favour a single arbitrary standard in place of the present three will have no difficulty in selecting time for this purpose.

The accuracy of establishment of the electrical units is perhaps somewhat disappointing, being about 1,000 times worse than the lowest accuracy of the fundamental units. It is therefore interesting that consideration should be given to the possibility of establishing a calculable standard of capacitance. To obtain an improvement in the establishment of electrical units by this method, it will be necessary to measure a capacitance of the order of 1 $\mu\mu$F. to an accuracy of 1 $\mu\mu\mu$F.—no mean feat of measurement.

The second panel is concerned with materials and components and there can be little doubt that Mr. Webb was justified in selecting, as the feature of greatest interest at the present time, the commercial production of germanium and silicon with impurity contents of less than one part in 10^8.

Measuring techniques, devices and instruments are covered by the third panel. This is a wide field where choice would be difficult. However, electrical joints occur in most electrical apparatus, sometimes in very great numbers.

The soldered joint made by a skilled operative has been long established and is still of great value, but occasionally a dry joint is obtained which may give trouble. Wrapped joints have now been developed, with a life expectancy of forty years, which can be made by unskilled operatives at great speed. The bound joint is an interesting variant in which wires of various diameters are bound together with binding wire of fixed diameter. This should simplify the design of wrapping tools.

The fourth panel is concerned with data processing, including analogue and digital computers. A vital component of the computer is the memory, which is often either a magnetic tape, a magnetic drum or a large number of magnetic elements such as ferrite toroids or straight magnetic wires.

The latest development involves the trapping of magnetic flux in a superconductor. This method holds out the hope of providing an access time about 1,000 times less than the fastest of the magnetic devices, but as the necessary equipment includes a helium liquefier the capital and operating costs of the memory may prove to be very high.

The fifth panel covers servo-mechanisms and control systems, a subject of some antiquity but one in which recent developments have occurred at a great rate.

The sensitivity and speed of response of modern servo-mechanisms are aptly illustrated by the possibility of controlling a magnetic field so that a piece of iron is held stationary between the upward pull of the field and the downward pull of gravity. Satisfactory damping has been achieved for this device.

A useful list of references is an unusual addition to a chairman's address, making it possible for the interested reader to go deeper into any subject of special interest to him. A. H. M. ARNOLD

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, NEW ZEALAND

ANNUAL REPORT

THE annual report* for the year ended March 31, 1958, of the Department of Scientific and Industrial Research, New Zealand, includes the usual statement by the Minister, the brief report of the Council and the longer report of the Secretary, together with reports from the branches and incorporated research associations. Some notes are included on grant-aided research at Canterbury Agricultural College, the Cawthron Institute, Massey Agricultural College and the University of Canterbury Industrial Development Department. Lists of publications are appended to the various departmental reports. Substantial effort was again devoted to the work of the International Geophysical Year, and a senior officer of the Department visited the New Zealand territories in the Pacific Islands to assess the agricultural problems to be solved if production is to meet the requirements of growing populations and satisfy the need for modern services and amenities.

Expenditure in 1957–58 was £1,535,000 gross, compared with £1,404,000 in 1956–57, the latter figure being 0·137 per cent of the national product. The Council believes that the future development of New Zealand depends very materially on scientific research and development, and urges that the percentage of national income should be increasing and not decreasing: during 1949–50 it was 0·173 per cent of the national product, and during 1951–52, 0·152 per cent. The professional staff of the Department at March 31, 1958, was 383, compared with 369 in the previous year, but was nineteen fewer than six years previously. In particular, the need to increase the work in nuclear science carried out by the Division of Nuclear Sciences and by the universities is emphasized, and the Council, after considering the position, envisages expenditure of some £500,000 to install and operate equipment to meet New Zealand's needs. Grants to research and allied institutions totalled £141,031, including £30,000 to universities and colleges of agriculture, and the Council is also concerned to extend the assistance at present given to industry.

The Secretary's report is mainly concerned with research completed during the year and includes a fairly full summary of the scientific activity in the Ross Dependency and in connexion with the International Geophysical Year. Scientific assistance given to the Police Department has included the use of paper chromatography for the separation and identification of barbiturates. The Philips electron microscope was installed at the Dominion Physical Laboratory in April 1958. The radiocarbon technique has been used to examine an ocean profile from the New Caledonian Trench, and preliminary investigations indicate that the method can also be used to study the circulation time and direction of underground water flow at Wairakei, while a

* Report of the Department of Scientific and Industrial Research for the year ended 31 March, 1958. Pp. 90 (H.34.) (Wellington, Government Printer, 1958.)

theoretical study has been made of a possible way of extending the range of the carbon-14 dating equipment by isotopic enrichment using a thermal diffusion column. The sulphur isotopic variations in the sulphide and sulphate of geothermal bore waters have been used to estimate a temperature of 370 ± 70° C. for the hot chloride water underlying Wairakei.

Surveys over twelve years of areas susceptible to grass grub indicated that none of the land sown in introduced pastures and crops is absolutely free from grub attack, and as the texture of the soil improved, the land became more liable to attack. Grass grubs may be the main cause of weed encroachment on pasture lands, and the satisfactory control of grass grub in both North and South Islands has shown that pastures protected with DDT do not become infested with weeds. The decreased effectiveness in the past three years of the scale insect, *Eriococcus ovariensis*, as a controlling factor on manuka in the northern Hawke's Bay area appears to be due to the presence of a parasitic fungus capable of killing the scale insect responsible for manuka blight. An insect survey of agricultural crops in New Zealand was initiated, and a preliminary survey of grasslands in the North Island has already yielded much information on the distribution and relative abundance of more than 270 species of insects. Trials on rape selected for resistance to aphids proved as productive, or more productive, than the Broad Leaf Essex strain, and still grew well under aphis infestation sufficient to destroy the latter. Field trials by the Plant Diseases Division indicated that a recently introduced variety of swede, Doon Spartan, is comparable to the New Zealand bred variety, Calder, in resistance both to virus and to the cabbage aphid, but that the varieties resistant to cabbage aphid are not necessarily resistant to other aphids.

Research into the fundamental cause of bloat or tympanites of cattle indicates that the disorder is a very complex problem in plant–animal interrelations, and the various aspects of animal physiology, microbial metabolism and plant biochemistry involved are now being investigated. In grassland research an improved strain of *Lotus uliginosus* is under trial, but although more vigorous than those strains obtainable commercially, it is still slow to establish from seed, and work is in hand to improve the winter productivity. Work continued on the soil fertility cycle and the various aspects of fertility increase under pasture, fertilizer and the grazing animal and the decrease under different forage and food crops, and a study of seedling growth. Recent work by the Plant Diseases Division has shown that the death of pines in shelter belts is associated with the presence of *Phytophthora* species in the soil, and in connexion with this investigation the Auckland Industrial Development Laboratories have developed a method of measuring flow of sap by means of heat transport.

A survey of phosphorus in New Zealand soils has indicated the factors which determine the amount and nature of phosphorus in the soils, and, in turn, a better understanding of their requirements of phosphatic fertilizers. The survey has shown the dominating influence of soil processes in determining these requirements. The general soil survey of the South Island was used as a basis for constructing a map of the present utilization and possible development of land in the Otago district.

Discovery of a method of separating apple cells without altering their shape or size has considerably assisted the Fruit Research Division's measurement of cell size in Sturmer apples after different fertilizer treatments with a view of forecasting storage quality, and to meet the need of the stone-fruit industry for good descriptions the Division has started to sort out some sixty varieties of Japanese plums. 'Vapan' and allyl alcohol have given promising results for control of weeds in tobacco seedling beds, but the former must be used at least four weeks before the seed is sown, and excellent control of both types of stem rot was obtained by applying a drench of ferban or thiuram to the seedling beds. Investigations at the Cawthron Institute show that shade and high humidity are factors in the development of blotchy ripening, a physiological disease of tomatoes, and preliminary results at the Dominion Physical Laboratory indicate that the critical stage of fruit development is when the fruit is fully developed and just beginning to ripen. Observations have also been made on the rate at which rabbits recolonize an area, following complete destruction of the population.

ELECTRICAL DISCHARGES

THE Physical Society autumn conference on "Gas Discharges" was held at the University College of Swansea during September 17–20. The wide interest in this field of study was shown by the presence of some 200 delegates, including many from Australia, Germany, Norway and the United States. At the five sessions of the conference more than thirty papers from Government, industrial and university research laboratories were read. The present report is restricted to a brief description of a representative selection, grouped in accordance with subject-matter.

The conference was opened and the first session presided over by J. A. Ratcliffe (Cambridge), president of the Physical Society. The inaugural address was given by Prof. H. S. W. Massey (University College, London) and was devoted to a comprehensive review of recent experimental and theoretical advances in the study of atomic collisional phenomena, particular attention being paid to cross-sections for collisions of electrons with atomic hydrogen, on which a reliable body of theoretical knowledge now exists. The experimental method being used at University College, London, in which a modulated beam of atomic hydrogen is crossed by an electron beam and the resultant ionization analysed by a mass spectrometer, was described, later, by Dr. R. L. F. Boyd and A. Boksenberg (University College, London).

Other topics discussed in the inaugural address included the experimental verification in the U.S.S.R. and in the United States of the existence of a negative metastable ion of helium, previously predicted on theoretical grounds by two Norwegian investigators, and other results of recent work on negative ions. Of particular interest were the facts that the electron affinity of O^- has now been established as 1·45 eV., and that the cross-section for the production of I_2^- by slow electrons has been found experimentally to