Tracking chemicals in the brain

Neurotransmitters — chemicals that help transmit electrical messages between nerves — appear to play crucial roles in various mental and behavioral diseases. Neuroscientists are eager to measure the levels of these chemicals in the brains of living subjects in order to learn more about which neurotransmitters correlate with which diseases and how drugs used to treat these diseases might work at the molecular level.

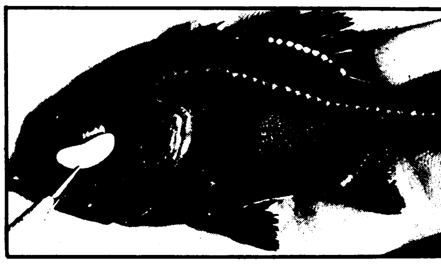
But how might researchers study neurotransmitters in the brains of living humans? They can't pry people's brains open to see what neurotransmitters are up to. And if they radioactively labeled a neurotransmitter and injected it into an individual's bloodstream in hopes that it might end up in the brain for study, it is unlikely that the chemical would slip past the blood-brain barrier — a network of blood vessels that help to keep large chemicals in the blood out of the brain.

One way around these obstacles now appears to have been found by E. S. Garnett and his nuclear medicine team at McMaster University Medical Center in Hamilton, Ontario. Garnett and his colleagues report, in the January Proceedings of the National Academy of Sciences, that they have devised a technique that can measure the levels of neurotransmitters in the brain of a living subject simply, safely and externally.

The technique calls for synthesizing a radioactive copy of a neurotransmitter precursor to serve as a marker for the native precursor. The radioactive precursor is injected into the bloodstream of a subject. Because the precursor is smaller than a neurotransmitter, it is able to bypass the blood-brain barrier and enter the brain. Radioactivity-sensitive probes placed externally over the head of the subject detect the presence of the radioactive precursor as it enters the brain and measure how much is present as it is converted to a neurotransmitter, stored in nerves, degraded or acted upon by various drugs.

So far the technique has only been tried on baboons and has only been used to track the intracerebral fate of dopamine, a neurotransmitter implicated in schizophrenia and depression. But the researchers are confident that it can also be used effectively and safely on human subjects, and that it can also measure brain levels of serotonin, noradrenalin and some other neurotransmitters as well. □

Flashlight fish's Atlantic cousin



Dave Powell, Steinhart Aquarium

Shy fish with bright headlight.

"Only madmen and ichthyologists would venture into the fishes' world at midnight without lights," says John E. McCosker, director of San Francisco's Steinhart Aquarium. But he and colleagues were well-rewarded for doing just that. They captured living specimens of an elusive luminescent fish during several nights of diving off Grand Cayman Island in the Caribbean. In 1907 a single dead specimen of *Kryptophanaron alfredi,* a relative to the Indian Ocean flashlight fish (SN: 2/18/78, p. 106), was found off the coast of Jamaica. But that specimen was lost the next year, and *K. alfredi* was not seen again for 70 years.

In January, McCosker was notified that *K. alfredi* had resurfaced. He hurriedly organized an expedition that included Richard Rosenblatt and Kenneth H. Nealson from Scripps Institution of Oceanography in La Jolla, Calif., and James G. Morin from the University of California in Los Angeles. The Atlantic flashlight fish lives in more than 500 feet of water and only enters lesser depths to feed during darkness. Its light organs, which may be seen by divers as far as 50 feet away, contain glowing bacteria and can be covered with a lid. Nealson plans to study the relationship between the fish and its bacteria. Morin will study how the fish uses its lights. The remaining specimens are on display at the Steinhart Aquarium. □

Sickle cell anemia: Test tube treatment

The bases are loaded with potential treatments for sickle cell anemia (SN: 2/16/74, p. 104, 1/10/76, p. 22), but no one has driven one home as a drug for humans that prevents sickling without prohibitive toxic effects. Now Lester Packer of Lawrence Berkeley Laboratory announces what may be an important base hit. A group of chemicals called monofunctional imidoesters have been shown to prevent sickling of human blood in the test tube. By combining these chemicals with a new method of administration, Packer thinks there is a good chance this technique will score as a successful human treatment.

When a red blood cell carrying abnormal hemoglobin enters an area of the body low in oxygen, it assumes a rigid crescent shape that can tangle with other sickled cells and block blood vessels, resulting in a painful sickling crisis. The imidoesters, agents commonly used in protein chemistry, prevent sickling by attaching as a bulky group to the abnormal hemoglobin molecules in cells from sickle cell anemia victims. That addition inhibits the reaction responsible for the periodic crises.

Packer has done some toxicity tests in animals and has found the monofunctional imidoesters to be relatively nontoxic. Test tube-treated red blood cells retain most of their normal properties, Packer says. Earlier work in Packer's laboratory examined a bifunctional imidoester that could crosslink hemoglobin molecules (SN: 3/1/75, p. 136). That chemical was more toxic. Packer has patented use of monofunctional imidoesters in sickle cell anemia treatment.

The method of drug administration, which Packer is working on with David W. Deamer of the University of California at Davis, involves trapping impermeable imidoesters in red blood cells. The researchers plan to put the drug first into lipid vesicles and then fuse those vesicles with red blood cells. This delivery procedure will be more specific than adding the permeable imidoesters to blood, and thus reduce toxicity. Packer and Deamer hope to apply that strategy for clinical use. □

Cancer-radiation link in shipyard workers

A study conducted for The Boston Globe and reported in the Globe Feb. 19 found an increased incidence of cancers, including leukemia, among workers exposed to low levels of radiation at the Portsmouth Naval Shipyard in Maine. Deaths from cancers were reportedly twice the national average; deaths from cancer of the lymph glands were 125 percent higher than the national rate; and deaths from leukemia were 450 percent higher than the national rate.

Admiral Hyman G. Rickover, head of the Navy's nuclear program, told a joint session of the House and Senate health subcommittees Tuesday that the Navy is unwilling to accept these findings without review. However, he said the Navy has been working with the Energy Department since December on plans to study naval-shipyard workers exposed to radiation. He said preliminary findings of a possible link between low-level radiation and cancer among Hanford, Wash., workers (SN: 2/25/78, p. 117) were the catalyst, but that the Globe investigation was also influential. Rickover said fully documented employee records of Portsmouth employees showed they averaged career exposures of only 2.5 rem with only one or two exceptions—well below the five rem per year limit. The House subcommittee has requested that the Center for Disease Control in Atlanta also study the Portsmouth workers. □