## BIOLOGICAL CHEMISTRY

THE rapid increase, during recent years, of our knowledge of the chemistry of the biological catalysts and of the chemical changes involved during intracellular respiration was the most striking feature of the Section of Biological Chemistry.

On the basis of this knowledge Prof. O. H. Warburg (Berlin-Dahlem) proposed a classification of these catalysts according to chemical structure. These ferments, or active proteins, he classifies into four groups.

| | Protein | Prosthetic Group | Active Group |
|---|---|---|---|
| 1. | Alloxazino protein | Alloxazine nucleotide | Alloxazine |
| 2. | Pyridino protein | Pyridine nucleotide | Pyridine |
| 3. | Cupro protein | Unknown | Copper |
| 4. | Ferro protein | Ferroporphyrin | Iron |

As examples were quoted (1) the yellow enzyme, (2) the enzymes of alcoholic fermentation and hexose phosphate oxidation, (3) the catechol-oxidase of potato recently investigated by F. Kubowitz, (4) the well-known catalysts of the hæmoglobin type. Such a classification will naturally meet with criticism in Group 2, where the conception of enzyme plus coenzyme forming as rigid a compound as, for example, hæmoglobin will not be generally accepted. The action of these ferments was described in the case of hexose phosphate oxidation involving the stoichiometric transfer of hydrogen to atmospheric oxygen via the alloxazine and pyridine nuclei.

Prof. R. Kuhn (Heidelberg) dealt with ferments of the first two classes in a paper illustrating the close relationship between vitamins and ferments. Thus, aneurine ($B_1$) when phosphorylated is the prosthetic group of carboxylase, lactoflavine ($B_2$) plays a similar part in the yellow enzyme, while ascorbic acid (C) without phosphorylation is the active grouping of esterase. Prof. D. Keilin (Cambridge) confined his address to ferments of the fourth class. The three compounds methæmoglobin, peroxidase and catalase were taken as well-established examples, and the remarkable similarities in the chemical and spectroscopic properties were emphasized. In particular, an account was given of the spectroscopic study of the reaction with hydrogen peroxide, by which it was established that the iron of catalase, but not of the other two, is reduced in reacting with hydrogen peroxide. Manometric evidence for this reduction was also brought forward.

The discussion which followed these two papers centred mainly round the role of the yellow enzyme. It was generally accepted that oxidation *in vivo* of the reduced yellow enzyme, which cannot take place at the oxygen tension in the tissue, must be brought about through the intermediate action of the cytochrome system according to the scheme previously proposed by H. Theorell.

In dealing with the chemical nature of pepsin, trypsin and bacteriophage, Prof. J. H. Northrop (Princeton) stressed the difficulties of obtaining reliable evidence as to the purity of so-called pure crystalline preparations. Apparently the most reliable criterion is the solubility test based on phase rule considerations. Thus only with a pure substance will the concentration of dissolved solids remain constant as further solid is added to a saturated solution. This method has established that many preparations formerly believed pure are mixtures. An active crystalline nucleoprotein has also been obtained from bacteriophage. These substances contain no prosthetic group, and the properties must be ascribed to characteristic molecular structure. Their formation from inactive precursors involves but a very slight chemical change, which is autocatalytic.

A general discussion, entitled "Enzymes, Chromosomes, Virus," was opened by Dr. N. W. Pirie (Cambridge), but was mainly restricted to the subject of virus. The chief problem here is the exact relationship between the crystalline preparations and the virus as it exists in the plant. Ultrafiltration of tobacco mosaic virus shows that particle size increases during purification and gives rise to anisotropy of flow. J. D. Bernal, reviewing his work on the optical properties of purified preparations and on X-ray diffraction measurements, produced evidence of a linear aggregation of virus particles during purification, and was able to deduce the dimensions and spacial configurations of these aggregates. The identical 'unit cell' dimensions of three tobacco viruses find a parallel in the serological tests of Prof. Garcia, whereby the tobacco and potato viruses fall into two groups of closely related individuals.

An address by Prof. E. K. Rideal on chemical reactions in monolayers indicated a new line of approach to the study of changes within the cell, where surface reactions predominate. The change of chemical activity with molecular orientation in a monolayer is well illustrated by the action of permanganate on a film of oleic acid. By compression of the film the molecules assume a perpendicular position, the double bonds are removed from the interface and the oxidation practically ceases. Similarly, the photochemical decomposition of stearyl anilide can be stopped by compressing a film so that the benzene nuclei, revolving until parallel with the incident light, no longer absorb in the ultra-violet region. Similar technique makes possible the study of the orientation of protein molecules, with results in agreement with Astbury's X-ray diffraction method, and the degradation of proteins with loss of chromophoric groups (tyrosine residues) and formation of melanine.

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