two similar receivers, the front one of which is exposed to the radiation. The target consists of a massive copper disk 4.5 cm. in diameter and 0.5 cm. thick to ensure temperature uniformity. Thermocouples are attached at a number of points in order to average the rise in temperature. The electrical heating element is cemented to the front disk on the side exposed to the radiation. The cycle of operations and the practice carried out in the Laboratory for the calibration of working-standard thermopiles against the Guild radiometer with a radiation source, consisting of a 1,000-W. tungsten lamp operated at a colour temperature of 2,850° K., together with water filter and heat-absorbing glass to absorb radiation of a wave-length longer than 1μ , are explained in detail.

The second booklet, No. 24 (ref. 2), is concerned with photometric standards and the unit of light. The development of light sources from the early nineteenth century and the evolution of the present primary standard, with the internationally accepted

unit of luminous intensity, the candela, are discussed, followed by a detailed description of the procedures carried out at the National Physical Laboratory with regard to the arrangement of the primary standard, and calibration of secondary standards of luminous intensity and luminous flux. Finally, the present international situation with regard to intercomparisons of photometric scales is reviewed, and a table is given showing the relative magnitudes of the candela (2,042° K.) as found in the most recent determinations (up to 1957) at various national laboratories. The monograph can be recommended as a comprehensive and instructive statement of photometric standards and light sources, and should be of value to all concerned with illumination. S. WEINTROUB

¹ Department of Scientific and Industrial Research: National Physical Laboratory. Notes on Applied Science, No. 23: *Radiometric Standards and Measurements*. E. J. Gillham. Pp. iv + 23. (London: H.M.S.O., 1961.) 1s. 9d. net.

² Department of Scientific and Industrial Research: National Physical Laboratory. Notes on Applied Science No. 24: *Photometric Standards and the Unit of Light*. J. S. Preston. Pp. iv + 32 + 4 plates. (London: H.M.S.O., 1961.) 3s. net.

GEOLOGY OF BROWN CLEE HILL AND THE ADJACENT AREA

*THE Old Red Sandstone of Brown Clee Hill and the Adjacent Area**, recently issued by the British Museum (Natural History), is an important paper as it deals with a classic area in which is displayed the most complete sequence of Old Red deposits of the Anglo-Welsh development. In the first quarter of the century Wickham King established a general stratigraphical succession for that development, which he based to a large extent on his findings in the Brown Clee district, but his supporting palaeontological evidence was too meagre and scattered to provide really convincing fossil zones. At that time too many of the forms had been inadequately described or named from fragments. King's work, however, generated a stimulus that has led to a revolution in our knowledge of the British Old Red ostracoderm faunas. This has been the result of systematic collecting and accurate description. The latter we owe chiefly to the senior author, Dr. E. I. White, and Part 2 of the present paper is his latest contribution to the subject. While our knowledge of the fossils has been gradually accumulating, the palaeontologist has had, to a great extent, to rely on King's stratigraphical conclusions, which were not always based on reliable mapping.

* Bulletin of the British Museum (Natural History). Geology. Vol. 5, No. 7: *The Old Red Sandstone of Brown Clee Hill and the Adjacent Area*. 1: Stratigraphy. By Harold William Ball and David Lawrence Dineley. 2: Palaeontology. By Errol Ivor White. Pp. 175-310 + plates 33-48. (London: British Museum (Natural History), 1961.) 70s.

In the present case the two junior authors have presented an excellent map based on accurate 6-in. survey and elaborate collecting, which have enabled them to determine the range of the fossils with considerable accuracy. For the Downtonian Series, they have taken advantage of much recent palaeontological work; and the zones for this series can now be regarded as well established, and their evidence as merely confirming conclusions reached previously in this and other areas. But for the desperately barren Dittonian and Clee Series, their painstaking field-work has supplied Dr. White with material, by which broad zones can now be defined with some exactness.

Part 1, devoted to the stratigraphy, includes interesting discussions concerning the geographical conditions governing sedimentation, the ecology of the fossiliferous 'pockets', the so-called *Psammosteus* Limestone (which has never yielded a fossil, let alone a *Psammosteus*), and foreign pebbles in the conglomerates; but its main significance is the correlation of the fossils with the stratal succession, and the determination of the range of each important species. A valuable feature is a list of more than a hundred localities with the fauna discovered at each.

Part 2 is descriptive of a number of new species and varieties illustrated by 60 text figures and 16 plates. Of particular value are the new forms discovered by the authors and others in the Clee Series and in the unconformable upper Old Red beds (the Farlow Sandstone Series). L. J. WILLS

FIRE RESEARCH 1960

THE recently issued annual report of the Joint Fire Research Organization* records the bringing into use, during 1960, of new buildings providing 30,000 sq. ft. of permanent floor area for the continued prosecution of fire research (see *Nature*, 189, 105; 1961).

* Department of Scientific and Industrial Research and Fire Offices' Committee Joint Fire Research Organization. Fire Research, 1960: *Report of the Fire Research Board with the Report of the Director of Fire Research*. Pp. viii + 67 + 12 plates. (London: H.M.S.O., 1961.) 5s. 6d. net.

Among the many investigations described, that which focused attention on the behaviour in draughts of oil heaters of the drip-feed radiant type has doubtless aroused the greatest public interest. The relatively new and unique wind-tunnel facilities of the Fire Research Station permitted an expeditious study of this problem, followed, within the year under review, by the publication of a report and a new British Standard and, finally, by the introduction of appropriate legislation.

Of particular scientific interest is the large programme of work now in progress on the quantitative aspects of fire in structures, both real and idealized. A particular object of this is to establish scaling laws for rate of burning, size of flames and the spread of fire by heat transmission from them, and the disposal of smoke by ventilation.

The statistical inquiries, as always, are interesting, and this year include reference to the incidence of fire in post-war houses, fires caused electrically, and

aircraft crash incidents. Tests have been carried out on the relative effectiveness of audible warning devices in traffic, from which the traditional fire bell emerges rather badly. Preliminary experiments on the use of a gas turbine as an inert gas generator for extinguishing fires in large building spaces have given encouraging results. Fire-resistance testing of building materials, work on the prevention or mitigation of gas and dust explosions, and a number of other projects have been continued. J. H. BURGOYNE

PROGRESS OF CANCER RESEARCH

THE annual report of the British Empire Cancer Campaign continues to expand year by year; the thirty-eighth edition* is a massive book of nearly 800 pages, the scientists working either wholly or partly under the aegis of the Campaign number nearly 1,500, and a million pounds was spent on research in 1960.

Some idea of the trends of cancer research, as described in the report, can be suggested by breaking down, into subject-matter and class, the total of papers published in 1960 by these investigators and comparing the resulting catalogue with that for 1950; the papers will, of course, represent the work more or less completed before 1960 rather than the present progress, but the main lines will undoubtedly remain substantially the same (Table 1). The table shows that in the ten years the trend has been to increase the volume of work on biochemical themes at the expense of carcinogenesis and radiobiology, and that the immunological and statistical approach is attracting more research.

Only a little of the large amount of research work detailed in the report can be referred to here. One of the most interesting investigations continues to be on the Gross leukemia-inducing virus and the related polyoma virus. Miller confirms that removal of the thymus in *C3H/JS* mice at 3-4 months after they have been neo-natally inoculated with the Gross virus prevents the development of lymphocytic leukemia which otherwise appears in 100 per cent of such inoculated mice. Grafting isogenic thymus into the thymectomized mice restores the growth potentiality of leukemia. *C3H* mice which had been made tolerant to tissue from *Ak* mice at birth were inoculated with normal *Ak* thymus and became leukemic; transplantation tests showed that the lymphocytic neoplasm arose from host cells and not from the inoculated *Ak* cells, thus demonstrating that a non-cellular factor from *Ak* thymus is a necessary component in the origin of this lymphocytic leukemia.

C3H mice injected at birth with the Gross virus were later given a lethal dose of radiation and protected with normal isogenic marrow from untreated mice; most of the injected mice developed leukemia, and tests with protecting cells carrying a marker chromosome indicated that the leukemogenic virus is not only radio-resistant but is also resistant to any immune attack that might have been exerted by the protective marrow cells, and therefore there is not much hope of treating leukemias of viral origin by total-body irradiation and marrow replacement.

* British Empire Cancer Campaign. Thirty-eighth Annual Report covering the year 1960. Part 1: The Chairman's Statement and the Accounts. Pp. xxxviii. Part 2: The Scientific Report of the Researches undertaken by the Central Organization and its Autonomous Councils in the United Kingdom, and by some of its Affiliated Organizations Overseas. Pp. xxxix-lviii+792. (London: British Empire Cancer Campaign, 1961.)

Ambrose and colleagues, in experiments on normal and malignant cells grown *in vitro*, conclude that "The characteristic properties of the tumour cells so far suggested in the present studies are therefore as follows: (1) the tumour cell membranes show reduced mutual adhesiveness as compared with normal cells; (2) several lipases and phospholipases are more toxic for tumour cells than for normal cells and the tumour cells are also more sensitive to lipid in the medium, suggesting that more exposed lipid is present on the tumour cell membrane; (3) the structure of the tumour cell involves a less basic protein than the normal cell, suggesting a more acidic micro-climate at the cell surface, in agreement with the electrophoretic studies indicating an increased negative surface charge".

The possible cancer risks attached to the use of oestrogen implantation in cattle and poultry is the subject of a report by Sir Charles Dodds: "There has been a new interest in the alleged carcinogenic action of oestrogens during the past year. The widespread use of stilboestrol and hexoestrol in agriculture has generally been approved by governments. Stilboestrol implantation in poultry for the purpose of caponisation has become almost universal and it is also estimated that a very large percentage of meat produced in the North American continent has been produced under the influence of stilboestrol, hexoestrol or some similar substance. There has been a change recently in the administrative outlook in the North American continent on the use of these substances and at the present time, in America, their use has been banned by what is known as the Delaney Amendment to an Act in the F.D.A. This whole question is being looked into and we have been particularly interested in attempts to assess the intake of oestrogens in a normal diet. This aspect of

Table 1. PAPERS PUBLISHED ON CANCER RESEARCH

Classification	In 1960	Total in 1960 (per cent)	In 1950	Total in 1950 (per cent)
Radiobiology; radiotherapeutics; physics; tracer studies	187	21	79	33
Biochemistry of DNA, RNA, proteins; enzymes; carbohydrate metabolism	177	20	33	14
Clinico-pathology	105	11.9	20*	8.3
Cytology; tissue culture; electronmicroscopy; cytochemistry	87	9.9	19	7.9
Carcinogenesis: carcinogens; biology of tumours	81	9.2	38	16.0
Cancer chemotherapy; cytotoxins	70	7.9	15	6.2
Hormones; steroids	54	6.1	12	5
Immunity; immuno-therapy; transplantation	50	5.8	4	1.7
Mutation; cytogenetics	25	2.8	5	2.1
Statistics; geographical pathology	26	2.8	1	0.45
Viruses	21	2.4	6	2.5

* Report of Clinical Cancer Research Committee.