MEDICAL ASPECTS OF COMPLEX CARBOHYDRATES

PROF. M. STACEY points out in his presidential address to Section *B* (Chemistry) that carbohydrates play an essential part in the vital processes of all living cells. Their simplest forms, the monosaccharides, are synthesized from carbon dioxide and water in the leaves of living plants by the agency of sunlight and chlorophyll. The chemistry of these photosynthetic processes, including sugar interconversions, phosphate transfer and the enzymes involved therein, is now being worked out. Likewise, the mechanisms of the build-up and breakdown of the complex carbohydrates, the polysaccharides, is now well established.

Microbial and animal cells, devoid of photosynthetic pigments, must use the simple sugars as material and energy sources for their own metabolic cycles. The proper carrying out of these cycles is necessary for the healthy condition of every living cell, and in the animal the blood sugar (glucose) balance must always be maintained. For the growth and reproduction of cells and tissue, complex polysaccharides must be built up, for example, to form cell membranes, structure and storage material and colloidal fluids, while the pentose sugars form a part of the genes and chromosomes.

Some of the important processes in which both simple and complex carbohydrates are involved are discussed by Prof. Stacey.

(*a*) *General metabolic processes.* These involve digestion of foods and the absorption of glucose and other sugars; they involve the metabolic cycles and the function of enzymes concerned with them. They concern the synthesis and breakdown of glycogen, the conversion of sugar to fat, the biochemistry of muscle action, formation of milk, etc. The hormones insulin and epinephrine are involved in glycolysis. The great medical value of insulin in controlling diabetic conditions is well known. In this field synthetic substitutes for use in diabetes are being actively studied.

(*b*) *Detoxication mechanisms.* Frequently the body needs to get rid of excess toxic substances such as drugs, and it can do this by oxidation processes, coupling up with the sugar acid D-glucuronic acid and then excreting the complex. D-Glucuronic acid is an important tissue component.

(*c*) *Structural components of the body.* It is with these substances that we can expect to see great advances in the future, for complex carbohydrates known as mucoproteins and mucopolysaccharides form a large part of components such as bone and cartilage tissue, cell membranes, connective tissue, skin and its ground substance, joint fluids, synovial fluid, eye tissues and fluids, gastric and intestinal mucosa, etc.

These complex polysaccharides have as their building units nitrogen-containing or 'amino'-sugars, hexuronic acids and hexoses, and often, too, acetyl and sulphate residues are present. Associated with the carbohydrate protein complexes is a novel group of 'nine-carbon' sugars, the nonulosaminic acids, known as sialic and neuraminic acids. Detailed work on the chemistry and biological importance of these acids is not yet well advanced. Generally, the mucopolysaccharides are concerned with movement of parts of the animal body and thus are important in conditions of arthritis, rheumatism, etc., and with general ageing processes.

(*d*) *Blood components.* Many components of blood contain complex carbohydrates; the red cell surface contains mucoproteins, white cells contain nucleic acids, while serum contains a wide range of mucosubstances.

Furthermore, many tissues and fluids of the body such as gastric mucosa, saliva, etc., contain the so-called blood-group factors, which are polysaccharide–amino-acid complexes. One of the most important medical developments has been with blood plasma substitutes, where the bacterial polysaccharide dextran has become established as an excellent expander of blood volume. The clotting of blood in the body is inhibited by heparin, a complex polysaccharide sulphate, the action of which can be imitated by other polysaccharide sulphates.

(*e*) In many other directions carbohydrates are becoming of increasing importance. In the antibiotic field, streptomycin is an important complex carbohydrate, while many others such as puromycin, magnamycin and kanamycin contain amino-sugars.

In disease-producing agents, the complex surface carbohydrates play a significant part in immunity studies, and there is a close relationship between carbohydrate structure and immunological specificity Pyrogens or fever-producing agents from bacteria are also carbohydrates. Muco-substances and the enzymes which destroy them are important in fertilization processes, but little is known at present about the carbohydrates of eggs.

A new branch of carbohydrate chemistry is developing in the virus field, and the necrosis of some tumours by bacterial polysaccharides has yet to be studied in detail.

RECENT DEVELOPMENTS AND TRENDS IN PALÆONTOLOGY

THE past two or three decades have witnessed a remarkable increase in the output of palæontological research. Most of this has been of a purely descriptive character, often related to the needs of the stratigraphical palæontologist, but much has been of more general interest, particularly in the borderline fields of taxonomy and evolutionary theory. Prof. O. M. B. Bulman attempts in his presidential address to Section *C* (Geology) to give a non-technical account of palæontological activities in some of these directions.

Chance plays a large part in the preservation and discovery of fossils, and modes of preservation limit the techniques which can be applied. Hence from the nature of his material, the palæontologist has less freedom than the neontologist in planning his research, and is often unable to follow some otherwise desirable line of investigation. New material is, however, constantly being obtained, and the scale on which effective techniques are being devised and applied is a distinctive feature of modern palæontology. Particularly characteristic of the immediately post-war years also have been the many attempts at constructive syntheses of palæontology and allied sciences.

Palæontology provides a general and imperfect, though steadily improving, record of most groups of organisms, and in supplying a few true evolutionary series it has given a fourth dimension to the concept of the species. Applying the results of absolute rather than merely relative dating of rocks, it is

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