FOOD TECHNOLOGY

A Solution to Hunger

➤ PROTEINS, amino acids and vitamins are some of the foods that can be produced synthetically in large quantities to ease the growing problem of hunger throughout the world.

This is the belief of Dr. Archibald T. McPherson of the Institute for Applied Technology, National Bureau of Standards. A leader in development of synthetic rubbers, Dr. McPherson's interest in food synthesis is not related to his bureau work.

A radical new method is needed to solve the hunger problem, Dr. McPherson told a seminar of the Dairy and Food Industries Supply Association in Washington, D.C.

"Conventional methods of increasing food production through agriculture, fisheries and the like offer little promise" of adequately and rapidly easing the crisis, he said.

The solution lies in the direct synthesis of essential food materials, starting with those now in shortest supply.

Millions of pounds of synthetic foods are already being produced in the United States at prices that should insure a ready market. Except for flavoring materials, at present the principal market for such foods is as animal feed rather than as human food.

For instance, amino acids such as lysine and methionine, along with added vitamins and minerals, are used largely in feed for poultry and swine, Dr. McPherson pointed out.

Since amino acids are the building blocks of the vital food element, protein, the production and incorporation of synthetic amino acids into the human diet would greatly benefit many nations, he said.

If left to normal commercial development, the synthetic food industry might attain large proportions in perhaps 25 or 50 years, Dr. McPherson said. But under the pressure of necessity, large scale production could be attained in a shorter time.

Unlike agricultural production, synthetic production could be geared to the demand and readily controlled at any desirable level up to the maximum output.

• Scinece News Letter, 87:68 January 30, 1965

BOTANY

Snatch Nitrogen from Air

➤ SCIENTISTS are closing in on the mysterious process of how plants are able to steal nitrogen from the air and change it into valuable chemical forms that aid growth.

Known as nitrogen fixation, this plant cycle is second in importance only to photosynthesis as a key biochemical process for feeding a hungry world, said Dr. Robert H. Burris of the University of Wisconsin, Madison.

Photosynthesis is the process by which living green plants use the sun's energy to manufacture carbohydrates. Nitrogen fixation is the process of using atmospheric nitrogen to manufacture proteins. (The atmosphere we breathe and which enters the soil contains about 80% nitrogen gas.)

Between these two plant processes, the basic vital materials of carbohydrates and proteins are produced, Dr. Burris told the annual meeting of the Association of State Universities and Land-Grant Colleges in Washington, D.C.

Nearly 5.5 million tons of nitrogen each year are converted in the United States alone by this amazing nitrogen-fixation process of plants, he said. The plants with this exceptional ability are found among the 13,000 species of bean plants known as legumes. Along the roots of plants such as peas, beans, clover and lupin are nodules containing bacteria which carry out the process.

The process goes much like this: free nitrogen is converted to ammonia which is quickly picked up and attached to the organic acid called ketoglutarate to form an important amino acid, explained Dr. Burris.

This amino acid then forms the basis for transfer of amino groups to other keto acids to form the other amino acids needed for manufacturing protein, he explained.

The mystery that scientists are trying to solve now is what occurs between the initial state, in which the nitrogen is free, to the point where it is combined with hydrogen to form ammonia.

In many laboratories, a clearer picture of this process is emerging, said Dr. Burris.

Part of the key to the solution lies in an enzyme, he explained. It is on the surface of this enzyme that the nitrogen molecule is converted to two molecules of ammonia, requiring a transfer of six electrons. Scientists believe that the nitrogen remains bound to the enzyme surface until released in the form of ammonia. This enzyme has been purified, but still is eluding final study of its chemical or structural properties.

Nitrogen fixation was first observed by the early Greek and Roman farmers who rotated leguminous and non-leguminous crops because they saw that the non-legumes grew far more vigorously when they were planted following the legume crop.

In 1886, experiments proved that root nodules of leguminous plants actually seize nitrogen from the air and fix it into organic compounds. Since then biochemists have been trying to work out the details of the process.

Root nodules are responsible for replacing much of the nitrogen lost from the land by erosion, leaching and disposal of sewage. Commercial manufacture of nitrogen in fertilizers is becoming more important, but on a world-wide scale it accounts for only a small percentage of nitrogen.

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