BIOCHEMISTRY

Earth Once Glowed

➤ THE EARTH'S SURFACE in its early years of life may have glowed like a beautiful rainbow, shimmering with the colorful array of light emitted by primitive organisms.

Light emission may have occurred soon after life appeared on earth, when the atmosphere lacked oxygen, Drs. W. D. McElroy and H. H. Seliger of Johns Hopkins University, Baltimore, Md., reported at the International Congress on Biochemistry in Moscow.

As small amounts of oxygen appeared in the atmosphere, not all of the organisms could tolerate the presence of oxygen. However, those that could quickly and rapidly remove the oxygen by reduction with hydrogen or electrons from primitive foodstuffs survived.

In removing the oxygen by the use of organic reducing substances, an excited state was produced resulting in the emission of light. The surviving organisms were therefore all potentially luminescent. Thus began the oxygen-using metabolism evident in most present day organisms.

After the aerobic system became well established the luminescent systems no longer had a selective advantage. Nevertheless they continued to exist and are now found in certain bacteria, fungi and the firefly.

The compound that makes the firefly glow, luciferin, was recently synthesized for the first time by Dr. McElroy and three other scientists at Johns Hopkins University. The firefly's luminescent system was adapted for a secondary purpose, the identification of the female firefly by the male.

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Photosynthesis Studied

➤ PHOTOSYNTHESIS—the conversion of light into energy by living cells—is not as simple as that observed in green plants.

By isolating the photosynthetic process from the complex living cell, scientists have found that the process is independent of oxygen and more closely linked with absorbing phosphorus. Scientists normally view photosynthesis in plants as converting carbon dioxide to sugars while giving off oxygen to the air.

Photosynthetic cells are distinguished from other cells by their ability to form two products from light energy, ATP (adenosine triphosphate) and PNH-2 (reduced pyridine nucleotide). The formation of these products is largely responsible for converting carbon dioxide to sugars. The reaction is accompanied by the evolution of oxygen, which to the casual observer seems to require more light energy.

It is these outward reactions that have resulted in the popular definition of photosynthesis.

University of California scientists in Berkeley carried on cell-free photosynthetic experiments by removing chloroplasts from spinach leaves. Chloroplasts are tiny particles of green leaves that contain the chlorophyll pigments where photosynthesis takes place.

The results of the experiments were presented to the International Congress on Biochemistry in Moscow by University of California professor, Dr. Daniel I. Arnon.

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Tranquilizer Effects

➤ PHENOTHIAZINE tranquilizers, used to depress the central nervous system and induce sleep, may be producing their effects by speeding the action of an enzyme in the brain, five biochemists from the University of Nebraska Hospital, Omaha, reported.

The effect of this particular group of compounds was described as "the most striking" observed in a general study of what tranquilizing agents do to enzymes, the catalysts that increase the rate of chemical reactions in cells.

Phenothiazine drugs were shown to step up the activity of a brain enzyme called L-glutamic decarboxylase. The enzyme changes glutamic acid to gamma-aminobutyric acid, which inhibits the functions of the central nervous system.

Dr. Herbert P. Jacobi, Dr. David Rosenberg, Dr. M. J. Carver, John Haggstrom and Martha Kelly, all of the University's biochemistry department, made their announcement at the International Congress on Biochemistry in Moscow.

Their study is based on the theory that the body's chemical processes are based principally on enzyme activity, and that the chief action of drugs used to treat diseases is one of interference with enzymes.

Information on drug-enzyme interaction is expected to give new insight on disease causes, as well as to help determine what drugs should be prescribed for varying types of ailments.

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Method Measures Protein

➤ AN IMPORTANT TOOL is seen in the discovery of a new technique for separating and measuring the sub-units of large protein molecules.

Dr. Francis J. Reithel, head of the University of Oregon chemistry department, reported his new technique at the Fifth International Congress on Biochemistry in Moscow. Up to now geneticists have had to use small protein molecules, which are not numerous. Separation of the sub-units of large molecules will give access to a larger number of molecules for this research.

The new technique involves dissolving purified proteins in a chemical reagent known as guanidine hydrochloride. Dr. Reithel uses an ultracentrifuge, a refined version of apparatus that separates material by rotation.

To separate the sub-units, Dr. Reithel used a technique called sedimentation equilibrium, in which diffusion of the molecules offsets centrifugation. The molecular weights are determined from readings on photographs, taken while the ultracentrifuge is in motion.

Ordinarily the sedimentation equilibrium process takes days, but by using a very short column of one millimeter or less of protein solution in the ultracentrifuge the experiments were reduced to a few hours. This use of a short column is less than two years old.

For his protein material Dr. Reithel uses enzymes, a class of organic substances that accelerate specific transformations in living cells. Dr. Reithel produced a pure form of an enzyme called beta-galactosidase, which comes from a common intestinal bacterium.

This enzyme appeared to have a molecular weight of 700,000 but it also showed evidence of having smaller functional units. Preliminary observation indicates a molecular weight of 35,000 for each of 20 sub-units.

Dr. Reithel said the analytical technique of combining the short column, sedimentation equilibrium method with the use of guanidine hydrochloride is a very convenient and powerful tool for determining molecular weights on very small quantities of material. He is now studying methods for preventing the separated sub-units from rejoining.

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GEOLOGY

Antarctic Research Program Planned

➤ THE UNITED STATES will soon launch its most ambitious program of scientific research in the Antarctic.

More than 200 scientists from various universities, research institutions and Government agencies will converge on the white continent in October to take part in research projects on and around the continent. Estimated cost of the program is about $5,500,000.

The studies include exploring one of the largest little-known mountain ranges, studying the unusual animal life, and making a glacial survey of the Ross Ice Shelf. One group of scientists will stay at a substation completely shut off from the rest of the parties for five months.

The "summer" season will be the first since the United States signed the cooperative Antarctic Treaty with 12 other nations. The treaty pledged all participating nations to the peaceful use and exploration of the continent.

The U. S. Antarctic research program is supported and coordinated by the National Science Foundation. The U. S. Navy provides the main logistic support for the scientific effort.

A floating research laboratory, the USNS Eltanin, will be operating in Antarctic waters for the first time. The Eltanin, outfitted primarily for oceanographic research, will also be used for meteorological and other related research.

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