nature conservancy and landscape, and Mr. P. Tideman (Doorwerth, Holland) found direct mapping combined with aerial photography very useful in the management of the various protected areas in Holland.

Two decisions of general interest may be briefly mentioned. (1) A permanent commission was formed for the preparation of a vegetation map of Europe, with Prof. R. Tüxen (Stolzenau) as chairman and the following members : Prof. J. Braun-Blanquet (Montpellier), Prof. L. Emberger (Montpellier), Prof. I. Horvat (Zagreb), Prof. A. Noirfalise (Brussels) and Prof. B. Pawlowski (Cracow). (2) The following resolution was adopted for submission to Unesco and all the member Governments concerned : "The vegetation of the Earth represents the vital productive potential upon which all life depends. Therefore, the comprehensive study of vegetation is of the utmost importance, and for this purpose the combination of ecological, phytosociological and cartographical methods are required.

"The present-day methods of mapping vegetation greatly enlarge our fundamental knowledge of plant communities, their development and distribution as well as providing a deep insight into their environments. In applied phytosociology the mapping of vegetation constitutes a solid basis for assessment of habitats, for utilization of vegetation, and for the evaluation, or even the forecasting, of any change or damage to vegetation by erosion, wind, water and other natural or human factors.

"It is suggested that no large-scale technical measures should be planned or carried out which may influence the vegetation or landscape without first mapping the vegetation prior to the respective technical measures being put into effect."

A. E. Apinis

BIOLOGICAL FIBRES

IT is some time since the X-ray Analysis Group of the Institute of Physics has met to consider biological fibres, so that the conference in Leeds held during April 17–18, even if only partly devoted to fibres, was very welcome. It is, however, symptomatic of the present place of specialist techniques (even if they are as well established as X-ray diffraction) in such fields as the study of fibre structure, and perhaps even more of the trend of development of the corresponding specialist groups, that of the seven papers presented on this occasion only two could be classed as predominantly crystallographic in content, whereas in two others, which dealt respectively with infra-red absorption and the electron microscope, X-rays had no more than a casual mention. That these other techniques are now essential partners with X-ray diffraction in research on fibre structure was emphasized by the part they played in the other three papers. Nevertheless, in this account attention will be confined chiefly to topics which are more closely associated with the nominal activities of the Group.

The successful study of the cellulose fibre by X-ray analysis set a fashion which is evidently, even after more than thirty years, not yet outmoded. This fibre is still presenting fundamental crystallographic problems for investigation ; for example, it seems still to be possible to argue about whether the cellulose chain molecules are all oriented in the same sense, or form two antiparallel systems. D. W. Jones and his colleagues (British Rayon Research Association) are non-committal about it in their discussion of cellulose I, but favour alternation in cellulose II. Prof. R. D. Preston (Leeds) suggests that in cellulose I alternation is unlikely, basing his argument on the idea that growth is by end-synthesis. His conclusion was, however, criticized in discussion, and also seems impossible to reconcile with the almost universal acceptance of alternation in cellulose II, although whether this is necessary or merely a convenient dogma is not at all clear. It does seem reasonable to expect that, if chain polarity is of any significance at all, the same type of arrangement will be present in both modifications.

Another controversial feature is the type of hydrogen bonding, about which there are two schools of thought respectively accepting or denying the presence of diagonal hydrogen bonds (specifically perpendicular to the [101] normals in the Meyer and Misch cell). The orthodox, among them the British Rayon Research Association team, agree with Meyer and Misch at least on this one point, that the hydrogen bonds are parallel to the a-axis of the unit cell. Both schools have recently adduced infra-red absorption results in favour of their arguments, creating further confusion for the non-specialist.

Agreement does seem to be reached on one point, that there is more than one cellulose I structure ; the eucellulose (Preston) or type A cellulose (Marrinan and Mann) of *Valonia* must, one supposes, be cellulose I proper ; ramie, the typical type B cellulose, is classed with most of the other plant fibres as yielding on hydrolysis, besides glucose, other sugars which are to be regarded as contaminants.

Some fibrillar aspects of the fine structure of cellulose also received attention. Preston believes that the microfibrils retain their identity when surrounded by incrustants in the cell wall, and that their surface structure is in some way responsible for the electron diffraction patterns which he and his colleagues have obtained from metal–cellulose complexes.

The application of X-ray analysis to the problem of the structure of silk fibroin is nearly as old as its application to cellulose, and we have been accustomed for a long time to distinguish between the structures of the two principal silks of commerce, domestic and tussah. It is now clear that these are but two of a family of at least six fibroins produced by various members of the orders Lepidoptera and Araneae ; the silks produced by some fifty species were examined by J. O. Warwicker (Shirley Institute, Manchester) to establish this. A disturbing observation is that there appears to be no strict correlation between the crystallographic type of the fibroin and the biological classification of the producing species. Structurally, the fibroins differ in the separation of the hydrogen-bonded pleated sheets of polypeptide

chains; this distance may be as small as 9·3 A. (*Bombyx mori*) or as large as 15·7 A. (*Nephila senegalensis*). In fibroins with the larger inter-sheet separations amino-acid residues with long side-chains must occur in the crystalline regions. In view of the importance of this idea, which has always been virtually rejected before in theories of fibroin structure, further details of the relevant chemistry would be welcomed.

The cross-β configuration, so extensively studied in the keratin–myelin–elastin–fibroin group of fibrous proteins, has always been something of a puzzle because of the difficulty of obtaining a good X-ray diffraction diagram. That a solution of the problem should now be given in terms of a structure closely allied to a fibroin rather than to keratin is one of those oddities which sometimes arise in fibre structure research. K. D. Parker and K. M. Rudall (Leeds) have found, in fact, a cross-β fibroin in the egg-stalks of the lacewing fly; it gives a remarkably good X-ray diffraction pattern the interpretation of which leaves no doubt that the fibroin chain-molecules are arranged in long folds transverse to the fibre-axis. From this folded configuration the chains can be brought into the parallel-β state by stretching the material to about six times its initial length. This change is regarded as a true intramolecular transformation like the α–β transformation in keratin, but differs from the latter in that so far no success has followed attempts to reverse the change.

Heavy-metal staining techniques are of great importance in electron microscopy, and are now being successfully employed in studies of the microfibrillar texture of keratin fibres. Work is going on in various centres to correlate such electron microscope observations with the older X-ray results that mercury, for example, can modify the intensities of the equatorial 'reflexions' at approximately 80 A., 45 A. and 27 A. in keratin. H. J. Woods (Leeds) reported that staining with mercuric acetate also affects the wide-angle diffraction pattern, when corrections are made for increased absorption due to the metal. In an attempt to account for the small-angle 'reflexions' in terms of a model of uniform microfibrils it is found that conventional Fourier transform methods for obtaining the radial distribution of interfibrillar vectors are inapplicable, and the direct method of calculating the intensity from an assumed radial distribution often results in a negative intensity. In the discussion it was suggested that there might be a failure of the conventional theory for systems so nearly close-packed as those considered, but it now seems more likely that the difficulty is due to the fact that for such systems the radial distribution must be so nearly determined by geometry that the use of an arbitrary distribution may well be physically unsound. J. Sikorski emphasized that the electron microscope results so far tell us only about the details in para-cortical cells; the size and packing of the microfibrils in the ortho-cortex may well be different. H. J. Woods

THE SMITHSONIAN INSTITUTION

REPORT FOR 1957–58

THE report of the Smithsonian Institution for the year ended June 30, 1958*, covers the 112th year of the Institution and includes the report of the Secretary and the financial report of the Executive Committee of the Board of Regents, together with reports of branches of the Institution and on the library and publications. The Institution has now nearly 51 million catalogued objects in its collections, and visitors to all its branches totalled more than 10·36 million. Field work during the year included the excavation of the Welcome Mound along the Ohio River in West Virginia; continued field investigations of the bird-life of the Isthmus of Panama, and the mammal survey of Panama; a long-range programme designed to solve the stratigraphic sequence in the Glass Mountains; and extensive palæontological work in Oklahoma, Texas, New Mexico and Colorado.

Systematic researches by the staff of the Bureau of American Ethnology included Eskimo and arctic studies, field-work in South Carolina, among the New York Seneca and in Florida, and excavations at Russell Cave, Alabama. The director of the Bureau continued also as director of the River Basin Surveys, which continued its programme for salvage archæology in areas to be flooded or otherwise destroyed by the construction of large dams. By June 30, 1958, 254 surveys and excavations had been made in twenty-nine States and 4,889 archæological sites located, of which 997 had been recommended for excavation or limited testing; by the end of the year, 388 sites in fifty-two reservoir basins in nineteen States had been partly or extensively dug.

The Smithsonian Astrophysical Observatory continued to work along the four principal lines of solar astrophysics, meteors, the satellite tracking programme and studies of the upper atmosphere, in which methods based on celestial mechanics were developed for inferring the density of the upper atmosphere from the motions of artificial Earth satellites, and a theoretical study of the nature and thickness of the lunar dust layer was completed. Its Division of Radiation and Organisms continued studies on photomechanisms in plants, with special emphasis on growth responses controlled by low levels of red and blue radiant energy. Studies of the interaction of gibberellin, kinetin and cobalt with the photo-process indicate that there is no direct interaction between red irradiance and the added substances, although all these materials modify the final growth response. Studies were continued on the effects of radiant energy on the biosynthesis of protochlorophyll in leaves of higher plants grown in the dark, and in a study of biochemical changes involved in the development and maturation of the chloroplast

* Smithsonian Institution. Report of the Secretary and Financial Report of the Executive Committee of the Board of Regents for the year ended June 30, 1958. Pp. x+232+14 plates. (Washington, D.C.: Government Printing Office, 1958.)