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.

• Science News Letter, 81:195 March 31, 1962

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.

the naked eye some 20,000,000 miles away.

However, the light bounced from the moon and returned back to the moon is expected to be only about 30 photons, which can be counted one by one using a sensitive photomultiplier. No return has been detected as yet, but bad weather conditions have hampered completing the experiment, Dr. Franken said.

The beam upon reaching the moon is so narrow that it covers only one-sixtieth of the lunar surface, about the size of some craters. It is aimed at Aristarchus because that crater has a high reflectivity, about equal to that of white sand.

Dr. Franken said that the laser beam could easily be seen by an astronaut if sent in his direction. However, an astronaut could also easily spot the flash lamp used to prime the maser.

Neither flash would be likely to blind the astronaut, although the ruby red laser light might have a temporary effect. Dr. Franken said he doubted that lasers would be used an as anti-personnel weapon, or so-called death ray, noting that there are more efficient ways of killing persons. Use of the sun instead of flash lamps to prime a laser is under development at American Optical Company, Southbridge, Mass., George R. Simpson reported to the meeting. The aim is to develop a maser that could be operated continuously by focusing the sun's light rays from a parabolic mirror 44 inches across through glass and sapphire lenses to concentrate them to one-eighth of an inch before introducing them into the maser.

The system would eventually be used to communicate between earth satellites, or between satellites and earth or the moon and earth if weather permitted. Mr. Simpson noted that the maser theoretically has a capacity to carry a million times more information than radio waves.

However, the problem of how to code the informtaion so that it can be carried by light waves is under only preliminary studies, and some scientists are pessimistic that this can ever be done.

• Science News Letter, 81:195 March 31, 1962

PHYSIOLOGY

A-Bomb Injuries Imitated

➤ AN OPTICAL DEVICE that gives off a very intense beam of extremely pure, ruby red light is being used to simulate in the laboratory the kinds of eye burns received when looking at A-bomb or hydrogen bomb explosions.

The flash blindness resulting from directly viewing such bomb bursts can also be caused by the intense light beam from a laser, or optical maser. One reason for studying the damage caused by the tight light beam from an optical maser is to find some way to help protect the many researchers now experimenting with lasers.

Experiments performed up to now, mostly with animals, indicate the two flash sources cause the same kind of damage. However, because the laser light is concentrated at one wavelength whereas the light from bomb bursts spreads out over the entire visible spectrum, some differences may be discovered in the future.

Two research physicists have already suffered minor eye damage when they accidentally exposed themselves to a laser beam, Dr. Milton M. Zaret of New York University Medical Center, New York, said. But when properly controlled, the intense light source has many possible healing applications in medicine, he reported to the Optical Society of America meeting in Washington, D. C.

With his co-workers, Drs. Harris Ripps, Irwin M. Siegel and Goodwin M. Breinin, he has been studying the biological effects of optical masers. The scientists have found that the biological effects, as with other forms of light radiation, are proportional to the amount of energy absorbed. When sufficient amounts are absorbed, the tissue is burned or coagulated.

Potential medical applications of this effect include burning out lesions, re-attaching retinas and obliterating abnormal blood vessels in the eye to prevent damage. Xenon light from a steady arc is now used to produce photocoagulation. Laser light considerably reduces the amount of time required to produce a coagulation and considerably increases the accuracy of focusing.

When laser light is combined with fiber optics, then body cavities not easily reached now can be examined and treated. Ulcers, for instance, could be vulcanized away. The combination should also prove valuable for diagnosis of many kinds of diseases of inner organs.

• Science News Letter, 81:196 March 31, 1962

ARCHAEOLOGY

Let Abu Simbel Drown, NYU Professor Says

➤ A FAMED, ancient Egyptian temple threatened with inundation by the Nile when the Aswan dam is completed should be left alone, a university professor believes.

The 24-century-old temple of Ramses II at Abu Simbel is now the subject of a multi-million-dollar drive to preserve the temple by jacking it above the waters backed up by the high dam.

"Let the Nile have it, . . . another sacrifice on the altar of progress," Dr. Jotham Johnson, head of the Department of Classics of New York University, states. Abu Simbel has no secrets of the past left to be probed by the scholars of the future.

The temple was built by Ramses II, a king of Egypt, who, like most important people, wanted to leave a record of his claim. It was cut into the red sandstone cliff, with a great opening leading to nine engraved and painted chambers. Four huge figures, 67 feet high, guard the entrance.

But the temple and its many treasures have been repeatedly "measured, drawn, surveyed, painted, described, photographed, copied, illustrated, published, and published again," Dr. Johnson pointed out.

"It is not possible to learn from further study of it any nugget of information not now known," he states in the New York University Alumni News.

The money being spent to rescue the temple, Dr. Johnson said, should be used for other archaeological excavations. With the interest on the money "it would be possible to finance . . . 100 new excavations, at 100 new archaeological sites, each one yielding new historical materials."

• Science News Letter, 81:196 March 31, 1962

Novas Del Mense in Interlingua will appear in next issue of SCIENCE NEWS LETTER.

SCIENCE NEWS LETTER

VOL. 81 MARCH 31, 1962 NO. 13

Edited by WATSON DAVIS

The Weekly Summary of Current Science, published every Saturday by SCIENCE SERVICE, Inc., 1719 N. St., N.W., Washington 6, D. C., NOrth 7-2255. Cable Address: SCIENSERVC.

Subscription rates: 1 yr., $5.50; 2 yrs., $10.00; 3 yrs., $14.50; ten or more copies in one package to one address, 7½ cents per copy per week; single copy, 15 cents, more than six months old, 25 cents. No charge for foreign postage.

Change of address: Three weeks notice is required. When ordering a change please state exactly how magazine is addressed. Your new address should include postal zone number if you have one.

Printed in U.S.A. Second class postage paid at Washington, D. C. Established in mimeograph form March 13, 1922. Title registered as trademark, U. S. and Canadian Patent Offices. Indexed in Reader's Guide to Periodical Literature, Abridged Guide, and the Engineering Index. Member of Audit Bureau of Circulation.

SCIENCE SERVICE

The Institution for the Popularization of Science organized 1921 as a non-profit corporation.

Board of Trustees—Nominated by the American Association for the Advancement of Science: William W. Rubey, University of California at Los Angeles; Wallace R. Brode; Douglas Whitaker, Rockefeller Institute for Medical Research. Nominated by the National Academy of Sciences: Harlow Shapley, Harvard College Observatory; Philip Bard, Johns Hopkins University; Henry Allen Moe, John Simon Guggenheim Memorial Foundation. Nominated by the National Research Council: Leonard Carmichael, Smithsonian Institution; John R. Dunning, Columbia University; Benjamin H. Willier, Johns Hopkins University. Nominated by the Journalistic Profession: Michael J. Ogden, Providence Journal-Bulletin; O. W. Riegel, Washington and Lee University; Ralph B. Curry, Flint Journal. Nominated by the Scripps Estate: Edward J. Meeman, Memphis Press-Scimitar; Frank Ford, Washington, D. C.; Charles E. Scripps, Cincinnati, Ohio.

Officers—President, Leonard Carmichael; Vice President and Chairman of Executive Committee, Charles E. Scripps; Treasurer: Wallace R. Brode; Secretary: Watson Davis.

Staff—Director: Watson Davis, Assistant Director: Dorothy Schriver. Writers: Ann Ewing, Faye Marley, Vincent Marteka, Tove Neville, William Small, Marjorie Van de Water, Judy Viorst. Science Youth Division: Joseph H. Kraus, Leslie Watkins. Photography: Fremont Davis. Production: Priscilla Howe, Marcia Nelson. Syndicate Sales: Hallie Jenkins. Conferences: Jane Marye. Librarian: Margit Friedrich. Interlingua Division in New York: Alexander Gode, 80 E. 11th St., GRamercy 3-5410. Advertising Manager: Fred A. Moulton, MEtropolitan 8-2562.