investigation. Comparison of the results obtained in three different laboratories, on the variation of nickel content across tænite inclusions in the same type of meteorite, indicated that standard methods of preparing the specimen must also be worked out. It was unfortunate that only an extended abstract was available of what would have been a most interesting paper by Borovski (Institute of Metallurgy, Moscow), who has independently developed the X-ray microanalyser for metallurgical research. It appears that he has made great progress not only with standardizing the procedures, but also in the automatic recording of concentration curves. His main interest is in diffusion problems and in transfer processes between solid and liquid media.

In summary, it can be said that the emission microanalyser is leaving the stage of being an interesting piece of gadgetry and is now having to prove itself as a routine research tool, in the course of which its capabilities and limitations will become more clearly defined. In particular, it remains to be seen how far it can help in some of the main problems of ferrous metallurgy: exploratory determinations of carbon have already been made by Dolby, but what the limits of accuracy may be and whether carbon and nitrogen can be distinguished from each other are problems still to be solved.

The Symposium ended with two sessions on microdiffraction, which becomes increasingly related technically to X-ray microscopical methods as the advantages of using micro-focus tubes are more widely appreciated. Further developments were described in the tubes themselves and in the spectrometers and micro-beam cameras used with them. The value of the method, especially in reducing exposure time to more practical limits when only very small crystals are available, emerged strongly from the work of Fournier (Centre National pour la Recherche Scientifique, Paris) on crystals from tumours, Mrs. Kennard (National Institute for Medical Research, London) on a number of clinical problems, Skertchly (Textile Physics Laboratory, Leeds) on keratinization of hair, and Wylie (Royal College of Technology, Glasgow) on the growth of crystals in balsa wood. Quite different techniques have been developed for investigating dislocations and other sub-structures in metals, by combining Bragg diffraction with X-ray microscopy. Extensions and applications of this 'Berg–Barrett' method were described by Newkirk (General Electric Laboratories, Schenectady) and Weissmann (Rutgers University, New Jersey). Shinoda and colleagues (Osaka University) had used a transmission variant of the method to investigate the recrystallization of zirconium and its alloys on the micro-scale.

A third symposium is planned for 1962, and will probably be held at Stanford University, California.

V. E. COSSLETT

THE BRITISH GELATINE AND GLUE RESEARCH ASSOCIATION

THE seventeenth meeting of the Research Panel of the British Gelatine and Glue Research Association was held on June 25, with Mr. S. G. Hudson (Richard Hodgson and Sons, Ltd.) in the chair. In the morning a review of certain aspects of the research of the Association was given by Mr. A. G. Ward, for whom it was the last meeting as director of research, and in the afternoon a discussion on gelation took place, with the main contribution from Mr. J. W. Janus (Kodak, Ltd.).

The review by Mr. Ward was entitled "The Present Position in Gelatine and Glue Research". The paper opened with a reference to a previous review given by the author to the second Research Panel meeting nine years earlier, in which considerable attention was given to those methods of polymer physics and chemistry which were applicable to the study of gelatin. The expansion of research on gelatin now made it necessary to limit the paper to the central problem of the structure of the molecules of the many different types of gelatin. This largely left on one side research on the collagen–gelatin conversion and also on gelation, except where these subjects threw light on the molecular structure of gelatin.

The chemical composition of gelatine, and animal glue, were shown to depend on the amino-acid composition of the gelatin itself, that is to say, of the collagen breakdown products, and on the occurrence and composition of rather small amounts of non-gelatin constituents. Separation procedures such as adsorption on activated charcoal, or '*IRC*50' resin, enabled small quantities of gelatin-free impurities to be obtained and analysed, and examination of fractions prepared with *iso*propyl alcohol showed that about 1 per cent of degraded protein, other than gelatin, might also be present in the residue from fractionation. Using hydroxyproline content as a measure of purity, it was suggested that a total of 3 per cent of organic impurities might be present, although the variation in hydroxyproline content could equally be the result of small differences in composition between gelatin molecules.

Revision of figures for the amide content of gelatines enabled very good agreement to be obtained between the analytical figures for the ionizable groups in gelatin and the results of titration curve determinations. This shows that, within experimental error, all the carboxyl, amino and guanidino groups are free to ionize and are not cross-linked. The accuracy attained did not make it possible to exclude the occurrence of a small number of cross-links involving these groups.

The properties of preparations of well-characterized soluble collagen extracted from calfskin, carp-swim bladder tunic and codskin, by Doty and co-workers, and their conversion of the soluble collagens to gelatin, could be explained in terms of dissociation of the triple-helix collagen structure. The gelatins obtained would, on this view, be single chains, free of cross-links. In contrast, first extract alkali process gelatins have been shown by Courts and Stainsby, using end-groups and light-scattering determinations of molecular weight, to be multichain, at least for the higher molecular weights. The relation between these results was discussed.

The problem of explaining the reduction in gel-forming ability in gelatine caused by neutral and alkaline degradation, although not by acid degradation, as distinct from any effect due to the reduction

in molecular weight, still remained to be solved. Suggested explanations were put forward in terms of internal re-arrangements of the protein chains which upset the ordered arrangement required for a gel bond, or alternatively, that intra-molecular cross-linking occurs progressively on heating under neutral or alkaline conditions, and interferes with subsequent gel formation.

After a brief discussion Dr. A. Courts (British Gelatine and Glue Research Association), in moving a vote of thanks, expressed the appreciation of the staff of the help given to them by Mr. Ward in his term of office. Mr. C. F. C. Simeons (British Gelatine Works, Ltd.), in seconding, added the thanks of the gelatine and glue industry.

Mr. Janus, in opening the discussion on gelation, gave a short paper on "The Formation and Structure of Gelatin Gels". He described the measured properties of gels, the rigidity of the matured gel, the melting-point and the setting time from the sol state, and showed how these depended on solution *p*H. He emphasized that setting might occur in a short time even at room temperature, whereas the gel rigidity increased over long periods at 0° C. The melting-point was, however, much less influenced by low-temperature maturing.

The influence of guanidino content on setting time and melting-point was made clear, but not that on low-temperature rigidity. Interference with setting can also be secured by alkaline copper solutions which are presumed to interact with the $>$CO groups of the backbone. An interaction between guanidinium groups and the backbone was therefore postulated as the mechanism of the early stage of setting. To explain the continued growth of rigidity at low temperatures, reversion to the helical structure was suggested, and support was drawn from the optical rotation changes.

Dr. R. Collison (British Baking Industries Research Association) presented a short paper by Dr. G. A. H. Elton and himself on "The Swelling of Starch". In this he described the swelling of the granules in water as the temperature is raised, and effects on the mechanical properties. He also mentioned the action of surface active agents in controlling swelling, probably by forming a hydrophobic layer on the granules.

Mr. D. D. Carruthers (University of Durham) described measurements on gelatin gels at high frequency, and discussed the dependence on temperature of the mechanical properties.

The general discussion was opened by Dr. G. Stainsby (British Gelatine and Glue Research Association), who emphasized the difficulty of establishing precisely the mechanism of gelation. The vote of thanks to Mr. Janus and the other speakers was moved by Mr. E. Bradbury (British Cotton Industry Research Association) and seconded by Dr. A. Jobling (British Glues and Chemicals, Ltd.).

ALAN G. WARD

THE TORRY RESEARCH STATION, ABERDEEN

THE Torry Research Station in Aberdeen of the Department of Scientific and Industrial Research, which was set up in 1929, together with its sub-station in Hull, the Humber Laboratory (opened in 1952), carries out research into the problems of fish preservation. The occasion of the open days during June 15–17, when the Station was on show to scientists, equipment manufacturers, the fish industry and the general public, provided an opportunity both of seeing the range of practically the whole of the research in the United Kingdom into fish technology and also of assessing how the treatment of the fish we eat is likely to change in years to come.

Although the fish industry has changed in numerous ways in the thirty years since Torry was opened, it nevertheless remains largely 'traditional'; there are many small firms, mechanization to any substantial degree is found only in a few factories and, with the exception of deep freezing, the methods of preservation used were familiar to our grandparents. Torry, which has been closely concerned in many of the changes which have occurred, is becoming more and more closely occupied with the technical development of the industry of the future. Changes are occurring at an increasing tempo and the next decade is likely to see a much greater alteration in both techniques and organization than the previous 30 years have done.

One of the major problems concerning our supply of white fish is that about half of it comes from Arctic waters. The fishing grounds are anything from three days to one week's steaming from the Humber ports, on which almost all the long-distance trawlers are based, and this consequently sets a limit to the age of the freshest fish that can be landed. Voyages are on an average of nearly three weeks duration and the fish caught first may therefore be 16–17 days old when it is landed. Cod and haddock, even when properly stored in crushed ice, remain in reasonably good edible condition for only 14–15 days. About ½ per cent per annum of the Arctic catch is in fact condemned at landing as unfit for human consumption. After landing, the vicissitudes of the distribution chain may render passable fish unpleasant and good fish only passable.

Since the Second World War, considerable attention has been paid at Torry to the problem of how to get fresher fish to the consumer. A promising solution is to build a trawler capable of freezing the first third of the catch. That the idea is practicable was shown in a full-scale trial carried out in 1955–56 under Torry's technical supervision and financed jointly by the Distant Water Vessel Owners' Development Committee, the White Fish Authority and H.M. Government. A Grimsby trawler was fitted with vertical plate freezers developed at Torry and capable of operating satisfactorily in the exacting conditions of Arctic fishing, and with a −30° C. cold store. The frozen fish was distributed to consumers throughout the country whose reactions were almost universally favourable. The latest development is the design of a vessel of normal size and cost which would show attractive economic advantages over existing high-speed trawlers. Such a vessel would be a trifle slower than the latter, the extra 1–2 knots of which are disproportionately expensive to obtain. It could spend rather longer on the fishing grounds and therefore land a greater weight of fish. The frozen part of