTS OF ANADROMOUS FISH

INCREASING attention has been paid, over the past few years, to the use of electric currents as aids for catching fish in freshwaters, and it is evident that the use of electrical methods promises to become an important technique both for the fisheries biologist who wants to carry out census work and the owner who wants to reduce or eliminate populations of unwanted fish from his waters.

A recent communication[1] by a member of the staff of the North of Scotland Hydro-Electric Board has described other uses of electric currents in fisheries. Hydro-electric works are bound to have important effects on the movements of migratory fish, since they frequently interpose barriers to migration or create other unnatural hazards in the course of their operation. Over much of the area covered by the North of Scotland Hydro-Electric Board, salmon are the most important migratory fish, and it has been found necessary to try to discover ways in which the potentially deleterious effects of hydro-electric developments could be minimized. When constructing impounding dams, the Hydro-Electric Board is legally bound to provide fish ladders so that migrating fish can pass upstream or downstream; but the construction of hydro-electric power stations creates other problems. Downstream migrants may be drawn into the tunnels or aqueducts which lead to the turbines, and the volume and turbulence of the water discharged in the tailrace from the stations may deflect migrants from their course and so interfere with their passage upstream. In the communication mentioned, an account was given of devices which are being used for trying to solve both these problems, following experimental work in the Board's laboratory at Dundee.

At Morar, an electric screen has been erected to deter salmon and sea trout from entering the tailrace of the power station. This screen consists of a row of aluminium electrodes, each about 14 ft. in length, which extends to three inches from the bottom of the channel, together with two electrodes, about 16 ft. apart, placed 7 ft. downstream from the main screen. A pulsating electric supply is applied across the electrodes. Salmon are seen to react when about 5–6 ft. from the outer electrodes since, at this distance, they turn and swim upstream past the end of the

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