

measurement, experimentation and logical inquiry; interdisciplinary collaboration; above all, the seeking of usable insights rather than the production of abstract and possibly sterile formulæ. This reaffirmation should do something to increase the supply of good literature on operational research. It will

certainly encourage those whose intentions are concentrated whole-heartedly on the essentially practical task of helping policy-makers reduce the influence of chance on the outcomes of their decisions.

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¹ See *Nature*, 188, 180 (1960).

BIOLOGICAL STRUCTURE AND FUNCTION

IN 1956, the International Union of Biological Sciences decided to set up a Biochemistry Section Committee which would be a co-ordinating committee between itself and the International Union of Biochemistry. One of the main functions of this Committee is to make recommendations to both Unions for international symposia, embracing subjects in which both biochemistry and the biological sciences are combining to produce a rapidly expanding sphere of knowledge; on this basis the subject "Biological Structure and Function" was chosen for the first joint symposium which was held at the Wenner-Grens Institute, Stockholm, during September 12-17. About 150 scientists attended the symposium, at which 72 members from 11 different countries presented invited papers to the seven sections of the symposium.

The first section was on macromolecular structure and function (chairman, A. Tiselius). Dr. J. C. Kendrew (Cambridge) described with great clarity the work which he has carried out on the elucidation of the structure of myoglobin, and Dr. P. A. Albertsson (Uppsala) discussed a new technique for separating macromolecules by partitioning them in aqueous two-phase systems containing polymers such as dextran and polyethylene glycol. This method has great possibilities in, for example, purifying viruses and separating different sized fragments of disintegrated mitochondria and chloroplasts. The second day, devoted to the subject of microsomes and protein synthesis, was memorable for a masterly discussion of the endoplasmic reticulum by the chairman, Dr. K. R. Porter (New York), which culminated in a series of electron micrographs which clearly demonstrated the existence of this structure in plant cells. In the more biochemical section the emphasis was on the role of ribonucleoprotein particles in protein synthesis.

Mitochondrial structure and function were discussed on the third day (chairman, O. Lindberg). At the moment, two subjects appear to polarize the interest of the various investigators studying the relationship between mitochondrial structure and function. One is the phenomenon of mitochondrial swelling. It seems, however, that different lines of approach are being followed by various laboratories. On one hand, swelling and shrinking are related to the transition of mitochondria from one to another well-defined functional state, for example, from a state of full respiration where the mitochondria are found to shrink, to a state in which the respiration is limited by the absence of phosphate acceptor and where the mitochondria are inclined to swell. On the other hand, mitochondrial swelling is considered to be the result of a more complete change of the normal structure with a loss of most of the mitochondrial functions; the inhibition of the swelling by

different agents or the reverse of swelling by way of a 'contraction' of the swollen mitochondria are followed as means to define the physiological implications of the phenomenon. The other topic, to which numerous papers were devoted, was the mechanism of electron transport and phosphorylation in the diphosphopyridine nucleotide-flavin region of the respiratory chain. The interest in this point was raised both because of the finding that in the presence of flavo-substrates a reversal of electron transfer could take place by way of reactions requiring high-energy phosphate, and because of the suggestion that this phenomenon could be related to an adenosine triphosphate activation of succinate oxidation, which on the other hand is not inhibited by uncoupling agents. It seems that work on these two reactions may provide a good deal of information on the question of the synthesis and utilization of the high-energy compounds during the operation, both in the forward and backward directions, of the terminal part of the respiratory chain.

In the morning session on chloroplast and chromatophore structure and function (chairman, T. W. Goodwin), electron micrographs of chromatophores isolated from both purple and green photosynthetic bacteria were shown by Drs. A. W. Frenkel (Minneapolis) and J. A. Bergeron (Upton, N.Y.), and Dr. M. D. Kamen (Waltham) speculated ingeniously on the primary act of photosynthesis. Later in the day Dr. D. I. Arnon (Berkeley) described his latest investigations on photosynthesis in cell-free systems of *Chromatium* and Dr. Birgit Vennessland (Chicago) gave her views on photophosphorylation with particular reference to the possible role of a 'nascent formate' intermediate, recently postulated by Warburg. The developmental physiologists discussed intact cellular structure and function on the morning of the fifth day, under the chairmanship of Prof. J. Runnström. The topics discussed ranged from 'mitosis', when Dr. D. Mazia described it in terms of a multitude of individual reactions co-ordinated into a fixed time pattern, to electron microscopy studies on ciliary and flagellar movements (B. Afzelius).

In the afternoon an important session on polysaccharides (chairman, G. Blix) included lectures by Dr. S. Hestrin (Jerusalem) on "The Growth of Saccharide Macromolecules" and by Dr. A. Dorfman (Chicago) on "The Acid Mucopolysaccharides of Connective Tissues", and concluded with another important paper on technique from Prof. Tiselius's laboratory, when Dr. P. Flodin described the gel-filtration method for separation of oligosaccharides.

The final session on specific membrane transport and its adaptation (chairman, B. D. Davis) produced further lively discussion, and the closing half-hour

was a salutary reminder that, in spite of the mass of information imparted during the week, our knowledge of the relationship between structure and function is still fragmentary—apparently two currently irreconcilable views are held on the mechanism of amoeboid movement.

The arrangements made by Prof. O. Lindberg and his colleagues in the Wenner-Grens Institute for this symposium were superb, and, thanks to their hard work and genius for organization, everything moved smoothly. Furthermore, the Wenner-Gren Foundation generously supported the symposium financially, and without its aid its existence would have been highly problematical. As could well be imagined, remembering the nationality of our hosts, the social side of the symposium was not neglected and highlights

included a banquet in Skansen and a visit to a performance of Pergolesi's "The Music Master" at the famous seventeenth-century Drottningholm Theatre. A specially delightful feature was that all foreign delegates spent at least one evening in a Swedish home.

The International Union of Biochemistry and the International Union of Biological Sciences are truly grateful to their Swedish hosts for arranging the first joint symposium, and hope that this Stockholm symposium will be the forerunner of similar international symposia based on fruitful co-operation between biochemists and biologists from all nations. It is hoped to publish the proceedings of the symposium in book form in the near future.

T. W. GOODWIN

POWDERS IN INDUSTRY

SIR ALEXANDER FLECK, the president of the Society of Chemical Industry, in opening the first symposium of the Surface Activity Group of the Society of Chemical Industry held during September 29-30, commented on the many imperfectly understood problems of physics and physical chemistry relating to industrial applications of powders, and referred to the largely empirical nature of many old-established manufacturing processes involving powders. "In recent years, however", he said, "application of the growing body of knowledge on the surface properties of powders has led to striking improvements in both processes and products and will undoubtedly lead to further developments, including the foundation of new industries".

In the words of Dr. M. G. Fleming, chairman of the organizing committee, the subject of powders was chosen for the symposium because so many industries make or use powders either as raw materials, intermediates or final products, many manufacturers being unaware of developments in otherwise unrelated industries which could assist them. The programme, he said, was planned to "sketch in the background and define the fundamental terms; next examine the particular requirements and problems of a diverse group of industries, and, finally, correlate these specialized applications, underlining their contiguity and exposing the shortcomings in our basic knowledge of the subject".

A laudable aim, but the event left the impression of unevenness and there were marked swings in the discussion from academic argument concerning, for example, the meaning of surface tension, to some severely practical details of powder processing. This was perhaps the inevitable result of covering so wide a field, theoretical and practical, in a relatively short time, but there was great value in bringing together so much material, the sequential grouping of which proved admirable.

Thirty-one authors contributed in the four sections, which covered "Principles of Production", "Properties of Powders", "Properties of Powders utilized in Industrial Fields", and "Principles of Application and Problems for the Future". There were seven sessions, each with its own chairman and an introducer, who presented the papers as a group on behalf of the authors.

The papers of the first two sections concerned powder production by milling and by controlled precipitation, and the recovery and processing of natural powders; the surface energy of solids, adsorptive properties of powders, adhesion between particles, particle size, shape and surface area, and the electrical and flow-properties of powders. These together provided an excellent general background against which to study papers in the industrial section covering pigments and fillers in paints, printing inks, rubber and plastics (including a paper on whitening); powders as used in building cements, ceramics, bituminous road materials, cosmetics, detergents, pharmaceuticals, pesticides, paper, drilling fluids, and explosives; and problems of mineral dressing, soil mechanics, powder metallurgy, and coal and smokeless fuel production.

The papers revealed extensive basic research, much of it in relation to particular practical problems, and there was much evidence of considerable skill in process manipulation based on experience and technical appraisal of the products. In a brief report it is, however, impossible to give details of the numerous problems in powder production, manufacture and use, calling for further attention, or on which more fundamental knowledge would appear to be needed.

On the production side there were many references to the inefficiency of powder handling machines, particularly grinding mills (better understanding of energy relationships could lead to new methods of grinding), and to the unknowns in present methods of powder drying and powder size classification processes.

From the papers covering numerous industrial uses it was clear that while many of the outstanding problems are specific to particular industries, work in one field is not always being fully utilized in others. On the other hand, techniques of study successful in one industrial context can be unsuited to different materials and applications. For example, methods of particle-size determination adequate for size-ranges down to, say, one micron, giving useful information for particular applications, may be quite unsuitable for the much smaller particles sometimes involved in other types of product.

There is also the problem of how to measure effective or operative particle sizes, in particular