CANCER RESEARCH

THE annual report for 1943 of the director of the Imperial Cancer Research Fund* makes encouraging reading, not because any startling or dramatic results emerge, but because the problem continues to be assailed on sound scientific lines by a number of different methods which are fully co-ordinated. Dr. W. E. Gye reports that during the past year work has centred almost entirely on experiments relating to mammary cancer in mice, the induction of cancer with pure chemicals, the action of hormones on the pituitary body and on the prostate gland, and to chemotherapy.

As regards carcinogenesis, H. G. Crabtree's earlier work has shown that a series of halogen compounds, graded with respect to their power of checking cell-glycolysis, could retard the development of skin tumours induced by pure chemical substances. The halogen compounds used could also affect other chemical cell-mechanisms, in particular those involving the sulphydryl group; for example, glutathione, enzymes containing sulphydryl groups as active centres, or the normal synthesis of proteins with sulphur-containing amino-acids in their essential composition. Recent observations suggest that sulphur metabolism is a factor in the artificial induction of cancer; it may also assist in determining the occurrence of spontaneous mammary tumours in inbred strains of mice.

The general growth-inhibiting properties of many carcinogenic and non-carcinogenic hydrocarbons seem to be related to the depletion of sulphur-containing amino-acids which co-operate in their elimination. Experiments have been made on the effect of tumour induction when sulphur metabolism is disturbed. One method consisted in the application of bromo-benzene to the skin. This substance in the organism is detoxicated by combining with cysteine and is then eliminated as a mercapturate. Crabtree has demonstrated the inhibiting effect of bromo-benzene on the formation of skin tumours in mice by 3 : 4-benzpyrene. The earlier types used in these inhibiting experiments, by virtue of their mobile halogen atoms, can react with the sulphydryl type with elimination of halogen acid, while the present type reacts by a coupled oxidation in which the relatively unreactive halogen remains as a constituent of the resulting mercapturate. This inhibition of tumour induction probably occurs with both types of compounds under conditions of localized sulphur deficiency, which suggests that sulphur metabolism is intimately concerned in the processes of chemical carcinogenesis.

Dr. B. D. Pullinger has continued her study of the Deelman phenomena, that is, the localization of tumours in scars and healing wounds. Her experiments indicate that trauma, as represented by excised wounds, has a slight stimulating action in increasing tumour incidence. Her work also suggests that the intervention of some specific carcinogenic chemical is necessary to stimulate or originate tumour growth, as well as the added non-specific action of trauma.

Cramer and Horning's work has shown that there is a reciprocal action between the sex organs and the pituitary body. Pursuing this work, Dr. Vaquez-Lopez has studied the effect of œstrinization in a number of species of animals. In the hamster, for example, when œstrogenic substances (œstradiol benzoate and diethylstilbœstrol) were subcutaneously implanted, the epithelial cells of the pars intermedia of the pituitary body multiply and invade the posterior lobe, which consequently enlarges. The invasion often replaces the whole of the pars nervosa and may extend along the neurohypophysis to the brain. In mice a similar enlargement takes place in the anterior lobe of the pituitary body. This hormonal stimulus causes an extension of a normal process; it is an invasive phenomenon, not a new growth, for there is no defensive reaction of nerve tissue to the emigration of intermedia cells, such as occurs in the event of an invasion by alien cells. Long-continued treatment with œstrogens gives rise to profound changes not only in the organs of internal secretion, such as pituitary gland, the suprarenal glands and the islets of Langerhans in the pancreas, but also in the testis, the mammary gland and the prostate. This work, then, bears upon the enlargement of the prostate in old age and, possibly, its tendency to malignant disease. Horning is now investigating the effects of œstrinization on the prostatic glands of pure-line mice of high and low incidence of mammary cancer.

Interesting work has been done by Dr. R. J. Ludlow and Miss H. Barlow on tissue cultures. The cell characteristics of primary tumours, both spontaneous ones and those induced by œstrin and chemicals, have been studied, as well as the action of malignant and non-malignant cells on fibroblasts *in vitro*. The latter research leads to the conclusion that some product of the metabolism of growing epithelial cells stimulates the growth of fibroblasts.

Mammary cancer in inbred strains of mice, on which Bittner, Andervont, Little and W. S. Murray in America have recently done much work*, has been further studied by Dr. Ludford and Dr. L. Dmochowski, and Dr. Ludford and Miss Barlow have continued their work on chemotherapy.

Knowledge of cancer increases year by year, and this report is no mean contribution to a problem which is gradually emerging from obscurity.

* Fortieth Annual Report, 1942–1943, of the Imperial Cancer Research Fund. Pp. 32. (London: Imperial Cancer Research Fund, 1943.)

* Bittner, *Trans. Stud. Coll. Phys.*, Philadelphia, **9**, 129 (1941).

PROTECTIVE SYSTEMS FOR RURAL ELECTRICAL DISTRIBUTION

A SYMPOSIUM of four papers on this subject was presented before the Institution of Electrical Engineers in London on May 12. In the first paper, by D. C. Field on systems up to 33 kV., the general principles of protection are discussed, emphasis being laid on the importance of considering the prevention of faults as well as their isolation. From an analysis of the causes of interruptions, which shows that a large number are only transient, and from the special conditions pertaining to a rural system, it is concluded that it is preferable to restrict the number of points at which automatic protection is provided, in order to facilitate the rapid resumption of supply. The methods of protection adopted in one large rural area are briefly described, together with a summary of the experience gained in operating several classes of equipment, including arc-suppression coils, auto-reclose switches and fuse-gear.

The second paper, by O. Howarth, is confined to 11 kV. networks and consists of a description of the

area supplied by the Lancashire Electric Power Co., and of the nature of supplies afforded in that area. The 11 kV. distribution system and the protective arrangements employed thereon are described, and figures showing availability of supply to consumers during a period of one year are given. The testing necessary to ensure satisfactory functioning of the protective gear is also dealt with. The experience of the Lancashire Electric Power Co. indicates that with a duplicate tail-end feeder system, simple overload and earth-leakage protection will ensure the minimum of interruption of consumers' supplies provided adequate tests are made to prove the reliability of the gear. Where two or more feeders operate in parallel between sending and receiving stations, and provided the load tapped off along the route does not exceed about 50 per cent of the normal load of the feeder, very satisfactory discrimination can be obtained with parallel-feeder protective systems.

In the third paper, by R. W. Steel and A. W. Allwood, systems up to 33 kV. are considered, and the importance of installing suitable and efficient protective apparatus on rural networks, at all stages of their development, is emphasized. A typical protective scheme, including arc-suppression coils, for an 11 kV. and 33 kV. rural distribution system which has been put into operation in a particular area of supply is described, and the reasons leading to its adoption are given. The practical difficulties met with in securing efficient operation and of carrying out proper maintenance are discussed and some statistical records of fault interruptions are presented. These indicate the number and type of faults causing total or partial failures of supply and show the conditions under which the protective gear is called upon to function. The nature of the faults which occur on rural networks is analysed and a suggested standard form of keeping fault statistics is put forward for general adoption by undertakings distributing in rural areas.

The fourth paper, by K. I. Brown, deals more particularly with the automatic selective isolation of sustained earth-faults on a network protected by Petersen coils, and explains what is believed to be a unique method evolved for the protection of a grid network of 37·5 kV. transmission lines against line-to-earth faults, which enables automatic selection and isolation of a section subjected to a sustained fault to take place without utilizing earth fault current for the operation of protective relays, or pilot wires between sectionalizing stations remote from one another. The scheme provides for the installation of Petersen coils together with special automatic selectors and associated equipment, and has been employed with considerable success since 1936 for protection of the Ganges Canal hydro-electric grid in the United Provinces, India.

The paper shows that by introducing Petersen coils and automatic selector equipment to the system, almost complete immunity from outages due to temporary line-to-earth faults had been achieved, and that in the case of a sustained line-to-earth fault the affected section can be selected and isolated automatically within a period of 30 sec. from the instant of fault, without any 'kick' being experienced by the power stations. No pilot wires are required between selector stations. The existing overload relays continue to protect the system against line-to-line faults, and if desired the original form of earth-leakage protection may be restored to the system by the manipulation of earthing switches.

To certain criticisms of the scheme that (*a*) there is the possibility of line surges occurring due to switching on a system entirely protected by Petersen coils, and (*b*) the interruption in supply to sub-stations connected to healthy lines between switching points must of necessity sometimes be experienced, it can be replied that no surge effects have been observed and the transformers, switchgear and line insulators have not been affected thereby, while since the majority of faults recorded clear before any sectionalizing takes place and as sustained earth faults are infrequent, momentary interruptions to load points are few. The probability of the selectors having to complete full sequence of operation in the event of a sustained earth fault is small, as there are eleven sections on which the fault may have occurred and it is only in the event of the fault being on the last section in the series, or in a substation structure, that the full sequence of operation takes place.

THE TERMITES OF AUSTRALIA

By DR. A. D. IMMS, F.R.S.

UNDER the above title there has recently appeared a timely and much needed monograph*. The author, Mr. G. F. Hill, has been an active worker on termites for many years and has an unrivalled acquaintance with these insects in so far as Australia is concerned. There are many difficulties to be contended with in the study and investigation of termites, and it is for this reason that monographs are badly needed from nearly all parts of the world that are inhabited by these creatures. Excluding the United States, which has a relatively meagre termite fauna, Australia is to be commended in giving a leading hand by furthering publication of an account of her native species. But the availability of a competent authority is about two thirds the battle—other lands are not so far equally favoured. India, perhaps more than any other part of the British Commonwealth of Nations, needs a proper monograph on her rich and vast termite fauna, that is productive of almost incredible damage to human effort. A sound monograph on this order is worth many of those on the more obscure orders, and it is to be hoped that a competent worker will be forthcoming one day, not too far distant, who will cope with the task.

But, as previously said, the difficulties are manifold when it comes to identifying these insects. The soldier caste affords the best and most reliable character—the winged imagines are seasonal and not so often met with in consequence, while the workers (that have earned for termites their notoriety as destroyers of products serving man's convenience) show ill-defined features that make their specific determination a thing of great uncertainty. Apart from the incidence, then, of three different castes of individuals in each species, it needs to be taken into account that two or more different species may inhabit the same mound or piece of wood. It often happens that two or more species of very distinct habits are almost indistinguishable in form and structure, and that individuals of the same species may differ very much in different regions so as to be

* Termites (Isoptera) from the Australian Region. By Gerald F. Hill. Commonwealth of Australia Council for Scientific and Industrial Research. 479 pp., 353 text figs. and 24 plates. (Melbourne, 1942.)