BIOCHEMISTRY

Green Plant Secret Sought

Both U. S. and U.S.S.R. seek nature's secret, photosynthesis. If and when scientists solve the puzzle, synthetic production of food might be possible.

➤ CARBON 14, radioactive form of the fundamental life element, is being used by both Russian and American scientists to force nature to part with the secret of photosynthesis.

The still unsolved problem of how plants build complex chemicals, the world's basis for all food supplies, is potentially a greater research goal than the problem of how to use atomic energy, the prime topic of the International Conference on the Peaceful Uses of Atomic Energy in Geneva.

Russian scientists T. N. Godnev and A. A. Shlik stressed the early stages in the formation of chlorophyll, the green pigment that houses the plant's secret food factory. By keeping plants in an atmosphere of carbon dioxide made of radioactive carbon, the Russian scientists were able to measure the rate of the plant's use of carbon atoms and to calculate that the average length of life of a molecule of chlorophyll is approximately 19 days.

The dawn of a technology that may provide future generations with food aplenty was foreshadowed by two University of California scientists who said they have completely illuminated one of the two major phases of photosynthesis.

They have discovered a new and unique enzyme chemical playing a part in the first, key step in the photosynthetic cycle.

The scientists described every step of the complex chemical cycle that begins when plants absorb sunlight, carbon dioxide and water; and ends when these simple ingredients are turned into sugars, starches and other energy foods.

A "Handle," Carbon 14

When Hiroshima was cremated, this chemical cycle was almost a complete mystery. And there was no way scientists could substantially penetrate the dark mystery surrounding the subtle reactions.

But when World War II ended, American scientists were given a wonderful "handle" on the mystery, carbon 14.

Dr. Melvin Calvin of the University of California and his associates put single-celled marine plants into test tubes, gave them water, and exposed them to light and radioactive carbon dioxide. Then they killed batches of plants at different intervals—ranging from a fraction of a second up to hours.

After tearing the plants apart chemically and isolating each chemical compound, the scientists located the radioactive carbon by means of its radioactivity. By a process of deduction, they traced the radioactive carbon from one step to another all through the cycle, eventually determining the nature of each reaction.

Dr. Calvin, whose collaborator on the technical paper is Dr. J. A. Bassham, described each step in the cycle. There are 11 distinct (enzymatic) steps in which at least eight different enzymes participate. There are 11 intermediate compounds between the plant's intake of the simple ingredients and the formation of the energy compounds. (See SNL, Aug. 13, p. 101.)

The cycle in which these steps are arranged is like a flow pattern of a great assembly-line factory. The simple materials enter, they are moved along, changed and added to by enzymes and high-energy phosphate compounds.

Ironically, the first, key step in the cycle was the most difficult and the last one bared by the Bergeley researchers. Only recently have they been able to confirm the true nature of this reaction.

Isolate New Enzyme

In the process of exposing this key chemical reaction, the scientists isolated a brand new enzyme, carboxydismutase. It is the only unique enzyme in the photosynthetic cycle. All of the others are common ones found elsewhere in biological systems.

The two scientists indicated that the great remaining challenge of photosynthesis research is the determination of how sunlight is converted into the form of energy required to operate the chemical cycle. Years ago scientists determined that sunlight is captured by chlorophyll, the green pigment of the plant cell. But how it is converted remains a great mystery, and one that does not yield readily to study with radioactive isotopes.

Two possibilities for application are indicated:

First, it may be possible to use the knowledge of the chemical cycle to improve the efficiency of photosynthesis on the farm—for example, by altering conditions so as to give the plant longer life or to increase the yield of certain end products.

Very slight improvements in the efficiency of photosynthesis can yield tremendous returns. Plants grown on farms capture only about one percent of the sunlight that falls on them. If another percent of that sunlight could be captured and converted, the food supply would be tremendously increased.

Second, after the light conversion process is understood, some scientists say that photosynthesis factories may be built to duplicate the work of plants—to produce food synthetically, and more efficiently, and for the first time in history to liberate man from his parasitic dependence upon plants.

Science News Letter, August 27, 1955

BIOCHEMISTRY

Using Atomic Radiation For Foods And Drugs

➤ THE ATOMIC AGE with cheap, plentiful radiation from the wastes of atomic power plants, will see:

1. Preservation of food by cold sterilization, outmoding some canning and freezing of vegetables, meat, fruits, etc.

2. Sterilization of medical supplies, such as antibiotics, drugs and bandages, to make them safer after they are packed for shipment and use.

INSIDE JOB—A stretched rubber band usually breaks "from the inside out," General Electric researchers have found by examining high-speed photographs such as shown here. After the band has snapped, the ends fly apart at speeds up to 500 miles per hour.