CHEMISTRY

Cellulose Synthesized

Cellulose, the structural material of all plants and the most abundant of all natural organic compounds, has been created by man for the first time.

➤ THE FIRST laboratory synthesis of cellulose, a major step in man's understanding of basic biological processes, has been achieved by University of California biochemists.

Cellulose is the most abundant of all organic compounds in nature. It is the main structural material of plants; the principal ingredient of such familiar natural products as wood and cotton; and the key material in such manufactured products as paper, rayon, cellophane and many plastics.

Scientists had previously gained an understanding of the chemical structure of cellulose. But until now they had not been able to duplicate the plant's method for producing the compound.

The scientists who made the synthesis are George A. Barber and Alan Elbein, assistant research biochemists, and William Z. Hassid, professor of biochemistry and biochemist in the Agricultural Experiment Station—all members of the department of biochemistry on the Berkeley campus. The report was published in the Journal of the American Chemical Society, Jan. 20, 1964.

Dr. Hassid was also a participant in the first laboratory synthesis of sucrose (the common "sugar bowl" form of sugar) announced at Berkeley in 1944.

The research has involved a careful sorting out of complex chemical steps that occur naturally inside the living plant.

A relatively simple molecule in its pure form, cellulose is a carbohydrate of a type known to chemists as "polysaccharide." Its long, chain-like molecules are composed of thousands of glucose sub-units held together by chemical bonds.

The glucose, in turn, is a common form of sugar. As all sugars do, it consists of carbon, hydrogen and oxygen atoms.

Linking the glucose units together to form the long cellulose molecules was not easily done. An intermediate compound that would supply the glucose with a sufficient energy "boost" to form the chemical bonds was needed.

After a long search, the scientists were successful in synthesizing such an intermediate compound—a substance called guanosine diphosphate glucose.

They found that this substance could be made from two chemicals that occur in plants: a simple compound of glucose (glucose 1-phosphate) and a second compound (guanosine triphosphate) related to the important genetic-code-bearing nucleic acid.

These two substances were linked together through the action of an enzyme—a catalyst protein—that the scientists had extracted from mung bean seedlings.

An important quality of the guanosine diphosphate glucose, the researchers learned, is the potential high energy contained in the "glucosidic bond" through which the glucose is attached to the phosphate in the sugar portion of each molecule.

By applying a second enzyme, the scientists succeeded in splitting off the glucose portion of the molecules while at the same time releasing the high energy. Under these conditions, the glucose units were instantly linked together to form the long molecules of cellulose.

Although knowledge of the way cellulose is formed may be useful in the chemical industry, there is little chance that man-made cellulose will ever replace nature's product.

Dr. Hassid pointed out that the living plant is still by far the most efficient producer of cellulose.

However, the report is a significant addition to the knowledge of the complex chemical mechanisms of plants.

• Science News Letter, 85:53 Jan. 25, 1964

NUTRITION

Bottle-Fed Eskimos Miss Vital Foods

➤ ESKIMOS and Indians may be giving up breast feeding too quickly, the Arctic Health Research Center reported.

A survey of dietary practices among residents of selected native Alaskan villages showed deficiencies in infant diets traced to widespread adoption of unsupplemented bottle feeding in place of breast feeding.

Analysis of 555 infant food intake records showed that many babies got only dilute canned milk from two to eight months of age. Sufficient iron, calcium and essential vitamins such as thiamin, niacin and ascorbic acid were lacking.

Dr. Christine Heller, nutritionist at the U.S. Public Health Service's center, said breast feeding should be continued in the villages where availability of supplementary feeding supplies are limited.

• Science News Letter, 85:53 Jan. 25, 1964

TECHNOLOGY

Better Adhesion Foreseen From Molecule-Thin Layer

➤ A BETTER WAY of joining plastics and glass together is foreseen from research conducted in Madison, Wis.

Extraordinary improvement in adhesion between the plastic and the glass reinforcing material is obtained when a single molecular layer of the adhesive material is used.

Increases in strength of 100% in glass-reinforced plastic laminates should be possible from an application of the use of vinyl trichlorosilane developed by L. L. Yaeger and co-workers at the Bjorksten Research Laboratories, Madison, Wis. The material is applied as a gas.

It was found that when the adhesive material was applied as an emulsion or from solution, only about 5% of the glass fibers are wetted and participate in the bond. Recent work at Bell Laboratories has also shown the effectiveness of adhesion when a single molecular layer is utilized.

• Science News Letter, 85:53 Jan. 25, 1964

Michigan State University

PHOTOSYNTHESIS STUDIED—Dr. Gertrude M. Orth of Michigan State University uses algae and carbon dioxide made with radioactive carbon-14 in her studies on the process by which plants use sunlight and carbon dioxide to produce sugars, proteins and other chemicals essential to life.