much larger number in applied work. An applied entomologist is primarily an investigator, and he is not fully trained until he is acquainted with the industry which he serves. University training should therefore aim at a synthesis of insect morphology, physiology and taxonomy, and afterwards a year or two of research. In addition, the applied entomologist will require at some stage a training or a period of apprenticeship in the industry which he is to serve. Dr. Wigglesworth concluded by enumerating some of the very diverse organisations wherein entomologists can seek employment if prepared to carry out applied work.

In the general discussion among members which followed the introductory papers, a number of points were made. It was suggested that biology, and therefore zoology, is now such a complex subject, with roots deep down in chemistry, physics and mathematics, that certain preliminary training in these subjects should be insisted upon before work in zoology itself is commenced at any other than a most elementary level. Such training is required for medicine; why should zoology exempt its trainees from being of a certain educational standard in such very relevant subjects? The great need for systematic zoologists was mentioned, but the opinion was expressed that systematists gradually develop in the course of general zoological training, and few, if any, could be specifically trained for taxonomic work. In any event, systematics is a very specialized field, and a relatively small one compared with the rest of the general field of zoology.

One speaker suggested that the rising cost of living, along with the relatively poorer career prospects in biology, is leading to an ever larger number of potential zoologists taking up medicine rather than zoology; but this point of view was immediately controverted by another speaker.

The fact that zoologists appear to have succeeded in a great number of non-zoological war jobs was cited as showing that zoology as a discipline has very considerable educative value, as distinct from being a subject of training in a specific technical field, and that it is desirable that this should be stressed. To speak of 'training' in zoology implies in itself that the trainee is to become a professional zoologist. No one would talk of a 'training' in classics, but an 'education' in classics was held to fit a man for almost any job where administration is involved. Is there anything that makes the man 'educated' in the classics or such similar subjects automatically a better potential worker than the man 'trained' in zoology?

JOHN SMART

MODERN METHODS OF FIBRE INVESTIGATION

STUDIES on the properties of single fibres have been particularly successful in increasing our knowledge of the structure of natural and synthetic high polymers and of the basic principles underlying many industrial processes. Special techniques have been developed to overcome the experimental difficulties involved in making measurements on single fibres, and many of these methods were discussed at a Conference on Single Fibre Testing held by the Textile Institute in the University of Leeds

on January 29. The February issue of the *Journal of the Textile Institute*, in which the papers read at the Conference are published, forms a valuable addition to scientific literature, and will be a useful practical reference volume for all who are interested in this field of investigation.

Determinations of breaking load, extension at break, and other elastic properties which have attracted many workers were discussed by R. Meredith, and an instrument designed by J. Sikorski, C. S. Whewell, and H. J. Woods was described in detail on account of its having proved satisfactory for making such measurements over a period of ten years. Interest in studies on bending has recently been intensified, and measurements of bending modulus may be made simply by the use of apparatus described by P. Carlene and by L. G. Wilson. R. H. K. Thomson and D. Traill gave an account of an apparatus designed to assess the resistance of fibres to repetitive bending—a property which is equally important, although some doubt was expressed as to the correlation between results obtained by this method and those obtained on material in bulk. Deformation of fibres by shearing stresses was considered by A. Finlayson, and papers by R. Meredith and by W. E. Morton and F. Permanyer supply details of satisfactory methods for measuring torsional rigidity and torsional relaxation, which are particularly significant in relation to the spinning of textile fibres. Determination of axial swelling by direct microscopic observation is slow and difficult, especially with fibres of varying and irregular cross-sections, but new methods of measurement devised by J. M. Preston and S. Das Gupta and by F. L. Warburton are much simpler.

Other fibre properties, less frequently studied, were the subjects of a contribution by J. M. Preston on the refractive index of textile fibres, and an interesting account of preliminary experiments by G. E. Collins on the surface tension method for measuring the perimeter of a fibre and the contact angle.

Weighing the single fibre is a necessary operation in most investigations, and has in the past been done by using torsion balances. These instruments are delicate and often lack stability, but the cantilever microbalance of E. Lord is more robust and stable, and is very suitable for routine work.

Sampling is one of the most important aspects of single fibre testing, and statistical analysis of the results is in most cases necessary. These topics were discussed by R. C. Palmer and H. E. Daniels, who illustrated their contribution by reference to the measurement of fibre length. The value of modern single fibre testing is possibly best illustrated by the results which have been obtained on animal fibres, for although opinions may differ on the detailed interpretation of certain observations, studies on the properties of natural and chemically modified animal fibres under various conditions have been particularly successful. Some of this work was described by J. B. Speakman, who gave a lucid account of the uses of load/extension curves, set, and supercontraction in the routine control of wool textile processes as well as in research on the chemistry of animal fibres. The new techniques developed by R. D. Preston and by F. Happey and A. W. Porter for obtaining X-radiograms of single fibres should also prove valuable in investigations on the structure of fibres.

C. S. WHEWELL