Dr J. I. Davies (University of Wales, Bangor) was concerned with the factors which control the intracellular concentration of cyclic AMP. Assuming these to be the enzymes adenyl cyclase (with or without hormonal stimulation) and cyclic AMP phosphodiesterase, he presented a theoretical kinetic relationship in the form of an equation which could be used to predict tissue levels of cyclic AMP. He showed most clearly that experimental results from many laboratories were compatible with his calculations.

Dr D. A. Stansfield and Mr D. J. Franks (University of Dundee) have approached the study of the properties of adenyl cyclase by attempting to separate luteal adenyl cyclase from the complex ATP hydrolysing system which is also present in plasma membrane fractions, and which competes very successfully with adenyl cyclase for the available substrate (ATP) in *in vitro* incubations. They emphasized the lack of understanding of the way in which fluoride ions activate adenyl cyclase and inhibit the "ATPase" and suggested that fluoride polyanions are responsible for some of the effects which vary with fluoride concentration. Studies with an ATP analogue, β,γ -methylene ATP, were also described.

The lack of convenient and accurate assay methods for cyclic AMP was underlined during the discussion, and by the presentation of two methods for determination of cyclic AMP in later sessions of the meeting. A method which seems to have very great potential was described by B. L. Brown, R. P. Ekins and W. Tampion (London); in this saturation analysis study a specific cyclic AMP binding protein from bovine adrenal cortex was used in combination with charcoal adsorption of unbound nucleotides. Several other communications dealt with kinetic studies of cyclic AMP phosphodiesterase. A. R. Sommerville, M.-L. Rabouhans, A. A. Smith, I. F. Skidmore and S. T. Hindley (Macclesfield) have explored the kinetics of this enzyme at substrate levels usually used in *in vitro* assays (about 0.5 mM) and at very low substrate levels. The Lineweaver-Burk plots they obtained suggested the presence of two enzymes, with very different K_M values.

Discussion also brought out the unreliability of implicating cyclic AMP in a system solely on the grounds that methyl xanthines had an effect on the system. Caffeine and theophylline can, apparently, have effects other than the inhibition of cyclic AMP phosphodiesterase.

SPOROPOLLENIN

Interest in Exine

from a Correspondent

THE unifying influence of sporopollenin was clear at Imperial College, London, on September 23 to 25. Geologists, organic chemists and many others gathered for a symposium on the most chemically inert substance produced by plants. Sporopollenin forms the outer coat of pollen grains and spores of higher plants, and there is interest in its composition, its formation in living plants and its survival in ancient sediments.

Professor J. Heslop-Harrison (London) reported that centrifugation and treatment with colchicine at different stages of pollen formation interrupt the normal pattern of sporopollenin deposition, giving new insight

into the controlling mechanism. In his experiments with *Lilium* fragments of microspore cytoplasm, lying within the pollen sac, but lacking a nucleus as a result of post-meiotic centrifugation, nevertheless had a normal sculptured exine deposited on their surface: while similar fragments derived from (diploid) tapetal cells received a layer of sporopollenin, but without the characteristic sculpturing pattern. He suggested that although most sporopollenin precursors must be supplied from the tapetum, these results are consistent with the view that the pattern is dictated by the cytoplasm of the haploid cell; and further, that this cytoplasm is already "programmed" (probably from the time of the first prophase of the meiotic division) for a pattern which is independent of the presence of a nucleus. The sporopollenin precursors, regarded by Dr G. Shaw (University of Bradford) and his students as carotenoids, seem to be polymerized *in situ* on the developing exine; the role of enzymes in this polymerization remains uncertain and Heslop-Harrison suggested that at least the final stages in the assembly of sporopollenin may be non-enzymatic.

The biological degradation of sporopollenin offers as many problems as its synthesis. Spores and pollen exposed to microbial activity in controlled natural soil environments by Dr A. J. Havinga (Wageningen, Holland), and fossil spore exines occurring in sedimentary rocks examined by Dr W. C. Elsik (Houston), all show evidence of degradation in which both fungi and bacteria seem to be involved. The role of soil fauna may be considerable, but this is less well documented. Sporopollenin is much more sensitive to raised temperatures and pressure for prolonged periods (diagenesis and, eventually, metamorphism) than mineral constituents of sedimentary rocks. Computer analysis of an extensive study of fossil sporopollenin in a wide range of lithologies subjected to different patterns of diagenesis, conducted by Drs M. J. Correia and G. Peniguel (Pay, France), offers a basis for evaluating the role of the many factors involved in the diagenetic process.

Drs J. Brooks (Sunbury) and Shaw emphasized the significance of the similarity of physico-chemical characteristics (infrared absorption spectrum, pyrolysis gas chromatography) of sporopollenin from living plants to those of the insoluble organic residues of ancient (3.7×10^9 year old) sediments and even of carbonaceous meteorites. Shaw advocated extending the term sporopollenin without qualification to all these substances, regarding their presence as evidence of life-activity, of both terrestrial and extraterrestrial source. Several botanists urged a narrower concept of sporopollenin, and would restrict its use to material demonstrably derived from the spores of higher plants.

In spite of the emphasis placed by chemists on the unity of sporopollenins from various sources, minor differences in composition may be clues of value in interpreting the history of fossil material. The use of ultraviolet fluorescence microscopy, described by Dr Van Gijzel (Nijmegen), of the new technique of cathodoluminescence on the scanning electron microscope, described by Drs M. Muir and P. Grant (London), and of centrifugation of fossil assemblages on a density gradient, described by Drs W. Chaloner and G. Orbell (University College, London), were all advocated as means of detecting small compositional differences, reflecting the origin and post-depositional history of fossil sporopollenin.