Chemistry

From our reporter at the annual meeting of the American Chemical Society in Atlantic City

Cleaning the blood with Amberlite

When a person suffering from a drug overdose is rushed to the hospital, part of the treatment is removal of as much of the drug as possible from the patient's bloodstream. This has been accomplished in the past with a hemodialysis (artificial kidney) machine, but the results are often less than satisfactory. The machines remove poisons slowly, and thus some comatose patients are not revived quickly.

A new approach has been designed by Jerry L. Rosenbaum of the Albert Einstein Medical Center in Philadelphia that has proven faster and more effective than hemodialysis in tests. Blood is circulated through a 10-inch column packed with a resin called Amberlite XAD-2. Fat-soluble drugs such as barbiturates, Doriden or Placidyl adhere to the resin and are removed quickly and almost completely from the bloodstream. The column is primed with a saline and sugar solution and no blood transfusions are necessary, eliminating the threat of contamination.

Rosenbaum has tested the column extensively on laboratory animals and human overdose patients. A drug firm is preparing the columns for distribution to researchers.

Arsenic and environment: Good score

Arsenic, a potent poison, came under suspicion on the coattails of mercury. Although its use has declined, it served for decades as a weed killer and plant defoliant, and many researchers wondered whether it, like mercury, could cause pervasive and damaging environmental effects. The results are still coming in, but new findings presented to the ACS pesticide chemistry division give arsenic a fairly good score —at least compared with mercury.

Probably the best news is that arsenic residues from soil and water do not biomagnify in the food chain. Edwin A. Woolson of the U.S. Department of Agriculture's research service in Beltsville, Md., reports that although arsenic is accumulated by plants and animals to a small extent, it is not magnified (found in increasing concentrations) as one moves up the food chain.

One of arsenic's physical properties has led to some worry—and research. Arsenic binds tightly to soil particles in the root zone of plants and will not leach to lower levels. This has led to concern that in fields where inorganic arsenic has been used over long periods of time, poison might be seeping into the roots of vegetables in harmful quantities. Leo N. Walsh and D. R. Keeney of the University of Wisconsin at Madison report that arsenic uptake was "not a problem until so much arsenic was added [to test fields] that yields suffered." Only after the equivalent of 20 years' use was applied did vegetables take up harmful amounts of arsenic. Samples of Wisconsin potato fields with a history of arsenic application showed no harmful accumulation.

One less optimistic note on the environmental impact of arsenic is a report on the ability of certain soil bacteria and fungi to "volatilize" inorganic arsenic (change it into dangerous gases). A potentially hazardous condition can occur in waste treatment plants if bacteria act on arsenic in waste water to produce poisonous gases within the plant. This accumulation must be monitored and released, Cornell University agronomist Donald P. Cox reports.

Noting the recent evidence on the carcinogenicity of inorganic arsenic (SN: 9/7/74, p. 149), the researchers said the cancer risks from environmental residues are negligible.

New organic metal fabricated

About two years ago a crystalline organic solid that conducts electricity like a metal was discovered. Called (TTF-TCNQ), it has created much excitement. A new picture of conductivity in relation to structure has begun to form, not to mention practical advantages organic metals could provide for solar energy conversion and solid state batteries, among others.

IBM chemists Edward M. Engler and Vishnu V. Patel now report the fabrication of a fraternal compound that is twice as conductive as (TTF-TCNQ) but retains the same structure with the substitution of selenium for sulfur. The new compound, (TSeF-TCNQ), is important, Engler says, because it provides new information on conductivity and structure and because it can be alloyed with (TTF-TCNQ) to yield "solid solutions." These will have conductive properties that are variable with different concentrations.

A prodrug for treating glaucoma

An estimated two percent of the world's population over 40 years old has glaucoma. In the United States alone, 50,000 persons are irreparably blind due to this disease. When it occurs, pressure builds up within the eye due to its inability to drain away enough of its natural fluids. The result is often loss of visual acuity, then blindness.

Glaucoma patients are usually given drugs that are chemically similar to the human hormone epinephrine. These help to relieve the pressure but cause a number of unwanted side effects, including cardiac stimulation and headaches. Also, their bioavailability is poor—a very large dose is required to achieve therapeutic effects because they will not easily pass through the cornea into the eye's interior.

Working with a class of compounds called "prodrugs," David A. McClure and his colleagues at Allergan Pharmaceuticals in Irvine, Calif., have developed an experimental drug that promises to be much more effective than existing drugs in the treatment of glaucoma. A prodrug, first of all, is a chemical that is converted into an active drug within the body. McClure's prodrug breaks down into epinephrine within the body, but is more efficiently delivered to the interior of the eye than whole drugs because it passes through the cornea before conversion. It works in small doses and does not produce side effects. McClure is hopeful that after more testing, the drug can be marketed.

Controlling fat in the blood

Speaking of new drugs, two biochemists from Pfizer, Inc., Groton, Conn., reported another promising one. Gerald F. Holland and Joseph N. Periera reported the development of "tibric acid," a drug that lowers the level of fats in the bloodstream. These fats are suspected of causing arteriosclerosis, the principal cause of the circulatory and heart diseases that account for half of American deaths each year.

Tibric acid, a sulfamylbenzoic acid, blocks the synthesis in the liver of the protein-fat complex (lipoprotein) that carries cholesterol and triglycerides to the arteries and veins. These fats alone cannot dissolve in the blood and be carried through the bloodstream, and in the presence of regulated doses of tibric acid, fewer lipoproteins are released from the liver.

Pfizer will apply for a drug license soon, Holland says, and hopes to market the drug next year.