

apparatus used for both low-energy and high-energy precision determinations of energy-levels, using for the latter the new Van de Graaff generator at the Massachusetts Institute. Results have been obtained for a variety of elements, in many places checking with those obtained elsewhere at low energy, and adding many new ones at high energy. Dr. Bender described the unique high-resolution beam analysing system used with the University of Pittsburgh cyclotron. He then summarized the results so far obtained by its use. These consist of energy-levels obtained from ( $pp'$ ), ( $p,\alpha$ ) reactions; many old levels have been found, some with new precision, and many new highly excited levels have been located. Finally, Dr. Way reported a new set of values for the binding energies of the nuclei above lead, and also in the region around neutron number 50 and atomic number 50. These were obtained by considering closed cycles involving alpha-decay and beta-decay. On the basis of the existing experimental data, differences in binding energies at both the neutron and proton 'magic' numbers showed up clearly.

Discussion leaders for the sessions included Dr. Maria Mayer (Argonne National Laboratory), Dr. Maurice Goldhaber (Brookhaven National Laboratory), Dr. S. T. Butler (Cornell), Dr. G. C. Wick (Carnegie Institute of Technology), and Dr. T. Lauritsen (California Institute of Technology).

PHILIP M. STEELE

## ISOTOPES IN MEDICINE

THE application of isotopes in medicine is a subject which shows signs of dangerous over-popularization, with the consequent unjustified simplifications of the problem. A recent publication, entitled "Isotopes in Medicine"\*, must therefore be very welcome since this series of articles, a number of them reviews, by acknowledged authorities in their respective fields demonstrates clearly the limitations as well as the possibilities of the clinical and biochemical applications of isotopes. The title "Isotopes in Medicine" is misleading, since only a few of the direct applications of isotopes in medicine are discussed and a number of papers are devoted to reviews of biochemical investigations which are unlikely to exert much influence on clinical medicine for some time. This, however, is not meant as a criticism of the standard of the material, which is high, and the editor is to be congratulated on his choice.

Isotopes represent an important new weapon in the armoury of the clinician and the biochemist; but it is clear that they rarely provide a short cut to the solution of a given problem, and their use demands not only considerable technical resources but, above all, a wide knowledge and experience of the particular field in which they are to be applied. The use of radioactive isotopes in radiotherapy can only be based on a wide experience of orthodox methods of radiation therapy, as is clear from the contribution to this volume by Ralston Paterson and his colleagues. In biochemical research the use of isotopes has in a number of fields raised rather than solved problems, and advances in the applications of isotopes will, to a very large extent, depend on advances in general biochemical theory and technique.

The basic problem in the clinical application of radioactive isotopes is that of obtaining adequate localization of the isotope within the required tissue.

\* *Brit. Med. Bull.*, 8, Nos. 2-3, 111-300 (1952), 18s.

A degree of localization is required for both therapeutic and diagnostic applications, but in therapeutic work a much higher degree of localization is needed in order that the healthy tissues of the body should not suffer too great damage. The concentration of iodine by the thyroid has been made the basis of many diagnostic and therapeutic studies, which are well reviewed in this volume; but it must be admitted that the popularity of thyroid studies with iodine is largely due to the fact that iodine alone of all the elements will achieve by metabolic processes a high degree of localization within the body.

Increasing use is being made in radiotherapy of radioactive isotopes in the form of discrete sources used either externally or within the body. No papers on this aspect of the subject are included, which is perhaps reasonable since the problems are basically technical ones, and the clinical applications follow along the lines of treatment with X-rays and with radium sources. Other methods of providing a localized irradiation of the required tissues are being developed, and two of the recent techniques are discussed. A description is given of the treatment of malignant bladder conditions by a radioactive solution enclosed in a rubber balloon in the bladder, and of irradiation of the pleural and peritoneal cavities by the injection into these cavities of radioactive gold in colloidal form.

The diagnostic application of isotopes involves to a large extent radiation measurements made externally to the patient and thus must depend basically on instrumentation. An application is described of scintillation counting in an attempt to diagnose brain tumours following administration to the patient of fluorescein labelled with iodine-131. So far, in Great Britain, the results with this technique have not been very promising.

One of the most simple and direct applications of radioactive isotopes in diagnosis lies in the study of blood flow. Here a measure is required only of the rate of transport of radioactive material injected into the blood, and valuable clinical applications have been found for this technique, described in several papers of this volume.

On the technical side the volume contains a number of extremely useful articles, in particular that by L. H. Gray entitled "General Principles of Assay and Standardisation of Radioactive Isotopes". A report is also given by members of the staff of the Radiochemical Centre, Amersham, on the availability of labelled compounds, with details of the methods of synthesis of a number of compounds labelled with carbon-14.

L. F. LAMERTON

## NATIONAL INSTITUTE OF AGRICULTURAL ENGINEERING OPEN DAYS

THE National Institute of Agricultural Engineering, at Wrest Park, Silsoe, Beds, held open days during July 22-24, when exhibits were staged to illustrate to visitors the work of the Institute. The exhibits did not cover the whole programme of the work in hand at Wrest Park (which is reported more fully in the recent report for 1949-51<sup>1</sup>); but, even so, they were quite comprehensive and representative of many aspects of the activities of the departments.

Noticeable features were the use made of instrumentation, comprising standard, modified or specially designed apparatus for use not only under laboratory conditions but also in the field; of techniques devised to meet the great variety of investigations undertaken; and of the experience and facilities of the Institute for developing machinery and equipment primarily for use by other research institutes. Examples of the last were the fertilizer placement machines shown by the Mechanical Engineering Department to meet the needs of research workers at Rothamsted Experimental Station and the Macaulay Institute for Soil Research; the combine harvester, using a new principle of threshing, for harvesting crops grown on plots; an elevator-loader for handling potatoes into covered storage, fitted with a sprout depressant dust-feed, for the Potato Storage Investigation Team of the Agricultural Research Council; and a press for the extraction of protein from macerated leaf which has been developed in association with Rothamsted and the Grassland Research Station.

The Mechanical Engineering Department is responsible for carrying out official tests of tractors and accessories, grain cleaners and driers, and grass driers. A full-scale test of the last was demonstrated, and included a specially designed mobile laboratory. A good deal of equipment has been developed for tractor testing, and that exhibited included a hydraulic loading car, drawbar dynamometers, a mobile belt-dynamometer and a power take-off dynamometer; a mobile trailer weighbridge used for grass-drier tests was also shown.

Research into the design and operation of tractors is proceeding with the help of the foregoing equipment, and a single-wheel tester which has been under development is now completed and will also be used for tractor testing. Research is chiefly concerned with the factors affecting the efficiencies of the engine, transmission and driving wheels; attention is also being given to the possibilities of using hydrostatic transmission, and an experimental motor built into the driving wheel of a tractor was on view.

Tests of agricultural machinery other than that already mentioned are the concern of the Agricultural Testing Department, and examples of the methods and equipment used were to be seen. These included a ploughing-depth recorder; portable weighers for wheels, sacks, bales, etc.; apparatus for collecting the complete contents of a potato ridge *in situ* and for sorting and grading them, for the measurement of the power requirements of machines and the dirt and top tare of sugar beet, and for the calibration and testing of seed drills and fertilizer distributors; and the method used for the detection of mechanical damage to potatoes. The work of this Department also includes investigations into the spring mechanization of sugar beet—a Dixie down-the-row thinner was at work—and the loss of sugar and dirt in field clamps of sugar beet.

The activities of the Horticultural Engineering Department cover a wide field; those displayed related to overhead irrigation, spraying, frost prevention, glasshouse heating and ventilation, tractor steering, the washing of vegetables and the harvesting of onions. Modern techniques such as those employing electronic apparatus have been brought into use; both irrigation and spraying for plant protection call for the production, control and distribution of droplets, and the assessment of the resulting patterns. A high-speed camera is used for the study of spray

formation by nozzles of different patterns, and the apparatus and photographs were shown; a dye is used in many of the sprays, and spray patterns were on view—the dye serves both for visual inspection and for colorimetric and gravimetric estimation. In co-operation with the Research Branch of the Post Office Engineering Department, photoelectric scanning apparatus and electronic counters have been adapted for studying spray patterns and providing data as to the number and sizes of the droplets deposited; the apparatus was demonstrated in use<sup>2</sup>.

Methods of frost prevention include fans and water sprays, and equipment and results were to be seen.

The apparatus used in the study of glasshouse heating and ventilation was shown, and included instruments for measuring and recording soil moisture, soil and air temperatures, air flow, carbon dioxide concentration, solar radiation and heat losses; the results of this work to date and also those of steam sterilization of soil were displayed.

Research work has been commenced into the problems arising from the design or adaptation of a tractor to meet the exacting requirements of market garden crops. Steering is receiving attention as a primary consideration, and a steering-deviation recorder and a speed and torque recorder were open to inspection. Adaptation has involved reversing the normal driving position and transmission of a tractor and mounting the implements ahead of the front driving-wheels of the reversed tractor in full view of the driver.

Research and development on ploughs and other tillage implements and on potato harvesters have revealed the need for more information about soil conditions, and a section of the department concerned has been formed which is devoted to soil physics; it is now known as the Soil Department. Known methods and new ones have been devised for obtaining, especially in the field, the data required. A soil penetrometer and torsion shear box were shown, and a demonstration was staged to illustrate the effect of compaction of the soil by tractor wheels.

Strain-gauge equipment in conjunction with a mobile laboratory was exhibited, by which the forces acting on a plough, on a tine or on the linkage of direct-mounted implements are recorded.

The development of a satisfactory potato-harvester has engaged the attention of the Institute for a number of years; the experience gained has been incorporated in the latest development, which takes the form of two separate units—a digging unit on a rear-mounted toolbar and employing a disk share for digging, and a rotating spider for separation; the crop can be left on the ground or an elevator can be fitted to deliver into a trailer, which can be fitted with a detachable picking conveyer. The separation of functions makes the arrangement suitable for the small grower.

The drying, handling and storage of cereal crops are the principal interests of the Grain Department; investigations have been carried out to improve the efficiencies of the installations developed—many of which are now in use on farms—and to extend their application, for example, to green crops and overseas products. Experimental plant of different types was on exhibition, including ventilated silos of concrete and fabric, a grain elevator, grain cleaner, platform sack drier used also for green crops, and special apparatus for measuring air flow, temperature, humidity, pressure drop, moisture content, etc.

Field surveys are carried out by the Field Investigation Department, and an independent survey of tractor utilization is in hand. Potato planting and harvesting, sugar beet and grain harvesting, and hay-making are under investigation. Present farming practice is studied, and planned trials, so far as practicable under controlled conditions, are undertaken. Results, methods and equipment were to be seen. A portable windrow weigher has been devised; but much of the apparatus used is that already mentioned in connexion with testing.

The main laboratories, forming the Instrumentation Department, are at the service of all departments. There special investigations are carried out, for example, on the specific heat of soils, ploughshare wear and precision drilling, besides routine calibration and analyses. Moisture content determinations are a prominent feature for which standard methods are not always suitable, and special apparatus has to be devised to cope with a wide variety of products—for example, apparatus was in use dealing with grass, with coffee beans and with tomatoes.

Considerable use is made of photography, including cine-films; two ciné-films with tape-recorded commentaries were shown in the Conference Room each day; the Library, which handles not only books, bulletins and periodicals but also manufacturers' catalogues and Institute photographs and slides, was open to visitors.

<sup>1</sup> Nat. Inst. Agric. Eng. and Scottish Machinery Test. Stat.; Report October 1, 1949–September 30, 1951. (Silsoe: the Institute, 1952.) 8s. 6d.

<sup>2</sup> See *Nature*, 169, 519 (1952).

## SPORTS TURF RESEARCH INSTITUTE

### MACHINERY EXHIBITION AND OPEN DAY AT THE ST. IVES RESEARCH STATION

THE combined machinery exhibition and open day of the Sports Turf Research Institute, held during July 15–16 at the St. Ives Research Station, Bingley, proved to be a very successful event of great interest to all users of sports turf. Manufacturers combined to put on show a wide variety of implements used in turf production and maintenance, and to many people it was a revelation to see the amount and variety of machinery called for to uphold modern turf standards in face of the increasingly heavy demands being made on playing areas. Mowing machines of very many types naturally were much in evidence; but there were also, among other things, tractors, fertilizer distributors, line-marking machines, compost shredders, turf-cutting implements, watering tackle, weed sprayers of all sizes and a variety of implements for piercing turf in order to relieve soil compression and facilitate easy ingress of air and water. A wide range of hand- and power-drawn machines was demonstrated. A recent development has been the use of the three-point hydraulic linkage of tractors for operating spiking equipment, while a new power-driven spiker, shown for the first time, roused much interest.

The variety of sprayers on view may be taken as a measure of the interest taken in weed control. On the experimental ground, where a number of current trials were demonstrated, the subject of weed control

also received attention. Weedkillers based on 2:4 D (2:4-dichloro-phenoxyacetic acid) and M.C.P.A. (2-methyl-4-chloro-phenoxyacetic acid) have proved a great boon, but some weeds have proved somewhat resistant and work on these is proceeding. On show were experimental plots treated with 2:4:5 T (2:4:5 trichloroacetic acid) at various rates with and without admixture with 2:4 D and M.C.P.A. Results obtained against clover were very promising indeed, but yarrow control did not appear so good. There were also trials of exfoliated vermiculite for turf establishment and maintenance and on the use of bitumen for toughening turf to withstand heavy wear. Further field trials on view included a number on grass-seed mixtures for various purposes and others on fertilizer treatment. Among the latter must be mentioned a series which must be about the oldest of its type existing, since in it individual plots have received their own particular kind of fertilizer treatment for a period of more than twenty years. The effects of these treatments on botanical composition, pest and disease invasion, drought resistance and the like were easy to see.

Much interest was displayed by visitors in the laboratories which were open to them. The increasing demand for scientific advice is well shown here, since only last year a new chemistry laboratory had to be fitted out to cope with the increasing demand for analytical work, while this year visitors were able to see for the first time the new Biology Department. Though its laboratory space is somewhat limited, the Department has an ambitious programme and is already making its presence felt.

This new Department undertakes routine examinations of diseased turf, the identification of turf plants, and turf pests; in addition, both short- and long-term schemes of research, mainly in the realms of turf diseases, are being conducted. In Great Britain there is not the great variety of turf diseases which may be found in, say, the North American continent, but there are definite problems in need of solution. Improved methods of control of *Fusarium* patch disease are being sought, and new fungicidal materials are on test in the laboratory and in the field for this purpose.

A study is being made of the biology of 'fairy rings' as a necessary preliminary to the devising of methods for their elimination. In the popular literature on turf management much has been written on the control of 'fairy rings'; but trials with reported curative treatments seldom seem to have been conducted under adequately controlled conditions.

## STANFORD RESEARCH INSTITUTE, CALIFORNIA

### REPORT FOR 1951

IN an address, "Research and Industry—Partners in Progress", to the board of directors of the Stanford Research Institute, California, on the occasion of the fifth anniversary of the founding of the Institute, Brigadier-General D. Sarnoff, chairman of the board of the Radio Corporation of America, said that the Institute is an outstanding example of the natural partnership between research and industry. That partnership, he believed, offers the