was to petition for the erection of monuments in the Garden to the memory of famous scientists, beginning with that of Linnæus, later destroyed by *sans-culottes*.

Prof. Jean Piveteau, of the Sorbonne, a well-known authority on Buffon, gave an account of his personality with particular reference to his ideas on evolution, how they developed and how, at times, they seemed incompatible. A valuable commentary gave the reasons for this, both psychological and diplomatic. Few men are so misjudged in Great Britain as Buffon. He had an enormous influence on the thought of his time. He was a man of wide scientific attainments and in every way a man of the world. His Discourse on Style, delivered on his admittance to the Academy of Sciences in August 1753, has given him his place in literature. This celebrated discourse was read at the meeting by M. Toni Taffin of the Comédie-Française. The audience was obviously thrilled to hear the sonorous phrases which probably all had read—there were at least sixty editions of it in the nineteenth century.

Dr. J. Ramsbottom followed with an account of the lives and work of Jean Lamarck and Charles Darwin. Lamarck first postulated progressive evolution; Darwin put the doctrine of evolution on so sound a basis that it became generally accepted. It was a pleasing acknowledgment of Darwin's epoch-making "Origin of Species" that he should be given a prominent place in what was essentially a celebration of French achievements: moreover, it was logical in realizing that it was the book and not the preliminary announcement of natural selection which was important. So Lamarck and Darwin could be spoken of as searchers after truth without some of the nonsense which has been allowed to belittle the former. Comparing the basic ideas of the two—Lamarck held that an organism in a changing environment is stimulated to vary; Darwin that variation is independent of the environment. For both the environment—adaphic, physical and biotic factors, the last including competition, parasitism, etc.—is all-important. Natural selection is not active like artificial selection, but passive: an organism can live under certain conditions, or it cannot. Lamarck suggested that the simpler animals and plants would provide instructive facts. Evidence accumulated since the introduction of pure culture methods suggests that environmental conditions can produce definite inheritable changes, though not necessarily of the kind Lamarck propounded. The boosting up of penicillin production in *Penicillium chrysogenum* has much in common with what Darwin considered to be the effects of domestication.

Mme. G. Duprat, librarian to the Museum, then gave an account of the career of P. J. Redouté, born in 1759, who was artist to the Garden and painted many of the famous *vélins*. She showed a series of projections of portraits of Redouté and a large number of his paintings, several of which were of specimens from the Royal Botanic Garden at Kew. An exhibition was arranged in the corridor adjoining the amphitheatre showing many of Redouté's original paintings and a number of his published plates; also an announcement of his lectures. The Muséum d'Histoire Naturelle, as one of its main functions, acts as a teaching university. There are at present 24 professors who give courses of lectures covering a very wide field, but there are no degrees awarded as the result of examinations. The system is *sui generis*.

Prof. H. V. Vallois, director of the Musée de l'Homme—attached to the Natural History Museum—gave a history of the Société d'Anthropologie, founded in 1857. In spite of the date the Society's beginning was in no way connected with the publication of the "Origin of Species"; indeed, it preceded it by six months. Social and physical anthropology in the widest sense have been the scope of the Society, and its activities, as outlined, make an impressive history. It is noteworthy how Darwin's name became increasingly prominent after the publication of his "Descent of Man" in 1871. Cuvier, the great exponent of catastrophism, died in 1832, but though there was no successor to stamp out heresies his influence was such that Lamarck's beliefs were still discredited and it was not until Darwin amassed and arranged the evidence that inquiries about the status of fossil man became scientifically respectable.

The last paper, by M. Franck Bourdier, assistant chief of the Service de Muséologie, dealt with the French forerunners of evolution. They make an imposing list far outnumbering the combined total from all other countries. The notion of permanent change in organisms and that of evolutionary sequence stood out clearly. It would be useful to distinguish between them, possibly by speaking of the first as transformism and the second as evolution.

In an adjoining corridor an exhibit was arranged where the matter of this lecture could be studied at leisure and in greater detail. Here again Darwin was included as the end of the old period or as the beginning of the new.

In addition to this intellectual feast and as part of the anniversaries, an excellent exhibition was staged in the gallery of the Botanical Museum, dealing with the history of the doctrine of evolution and illustrating development up to and including man. Specimens, casts, models, photographs and all the modern methods of display provided a most instructive and convincing story.

J. Ramsbottom

X-RAY MICROSCOPY AND X-RAY MICROANALYSIS

The second International Symposium on X-ray Microscopy and X-ray Microanalysis was an independent meeting held in Stockholm in 1959, and sponsored by the same three laboratories as were responsible for arranging the first Symposium, held in Cambridge in 1956: the Department of Medical Physics, Karolinska Institutet, Stockholm; the Departments of Physics and Biophysics, Stanford University, California; and the Electron Microscope Section of the Cavendish Laboratory, Cambridge. The attendance of 180 was 50 per cent greater than that at the previous meeting, although the number of papers presented (74) was not appreciably greater than before (66). The participants were drawn from seventeen different countries and from 120 different laboratories.

The programme was divided according to the nature of the physical techniques employed: X-ray absorption microradiography, X-ray emission micro-analysis, and X-ray microdiffraction analysis. Each division was sub-divided into sections on methodological aspects and equipment, technical applications and biological applications. The number of communications under these three cross-divisions was 43, 10 and 21, respectively, showing that the development of techniques is still enjoying most attention and that their application in biology and medicine is ahead of that in mineralogy and metallurgy.

In absorption microradiography, interest was mainly in the relative merits of the contact and projection techniques, only two contributions being concerned with the reflexion method, in which the correction of aberrations is still the main problem. For qualitative microscopy, all three methods at present have about the same limit of resolving power, at about $0{\cdot}25\mu$. H. H. Pattee (Stanford University) has investigated a number of alternatives to the photographic emulsion for recording the X-ray image in contact microradiography, including radiosensitive dyes and plastics, some of which give images which can be enlarged in the electron microscope. J. H. Auld and J. F. McNeil (Aeronautical Research and Defence Standards Laboratories, Australia) showed that xerography with liquid developers allows a resolution comparable with that given by ultra-fine grained X-ray films and at exposure times similar to those of the fastest X-ray films. In the projection method, improvements are being made in the technique of focusing at very high resolution (W. C. Nixon, Cavendish Laboratory) and in obtaining improved contrast (S. P. Ong and J. B. Le Poole, Delft). The main emphasis, however, was on the perfection of the absorption procedure for micro-analysis, whether of particular elements (sulphur, phosphorus, calcium) or simply of the dry weight of biological tissues. The contact method has been developed for this purpose, especially in Swedish laboratories, and improvements in the technique were described by Howling and Fitzgerald (New York), Hydén and Larsson (Gothenburg), Lindström and Hoh (Stockholm) and Müller and Sandritter (Frankfurt-on-Main). The accuracy of analysis varies between 5 and 10 per cent, depending on the nature of the specimen. A detailed study of all the factors involved is being made by Henke (Pomona College, California), using red blood-cells as standard specimen. In the projection method direct measurements can be made with a counter on the enlarged X-ray image, thus eliminating the stages of photography and microphotometry, so that the accuracy of analysis is better. In determinations of calcium in bone, Long (Cavendish Laboratory, Cambridge) obtained 2–3 per cent accuracy. The smallest area which can be analysed is a few microns in diameter in either method, the limit being set by the light spot in microphotometry and by the counter aperture in projection recording. The ultimate mass sensitivity is of order 10^{-11}–10^{-12} gm., since sections thinner than 10μ cannot be used.

The applications of absorption microradiography, by one or the other experimental technique, covered a wide range of subjects. In the inorganic sciences, papers were concerned with mineral dressing, petrography and mineralogy; in biology and medicine, with bone (six papers), vascular systems (five papers), other animal tissues (four papers, including a wide survey by Saunders, of Dalhousie University), plant tissues (two papers) and foraminifera (one paper). Most of this work was qualitative, only Lindström (Stockholm) and Sissons (Institute of Orthopædics, London) describing quantitative applications.

X-ray emission microanalysis is more definitely a quantitative method, and rapid progress is being made with its development now that its value in metallurgy and mineralogy has been demonstrated. In biological research, where compounds rather than elements are of interest, its scope is much more restricted. The mechanism of emission is more complicated than that of absorption and in practice results are subject to a variety of corrections. The efficiency of X-ray production by direct electron excitation was discussed by Archard (Associated Electrical Industries Research Laboratory, Aldermaston) and by Cosslett (Cavendish Laboratory, Cambridge), and the corrections for absorption and fluorescence by Philibert (Institut de Recherches de la Sidérurgie, Paris) and by Austin, Richard and Schwartz (Battelle Institute, Columbus). The factors limiting the spatial resolution (or 'localization') of the method were discussed by Duncumb (Cavendish Laboratory, Cambridge), the main factor being the very rapid decrease in electron-beam current as the focal spot is reduced to less than 1μ in diameter. At present the practical limit is about $0{\cdot}25\mu$, and further improvement must wait upon developments of the electron source, electron lenses and recording system. A great gain is attainable if a proportional counter can be used for wave-length discrimination, instead of a crystal spectrometer, and Dolby and Cosslett reported promising results with a counter of wide collection angle coupled to an electrical network which can separate the pulses produced by neighbouring elements in the periodic table.

Improvements in the design of microanalysers were reported from the laboratories of Associated Electrical Industries (Aldermaston) and Tube Investments (Hinxton) and from the Cavendish Laboratory. The Associated Electrical Industries instrument is now being manufactured by Metropolitan-Vickers and the first model was on view during the meeting. The production of the scanning microanalyser developed in the Cavendish and Tube Investments laboratories, which displays images of the distribution of selected elements in the specimen, was announced by the Cambridge Instrument Company. The original static spot instrument of Castaing is in production in France, and two similar instruments are now being commercially made in the United States. This activity has been stimulated by the great interest now shown in the method by metallurgists and mineralogists, which was reflected in the papers on applications by Austin, Long, Melford (Tube Investments) and Philibert. All elements with atomic number greater than 11 (sodium) can already be analysed, with an accuracy in favourable cases of better than $0{\cdot}1$ per cent. Since the localization of the analysis can be smaller than 1μ, in depth as well as in diameter, this corresponds to a minimum detectable mass of about 10^{-14} gm. As the range of applications is extended, however, it is becoming clear that the limits of accuracy must be more closely investigated in each special type of alloy or mineral. The work of Philibert on light alloys showed that very careful correction needs to be made for fluorescence effects as well as for absorption of X-rays from one constituent by the others present. To reduce such corrections to a minimum, it will be desirable to build up a collection of reference standards so that one may be selected which is as close as possible in composition to the specimen under 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