diglyceride kinase and phosphatidic acid phosphatase. The questions raised during the course of this meeting suggest that it would be foolish to expect a complete understanding of the function of phospholipids even within the next thirty years. A. D. BANGHAM

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BUILDING RESEARCH

THE annual report for 1960 of the Building Research Board of the Department of Scientific and Industrial Research (Pp. 99. H.M.S.O., London. 7*s*. 0*d*.) is written and illustrated with the clarity which has characterized previous reports, and provides a convenient summary of the very diverse activities of the Building Research Station.

Before a new building material can be used with confidence, information is needed on many aspects of its behaviour over long periods of time, and the devising of suitable accelerated tests is a major problem in this field of research. The present report describes such a test for the weathering of polyester roofing sheets reinforced with glass fibre. Work is in progress on the behaviour of rain-water goods made from various plastics; the chief problem here appears to be lack of colour stability.

Another group of materials, lightweight aggregates for structural concrete, poses many problems including mix design, bond strength, moisture movement, and corrosion of reinforcement.

Work in this field, begun in 1957, is still in progress, and aims to provide the basis for a future code of practice.

Like most similar organizations, the Building Research Station is often asked to solve a problem within a few months. Their experience has shown that "superficial short-term examination of problems is apt not to be rewarding". Unhappily, the converse is not always true, and one feels sympathy for the workers on stone preservatives who report, after five years investigation, that "no 'stone preservative' treatment has yet served its purpose well enough to merit commendation. Some have done more harm than good . . . nothing of proven value has emerged . . .".

Another important group of investigations is concerned with the economics of building construction and maintenance. A survey of 1,000 post-war houses in Scotland has shown that certain non-traditional forms of construction lead to abnormally high maintenance costs, especially in conditions of severe exposure. Prefabricated systems have a tendency to leave small quantities of work to be completed by traditional methods, at disproportionately high cost.

The structural designer will be interested in the development of realistic design methods based on more comprehensive data than those now available. New surveys of actual floor loads and snow loads on buildings are now in hand, and the problems of wind loading on tall buildings are also receiving attention.

An important study of composite action in buildings is in progress. Attention to the interaction of beams and slabs, and of walls and structural frames can make more difference to frame design than can the most elaborate frame analysis.

The Building Research Station pioneered soil mechanics research in Great Britain, and is continuing the investigation of pile foundations. It would appear from results quoted in this report that the ability of deep cylinder foundations to carry load by both shaft friction and base reaction is still in some doubt.

This important conclusion appears to be based on a limited series of tests on a laboratory model, and it would be a great help to readers if statements of this nature were accompanied by references to the list of publications at the end of the report. At present it is not at all easy to relate the conclusions reported to the publications giving details of the original work.

The contents of the present annual report cover a very wide field, and this arbitrary selection of topics can do little more than indicate the diversity of matters treated. No mention has been made, for example, of the interesting work on the equatorial comfort index for tropical buildings, or the effect of various construction methods on the earth pressures on buried service pipes. In both cases an attempt is being made to replace the present trial-and-error approach by a logical theory developed from observed facts.

This report should be of interest to all who design buildings or organize their construction.

R. PAUL JOHNSON

INDUSTRIAL RESEARCH AND DEVELOPMENT IN THE UNITED STATES

TO obtain information about the economic resources allocated to research and development activities, the National Science Foundation of America has been conducting comprehensive surveys of research and development in the economy on a periodic basis. Such surveys yield economic data that assist the National Science Foundation, the Federal Government, and other public and private organizations to assess the present research and development efforts and to formulate science programmes for the future.

A report* summarizes the results of the 1958 survey of industrial research and development, the survey representing a continuation of the Founda-

* National Science Foundation, Washington. Surveys of Science Resources Series, NSF 61-32: Funds for Research and Development in Industry, 1958. Pp. xvi + 119. (Washington, D.C.: Government Printing Office, 1961.) 65 cents.

tion's series of annual surveys of research and development in industry that began in 1953.

Funds for research and development performance in the industrial sector of the economy totalled 8·2 billion dollars in 1958. More than half this total was for research and development performed in the aircraft and parts, electrical equipment and communication industries, which were heavily engaged in Federally financed research and development.

The amount spent on industrial research and development in 1958 was 7 per cent higher than the 7·7 billion dollars total for 1957. Increases occurred between 1957 and 1958 in all industries for which separate data were obtained except aircraft and parts and rubber products. The relative increase in research and development of companies with less than 5,000 employees (15 per cent) exceeded that of companies with 5,000 or more employees (6 per cent) between 1957 and 1958.

More than half (56 per cent) the industrial research and development performance was financed by the Federal Government. Industries with the highest proportions of federally financed research and development performance were aircraft and parts (85 per cent) and electrical equipment and communications (68 per cent).

In contrast to the large Federal research and development financing in certain industries, 90 per cent or more of the total funds for research and development performance were from company funds in the following industries: food and kindred products, paper and allied products; drugs and medicines; other chemicals; stone, clay and glass products; primary ferrous products; and petroleum refining and extraction. The chemical and allied products industry exceeded all others in the dollar volume of company-financed research and development.

Companies with 5,000 or more employees accounted for 84 per cent of the funds for performance of industrial research and development, compared with 7 per cent in companies with less than 1,000 employees and 9 per cent in companies with 1,000–4,999 workers.

An estimated number of 11,800 industrial firms carried out research and development in 1958, including 10,300 manufacturing companies and 1,500 non-manufacturing companies. In terms of research and development moneys, however, manufacturing companies accounted for 98 per cent of the total. Funds for research and development in 1958 were distributed by the character of work as follows: basic research, 4 per cent; applied research, 23 per cent and development, 73 per cent. Approximately three-fifths of the 295 million dollars for basic research was expended in the physical and mathematical sciences, about one-fifth in the engineering sciences, and the remainder in the life and other sciences.

The product fields of guided missiles, communication equipment, and aircraft and parts accounted for more than half the 7·9 billion dollars utilized for applied research and development. Although the companies in the aircraft and parts, and electrical equipment and communication industries accounted for most of this, companies in other industries also performed substantial amounts of applied research and development in these product fields.

The dollar volume of research and development performance per research and development scientist and engineer in 1958 was 32,900 dollars for all industries combined. Among major industry groups the average ranged from 16,400 dollars in food and kindred products to 52,500 dollars in motor vehicles and other transportation equipment.

Funds for industrial research and development comprised 3·8 per cent of net sales in manufacturing companies performing research and development. Total performance includes federally financed research and development, which amounted to 56 per cent of the total amount for 1958. Research and development performance funds as percentages of net sales were highest in the following separately reported industries: aircraft and parts (17·7 per cent), electrical equipment and communication (10·5 per cent), and scientific and mechanical measuring instruments (9·9 per cent).

STRUCTURE OF ALPHA-KERATIN

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THE structure of α-keratin[1] has been assumed to be based on the α-helix[2] following the demonstration[3,4] that the coiling of such helices, possibly arising from periodic axial distortions[5,6], can account for the presence of the 5·15 Å. and 1·5 Å. meridian reflexions in the X-ray diffraction pattern. In particular, a three-stranded rope[6] seemed to account satisfactorily for the main features of the diffraction pattern[3,4]. Recent work[7], however, indicates that this structure may not be entirely satisfactory in explaining the details of the pattern, and other models involving additional layers of helices have been suggested[8]. The present ideas do not satisfactorily account for the changes in the X-ray pattern resulting from treatment with heavy metals[9,10], nor for some of the longitudinal regularities found in the matrix component of α-keratin by electron microscopy[10].

It is the purpose of this article to explore a possibility which has not been considered before and which seems to have merit in accounting for much of the data. Specifically, it is proposed that in the two-phase structure of α-keratin consisting of microfibrils and matrix; the latter, far from being amorphous or disorganized, consists of a relatively highly organized structure. In particular, whereas the microfibrils, as is known, compose the α-helical component, it is suggested that the matrix is built up of a structure similar to that of feather keratin, and that this matrix structure accounts for the 198 Å. fibre period[11,12] and the various orders of it which are observed and which are intensified by heavy-metal treatment.

In considering the evidence which suggests this proposal, it may first be noted that the characteristic α-keratin spacings at 5·15 Å. and 1·5 Å. may not, and indeed need not, be correlated with the 198 Å. repeat. Although accurate diffractometer measurements[13,14] give the former spacing as 5·18 Å., which would be a reasonable 38th order of 197 Å., it is not