ELECTROMAGNETIC DISTANCE MEASUREMENT

THE International Association of Geodesy, on the invitation of the Royal Society of London, held a symposium on "Electromagnetic Distance Measurement" at Oxford during September 6–10, 1965. The precise measurement of long distances on the Earth's surface, and also to artificial satellites, has become an increasingly important technique of geodesy during the past twenty years. Numerous instruments are now available commercially for this purpose, using either modulated light or microwave beams, and much research is going on, including work on the application of lasers to distance measurement.

These instruments have created new problems for geodesists who seek accuracies of one or two parts per million. The speed of light is a vital parameter in the calculations, and the effect of atmospheric refraction is most important. The precise determination of the mean refractive index for long lines through the atmosphere at present constitutes the most intractable problem. A further complication with microwaves is that they are reflected from surfaces below or adjacent to the line measured, causing difficulties in observation and uncertainties in the final determination.

It was to investigate these and other associated problems, and to evaluate the available instruments, that Special Study Group No. 19 of the International Association of Geodesy was formed in 1958. The symposium was convened by Major-General R. C. A. Edge, president of the Study Group (and now director-general of the Ordnance Survey), to provide a forum in which the geodesists' problems could be discussed with physicists and meteorologists from all over the world whose work had an important bearing on the subject.

The working sessions covered microwave instruments, electro-optical instruments, propagation problems, laser applications, airborne systems, ranging to artificial Earth satellites, and finally the precise measurement of distances of the order of 1 km or less to accuracies better than one part per million. This last is a newcomer to the work of the Study Group, but one of increasing importance in precise engineering, as for example in the construction of particle accelerators. Plans are now being made to publish a full record of the proceedings, including discussions.

Further information concerning the symposium may be obtained from the Director-General of the Ordnance Survey, Leatherhead Road, Chessington, Surrey.

AUSTRALIAN BIOCHEMICAL SOCIETY MEETING

A MEETING of the Australian Biochemical Society was held at Monash University, Clayton, Victoria, during August 24–27. It took the form of general research papers and symposia on protein structure, function and synthesis—the latter in relation to the genetic apparatus—and the genesis and function of membrane systems. Speakers from overseas and Australia were invited.

S. Moore discussed the chemistry of the catalytic site of ribonuclease with particular reference to the histidine residues at positions 12 and 119 and the lysine residue at position 41. The proportion of each histidine alkylated at nitrogen-1 of histidine 119 and at nitrogen-3 of histidine 12 was found to vary with the chain-length and the particular isomer of the alkylating agent. Charged substitution (carboxymethyl) of lysine-41 lowered the rate of histidine alkylation, but an uncharged (carboxyamido) derivative did not affect it. The spatial relationships of these three amino-acid side-chains as a part of the active centre can now be visualized.

The mechanism of action of certain hydrolytic enzymes as followed by kinetic analysis of the formation of acyl intermediates and their subsequent rate of decay was discussed by B. Zerner. In the case of chymotrypsin and trypsin the decay of the acyl derivative was found to be the rate-limiting step. The mechanism of hydrolysis by liver carboxylesterases, urease and certain other proteolytic enzymes seems to follow the same general chemistry of an acyl enzyme intermediate. He pointed out that the detailed chemistry underlying enzyme specificity is still unsolved.

E. O. P. Thompson gave an account of the accumulated information concerning keratin structure with particular emphasis on Australia's national product, wool. Urea and a reducing agent are required to disrupt the firmly bound structure. Subsequent alkylation of the thiol groups so formed gives protein fractions amenable to conventional separation methods. The large number of acetyl end groups is of considerable interest. Three general heterogeneous classes of protein are present in wool—high sulphur, low sulphur and high glycine. The high sulphur proteins are found in the matrix between the fibrillar structures and may vary from 22 to 31 per cent with forced feeding. Serious attention is now being given to the bottom (growing) end of the wool fibres. There are suggestions that the high sulphur proteins are formed later than the rest and that consolidation of the protein system occurs higher up the fibre.

What was true and new about our oldest and best-known protein system—gluten—was amusingly discussed by M. V. Tracey. In latter years the separation methods successfully applied to other protein systems have been tested and shown to be not very useful with gluten. But the attempts have gone on. The protein as it occurs in flour has the original characteristics of the protein as synthesized, but with maturation of the grain, etc., subsequent alterations have been superimposed. Mr. Tracey, in opposition to the simplifiers, pointed out that, as isolated from the flour, the gluten complex has a range of molecular weights of 20,000 to many millions. Using common-sense arguments he pointed out that random polymerization through disulphide cross-linking would give rise to giant molecules. He argued further that an allo-polyploid with endosperm cells having three sets of chromosomes plus accumulated mutations would not be expected to synthesize storage proteins of simple variety.

V. Moses discussed the observation that proteins synthesized in *E. coli*, after depleted cells have been supplied with nutrients, appear at different rates. This discrimination was interpreted in terms of stability differences in the related molecules of *m*RNA. He raised the question of the control of protein synthesis when the related *m*RNA is of the stable kind. If it is exercised, control in such a situation must be at a later stage than transcription of DNA. B. W. Holloway reviewed the evidence relating to a general operon hypothesis for control

of genetic expression of clusters of related genes. He concluded that in *E. coli* and *Salmonella typhimurium* up to 70 per cent of the genes showed some clustering, but that in *Pseudomonas aeruginosa* it is quite rare. It was expensive, he thought, for each gene to have its own operator and so, without clustering, it was reasonable to expect regulation of enzyme synthesis at the translation level—a point arrived at by the previous speaker. W. H. Elliott also suggested control of ribonuclease synthesis in *Bacillus subtilis* at a stage later than transcription. He has found that actinomycin stimulates ribonuclease production—an observation which would seem to preclude control at the transcription stage. The presence in the cell of a firmly complexing inhibitor of the active ribonuclease secreted by this organism suggests that this enzyme is synthesized close to the cell membrane—from which it is released to the medium. Dr. Elliott also gave evidence for the synthesis of the exo-enzyme α-amylase close to the cell membrane.

The regulation of RNA biosynthesis in general was reviewed by L. R. Finch, who added the idea that the present concepts of the utilization of *m*RNA for protein synthesis, before its own transcription from DNA was completed, allow possible alternative methods of repression not immediately connected to the operator region. He saw combination of the repressor with the nascent peptide chain as offering more specificity than the simple operator region hypothesis.

G. L. Ada spoke of the structure of immune γ-globulin and the problems besetting the investigation of the mechanisms controlling the synthesis of antibody by cells from the spleen and lymph nodes. The heterogeneous nature of the lymph nodes makes conventional methods of following protein synthesis difficult to interpret in terms of antibody synthesis, but the use of radio-autography and specific fluorescent staining offers hope. Injection of powerful bacterial antigens labelled with radio-iodine into rats leads to the uptake of less than four molecules of antigen per plasma cell. It was inferred that intact antigen does not act as a template in the synthesis of antibody. The association of antigen with RNA as being involved as an intermediate in the antigenic response was discussed.

Attempts to define the number and function of proteins coded for by poliovirus RNA after infection were discussed by P. D. Cooper. Mutants resulting from treatment with 5-fluoro-uracil were selected for heat-defectiveness over the small range of temperature of 37°–39·5° C. Five to six genes affecting host cell metabolism have been detected, but the mechanism of their action is as yet little understood. He suggested that the proteins formed as gene products in the mutants differed in perhaps one amino-acid only and that this alteration allowed easy temperature deformation.

J. K. Pollak discussed his work on the origin of the endoplasmic reticulum in developing and regenerating liver. He presented evidence supporting the formation of the reticulum from precursor granules (reticulosomes). These consist mainly of protein which combines with phospholipid to form stable complexes resembling a membranous reticulum. D. E. Green discussed his accumulated knowledge of the methods of separating and re-forming the structural protein phospholipid complexes of mitochondria. He also discussed the evidence for the association of the integrated enzyme systems with structural components of the mitochondria. The localization of the effect of chloramphenicol on the formation, in *S. cerevisiae*, of completed mitochondria with respect to a marked decrease in the number of cristae and of certain mitochondrial enzymes was discussed by A. W. Linnane. The organism grows extremely well on the readily fermentable glucose. His results suggest specificity in the effect of chloramphenicol on mitochondrial development. The synthesis of chloroplasts with respect to regulation, the greening process and the involvement of contained DNA, RNA was discussed by R. M. Smillie. Once again chloramphenicol was reported to show specificity in its effect on the synthesis of protein in the developing organelle.

Using mitochondrial swelling as a measure of substrate uptake, J. B. Chappell presented results which were consistent with the presence of carriers for malate and succinate dependent on phosphate and for citrate being dependent on the presence of L-malate in addition. He sees the process of uptake as being by exchange diffusion. Many in the audience came to sensible grips with mitochondrial swelling for the first time.

T. P. Singer summarized the existing knowledge on the complexities of $NADH_2$ dehydrogenase, with its flavin, non-haem iron and labile sulphur. Its functional position in the electron transport chain in relation to phospholipid and the modifications of its properties by heat and organic solvents and mercurials were discussed.

L. P. Vernon and N. K. Boardman discussed chloroplasts and their functional components which are concerned in electron movement following photochemical excitation. They considered these components with respect to the individual steps and pathways involved and with respect to sub-units having definable activities. Knowledge of chloroplast function now seems to be comparable in depth with that of mitochondria from animal tissues.

F. J. R. Hird

CONTROL OF BIOLOGICAL DEVELOPMENT

THE seventh International Embryological Conference, sponsored by the Editorial Board of the *Journal of Embryology and Experimental Morphology*, was held in London during September 6–10. Three different forms of scientific communications were used: twelve main papers, five discussion groups and some eighty demonstrations were presented by scientists from twenty countries. The control of development formed the major topic of the meeting, since classical embryology is now being reinterpreted in terms of the mechanisms of control of protein synthesis by the genes. Development, of course, requires that a sequence of changes occurs in the types of synthesis carried out by a developing cell. Dr. S. Brenner (Cambridge) introduced the session on the genetics of embryogenesis by discussing the possible control mechanisms whereby a series of cistrons could bring about the sequential series of changes in synthesis required in differentiation. Dr. H. MacGregor (St. Andrews) described recent work on the lamp-brush chromosomes found in newt eggs during their formation. These chromosomes are intensely concerned with the synthesis of materials which form the egg.

However, genetic control systems of embryogenesis tend to fail even if the chromosome number is haploid or polyploid rather than diploid. Prof. L. Gallien (Paris) described a number of instances of polyploidy in amphibia and correlated these abnormalities and examples of aneuploidy with the type of failure of development observed.

Dr. L. Hamilton (London) spoke on her work on the genetic factors which may be involved in the 'haploid syndrome' found in haploid amphibian embryos. This syndrome is characterized by oedema and a tendency to failure of development and is very variable in its expres-