ENVIRONMENT

Powerful mutagen identified

The laboratory chemical diethylnitrosourea, or ENU, is the most potent mutagen ever encountered in mice, according to a report in the November PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES by researchers at Oak Ridge National Laboratory. Perhaps the most potent plant mutagen also, this simple hydrocarbon-based compound is seldom encountered outside the laboratory.

In ORNL's tests, mice injected with ENU (at doses of 250 milligrams per kilogram of body weight) initially became infertile for a period lasting 13 weeks. When fertility returned, mutations appeared in their offspring at a rate 87 times that occurring naturally, and at a rate five times that for mice irradiated with the most mutagenic dose of X-rays known.

William Russell, an ORNL consultant and chief investigator in this project, said the most useful aspect of the finding is that ENU becomes a "model mutagen" for mice against which the effects of all others can be compared. His team is now trying to identify mechanisms by which ENU triggers mutations.

Bacterial desulfurization of oil

A University of Georgia microbiologist has found a way to harness a team of bacteria for the removal of up to 95 percent of the organic sulfur found in crude oil. William Finnerty says the key to his system lies in "pregrowing" the pair of bacteria — *acetobacter* and *micrococcacae* — together before adding them to the oil. Enzymes, which form while the bacteria grow, later attack sulfur covalently bonded to aromatic compounds found in crude oil — such as dibenzothiophene — converting them into such water-soluble sulfur-containing molecules as dihydroxydibenzothiophene.

In laboratory tests, Finnerty simply adds the cultured bacteria to a batch of crude oil. When he "washes" the oil 48 hours later, the sulfur compounds leach into the water, which is then removed from the oil. Finnerty says he finds no evidence that the process alters the quality of oil. And preliminary studies suggest the room-temperature technique should cost much less than processes currently used to chemically desulfurize oil.

Finnerty, who has been collaborating with the developer of a similar project at the University of Göttingen in Germany, is seeking funds from the Energy Department to develop his process for the commercial market. To optimize the system, Finnerty envisions bonding the bacteria to support resins and passing the oil across them in a steady continuous flow.

Banking in pollution

The world's first environmental-specimen bank opened this month at the National Bureau of Standards in Gaithersburg, Md. Over the next four years, the $1.5 million experimental program will develop a "historic" file of specimens in special deep freezers. Scientists hope to be able to analyze environmental trends by comparing concentrations of chemicals in identical samples taken years apart. Sponsored jointly by the U.S. Environmental Protection Agency and its counterpart in West Germany, the program will test the feasibility and advisability of developing a larger national program.

Specimens fall into four categories: human livers, marine bivalves (such as oysters), food grains, and either lichens (which filter the air and therefore provide a key to atmospheric pollutants) or particulates caught in air filters. Beginning with livers this year, the bank adds a new collection category each year. In its fifth year, NBS will evaluate how well the banking concept lives up to its goal and whether specimen-preservation techniques are adequate for storing materials from five to 50 years.

CHEMISTRY

Electrons as chemical elements

Electrons have no place, yet, on the periodic table of the elements, but recent research has demonstrated that they do have a chemistry of their own. James L. Dye and colleagues at Michigan State University have assembled an unusual salt in which an electron, rather than chloride for instance, supplies the negative charge. The novel salts, which they call "electrides," are built around alkali metal ions — lithium, postassium and cesium cations have been used so far. In the first step of electride synthesis, positively charged metal ions are trapped within large organic molecules called cryptate complexes. "With an appropriate solvent, such as liquid ammonia, we can have solvated electrons on the outside," Dye says in the Dec. 10 CHEMICAL AND ENGINEERING NEWS. "When we get rid of the solvent, the electron has to be somewhere." So it serves as an anion to the alkali metal-cryptate complex.

Lithium electride has been studied most extensively. It has two forms, both of which transmit intense blue light. At temperatures above −45° C (−49° F) the electrons of the electride are delocalized and the material acts like a metal. Below −48° C, the electrons become localized and the electride's conductivity is abruptly reduced. One difficulty in experiments is the material's reactivity; the electrons act as a reducing agent at temperatures above −73° C. Another problem is that investigators have been unable to crystallize the electride. So far, reduction in the volume of a sample, instead of giving crystals, yields a "kind of mud on the vessel walls," Dye says. The properties of electrides so far described are similar to those of another relatively new type of material. Expanded metals, which are made with solvents such as ammonia rather than with cryptate complexes, also seem to use simple electrons as anions.

Color vision: A matter of charge

Each light-sensitive cell of the human eye responds to a particular wavelength of light. Some sense red, some green and others blue. Yet the same chemical component is involved in detecting each hue. A molecule called 11-*cis*-retinal absorbs light in every receptor cell, but the large protein molecule to which the retinal is bound determines what wavelength of light it best absorbs. Now Koji Nakanishi of Columbia University and Barry Honig of the University of Illinois report just how the protein influences retinal's light absorption. Precisely located negative charges, probably on the amino acids of the proteins, are responsible for color discrimination.

This model for color vision is based on experiments with chemically synthesized molecules resembling retinal. Through these syntheses the scientists can control the charge and geometry of light-absorbing molecules. In the Nov. 7 JOURNAL OF THE AMERICAN CHEMICAL SOCIETY, the investigators report shifts in light absorption characteristics when they change the charge at sites about 3 Angstroms from the bonds involved in light absorption.

The synthetic analogs of retinal can combine effectively with retinal-binding proteins of the eye. In an experiment described in the Nov. 12 CHEMICAL AND ENGINEERING NEWS, one of the retinal analogs was injected into rats deprived of vitamin A, the dietary source of retinal. Although the analog occupied the correct site in light-sensitive cells, the animals were blind. Reintroduction of retinal returned the rats' vision. Nakanishi is now attempting to make a retinal analog that would help color-blind persons perceive color. He also hopes to introduce into animals analogs that absorb light in the infrared region of the spectrum. He is interested in learning how an animal's brain would process such information about a part of the spectrum it normally cannot detect.