BIOLOGY

Photosynthesis Puzzle

Scientists believe another pigment, besides chlorophyll, is needed for a plant to convert sunlight, water and carbon dioxide to food—By Tove Neville

➤ A NEW STEP in solving the puzzle of how plants convert sunlight, water and carbon dioxide into starch, the plants' food, was reported in Stanford, Calif.

Dr. Ellen C. Weaver of Stanford University told SCIENCE SERVICE that she and her co-worker, Prof. Norman I. Bishop of Florida State University, Tallahassee, believe that another green pigment besides chlorophyll is necessary in the food-making process of plants. This pigment is called P-700. (P stands for pigment, and 700 is the wavelength at which the color absorbs light.)

Dr. Weaver said that up to now normal green cells have been thought to synthesize by the use of chlorophyll alone. However, new studies with green cells of mutant algae, reported by Dr. Weaver to the Pacific division of the American Association for the Advancement of Science meeting in Stanford, Calif., point to the importance of P-700 in photosynthesis.

Normal green plant cells contain both chlorophyll and P-700 but the latter is missing in mutation cells, which cannot synthesize light, water and carbon dioxide to make their own food. Two other important ingredients always found together in photosynthesis, a rapid resonance and a slow resonance, have never been found before in living mutant cells.

Dr. Weaver and her co-worker have now, for what they believe to be the first time, succeeded in identifying each of these resonances singly in living mutant algae. The two strains of algae lived under "natural" conditions on a salt solution. (They were fed sugar to keep them alive.) The rapid resonance was found in one strain, the slow resonance in the other, but these two resonances never occurred together.

The fact that the pigment P-700 is also absent leads the scientists to believe that the occurrence of both resonances together is dependent on P-700, not chlorophyll.

The scientists investigated the mutated algae by electron paramagnetic resonance (EPR) spectroscopy, a physical method for detecting unpaired electrons that occur in green plants when light falls on them. It is generally believed the flow of free electrons that can be observed will eventually give a clue to how sunlight is converted by plants into food, which is not now known.

• Science News Letter, 84:2 July 6, 1963

BIOTECHNOLOGY

Camera Spots Tumors

➤ A NEW TYPE of camera, using minute amounts of radioactive isotopes to spot many kinds of brain tumors, has been developed.

Research engineer Hal O. Anger of the University of California's Lawrence Radiation Laboratory, Berkeley, Calif., invented the "positron scintillation camera" that detects tumors by photographing positron-emitting isotopes injected into patients. Positrons are positively charged atomic particles sometimes called positive electrons.

Mr. Anger told SCIENCE SERVICE that more than 60 patients have now been examined with the new camera.

Its accuracy is approximately 80% in those cases for which follow-up information is available.

Dr. Alexander Gottschalk, clinician on the project, said that in a small sample of patients examined, the same tumors that had been found by conventional isotope scanners were also spotted by the positron camera.

In addition, two that had not been found by conventional scanning methods were detected. These two tumors were lesions of the pituitary gland, the gland regulating hormone-producing organs in the body.

The amount of radioisotope given to patients for making scintiphotos with the positron camera is 250 microcuries, causing an estimated whole-body radiation dose of less than seven millirads. This is a much lower radiation dose than that from other methods using radioisotopes for brain tumor localization.

Methods not using isotopes involve tapping of the spinal fluid and injecting air into the ventricles of the brain, or injecting substances visible by X-ray into the arteries of the neck. These procedures are frequently laborious and often uncomfortable for the patient.

The "scintiphotos" are made in a short time. Pictures of relatively sharp focus and high sensitivity are usually made in ten minutes and sometimes in as little as two minutes.

The radioactive gallium-68, used for scintiphotos, is coupled to an organic molecule and injected through a filter. It accumulates in most tumor tissue whereas healthy brain tissue rejects it.

The results achieved and a demonstration of the camera were presented by the scientists in an exhibit at the Society of Nuclear Medicine meeting in Montreal. A detailed description of the first clinical uses for the positron camera will be published in the Journal of Nuclear Medicine (July).

• Science News Letter, 84:2 July 6, 1963

PHYSICS

Theory of Nuclear Particles Developed

➤ MATTER and anti-matter are believed to be the missing links in a new theory that will explain what nuclear particles, the basic building blocks of matter, are made of and why they have the properties they do.

The theory, called the scattering matrix theory, will help in the explanation. The theory is so called from the basic notion that all nuclear experiments are scattering experiments of nuclear matter, Dr. Geoffrey F. Chew, University of California physics professor, told SCIENCE SERVICE.

A theory to explain nuclear particles has been sought for many years because it was clear even 30 years ago that it is impossible to try to measure anything as small as the nucleus, the size of which is 10 to the minus 13th power centimeters.

Therefore it is meaningless to consider space and time when dealing with these particles, Dr. Chew said. It has also been shown to be in conflict with the theory of relativity and the quantum theory.

Prof. Werner Heisenberg of Munich, Germany, who won the Nobel prize for his discovery of quantum mechanics and formulation of the quantum theory, was one of the first persons to suggest that the idea of measuring particles in terms of time and space be given up. The scale of measurement is just too tiny and nature itself rebels.

Instead, Prof. Heisenberg suggested that momentum be made the basis for physical laws about particles. Prof. Heisenberg tried to construct a theory on momentum alone during World War II but did not succeed.

This, Dr. Chew said, was because he did not consider the missing link, the relationship of particles to anti-particles. For every particle existing, there is an opposite called an anti-particle with all the properties of a particle reversed, except its mass.

However, Dr. Chew said, when the particle-anti-particle relationship is incorporated into Heisenberg's original principle, the idea of momentum can be developed into a theory explaining what particles really are. This theory, on which Dr. Chew is now working, is the scattering matrix theory.

Dr. Chew discussed some of these principles in an opening address at the International Conference on Nuclear Structure at Stanford University in California.

He commented on the still revolutionary idea, which has become increasingly accepted during the past two years, that there are no elementary particles of which all others are made.

The earliest theory was that protons and neutrons, the so-called nucleons, were elementary particles that could not be broken down into other particles.

However, now no such entities are even believed to exist. Protons and neutrons now appear to have a structure no different from other particles, such as alpha particles or deuterons, but are also composites and made up of other particles. Many believe that all nuclear particles are composites and none deserves to be called elementary.

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