OPHTHALMOLOGY

Deep Purple Triggers Eye

Chemicals in the eye create deep purple which triggers the seeing mechanism. Three other discoveries of the eye's structure were made, Ann Ewing reports.

➤ DEEP PURPLE is created by chemicals in the eye whenever light strikes the eye.

The deep purple lasts only a millionth of a second but it is the triggering mechanism in a chain of events by which you see.

The discovery was made during fundamental studies on vision by Dr. Toru Yoshizawa, now at Harvard University. The experiments were conducted at temperatures of 330 degrees below zero Fahrenheit, where all chemical reactions are considerably slowed down and they can therefore be studied more easily.

The deep purple substance is so far named only "pre-lumi-rhodopsin." Its discovery was a sidelight to three important advances in the understanding of how humans see reported to the Optical Society of America meeting in Washington, D. C.

The advances were explained by Drs. H. Fernandez-Moran of Massachusetts Institute of Technology, Jerome Wolken of the University of Pittsburgh Medical School, George Wald of Harvard University's biological laboratories and Dr. Werner Noell of the University of Buffalo.

The advances are:

Discovery that the eye has a special kind of pumping mechanism that makes the fluids surrounding its cells enriched in potassium.

Finding that there are visible particles made up of perhaps only 50 molecules on one part of the eye's pigment cells.

Discovering that the molecules in the eye's cells are all lined up in the same fashion, just as the molecules in crystals are aligned.

Dr. Noell said that he and his co-workers, Drs. Donald Crapper and Charles Paganelli, found that the relative amounts of sodium and potassium in eye fluids are not the same as in other cells. Previously, scientists believed that cells had a high potassium content on the inside, and a high sodium and low potassium in the fluid surrounding the cells.

However, in the case of the eye cells known as rods, which give night vision, the surrounding fluids have a high potassium outside. Since the potassium is in higher concentration than in the blood going to the eye, the eye must have a special pumping mechanism to enrich it.

Discovery of the crystalline-like structure and identification of clumps of molecules within the eye's cells came from studies with the electron microscope, which gives great magnification.

The molecular clumps, or particles, Dr. Fernandez-Moran said, may contain the visual pigments. The particles now seen are about one four-millionth of an inch in diameter, and each particle contains about 50 molecules. Since there are about 35,000,000 particles in a rod, there are about 1,750 million molecules in a rod.

Discovery of the highly organized, crystal-like structure of rods and cones offers the possibility of some day building a computer-like system, or model, that would be a close approach to the living eye. The crystal-like structure has the same dimensions as molecules, and sticks out from the cell, although attached to it.

Dr. Wald pointed out that it is known the rods are triggered by one quantum of light, which is the "absolute physical limit of sensitivity," since a light quantum is the smallest quantity. The question still to be solved is exactly how the light is turned into a nervous excitation that is transmitted to the brain.

He said that none of the mechanisms of excitation, whether of nerves, muscles or sense organs, were really understood. He likened the action of one quantum of light to pulling the trigger on a loaded gun. Turning rhodopsin into pre-lumi-rhodopsin is pulling a trigger that ends in vision.

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OPTICS

Light Bounced Off Moon

➤ A SPECTACULAR ruby red needle of light is being bounced off the moon by scientists at the University of Michigan.

The experiment is to develop techniques for bouncing tight light beams from a satellite, then comparing the speed of light with the speed of extremely short radio waves bounced from a satellite at the same time.

The Michigan experiment was reported to the Optical Society of America in Washington, D. C., by Dr. Peter A. Franken. The needle of bright red light is produced by an optical maser, a device that concentrates light several million times more than a flashlight beam.

An optical maser is also called a laser, an acronym for Light Amplification by Stimulated Emission of Radiation. "Maser" is pronounced somewhat like "amaze," which it does.

The ruby laser may also be used to try to achieve an extremely brief thermonuclear reaction, although chances of success for this are slight. Dr. Franken also reported that the laser could be used as a tool for analytical chemistry and in eye surgery.

The optical maser amplifies and sharpens weak light waves to produce a very narrow, intense beam of a single, extremely pure color. When ruby is used for the maser action, the light output is red. The beam aimed at the moon through the University of Michigan's 37-inch telescope contains billions upon billions of photons, or light quanta, the basic units of light. The beam, which lasts only about a thousandth of a second, is strong enough to be visible to

WILL SCAN ARCTIC OCEAN—The 47G-2A helicopter, made by Bell Helicopter Company, Fort Worth, Tex., demonstrates in the ice-coated water of St. Lawrence River how hydrographic sounding gear will be used for charting the ocean floor in arctic regions.