chemistry

From our reporter at the meeting of the American Chemical Society in Boston

Cancer in the city air

Cigarette smokers living in urban areas have a higher incidence of cancer than those in rural areas. Smokers who migrate from urban to rural areas continue to have a higher incidence of cancer. City life, therefore, is related to cancer, and scientists have known for at least 30 years that urban air pollutants are a causal factor in cancer. From animal experiments they have assumed that 3,4-benzpyrene (a product of the combustion of organic matter) is the major carcinogen.

Samuel S. Epstein of Case Western Reserve University in Cleveland says that compound may not be the main culprit. He reported that fractions of air pollutant extracts, free of benzpyrene, were injected into mice and caused cancers. The chemistry of these fractions is not completely defined because they occur in relatively small quantities, but Epstein says they may be as carcinogenic as those containing benzpyrene. The most carcinogenic fraction, he says, contains di-alkylated benz(c)acridines (products of the combustion of fossil fuels).

Identifying these carcinogens is important, but, says Epstein, "we already know that city air pollutants can cause cancer. There is no use waiting for more evidence." He advocates rigid pollution standards, low sulfur fuels and more efficient methods of combustion.

Different faces of the moon

Because the moon's rotational period is equal to its orbital period, the same side is always seen from the earth. Photographs of the back side of the moon, however, show that its surface and crust are different from the earth-facing side (SN: 9/18/71, p. 194). John A. Wood of the Smithsonian Astrophysical Observatory says this is because the moon is more heavily bombarded on its western edge and its earth-facing side.

A computer was programmed to fire imaginary projectiles, from all angles, into a model earth-moon system. Just as insects collect on the windshield of a moving car, planetesimals collect on the moon's leading or western edge as it moves in a counterclockwise orbit. Planetesimals strike the back side of the moon in a random pattern. But those that hit the side facing earth must first pass through the earth's gravitational field. This affects them and they tend to converge or focus on the earth-facing side of the moon. Peak bombardment would have occurred somewhat west of Oceanus Procellarum. "I suggest," says Wood, "that such a process may have thinned the crust beneath the present Oceanus Procellarum by 20 percent, which would account for observed differences in topography."

Toxic chemicals in food

Pesticides and preservatives account for many of the toxic chemicals in food. Hans L. Falk of the National Institute of Environmental Health Services in Research Triangle, N.C., notes that toxins also occur naturally in foods. Chemicals produced by fungi or by the defense mechanisms of vegetables account for many of them. Industry's answer to this problem has been to make food additives inert and nonmetabolizable. The feeling is that if it does not react, it is safe. Falk does not agree. The chemicals are stored in the body and can eventually become toxic, especially through synergistic effects. The answer, he says, is to have a widely varied diet, like the Chinese. This should minimize the intake of any one particular toxin.

Falk also emphasized that research must not concentrate on acute toxicity. Chronic toxicity is as much of a problem. A king's food taster, for example, would not die after one exposure to a mild contaminant. But it could kill the king and his taster after five years of exposure. Falk was instrumental in the banning of cyclamates and is presently attempting the same thing with saccharin. He predicts that it will soon be a prescription-only drug.

Biodegradable analogues of DDT

The major biochemical reaction of DDT is its conversion to DDE, a noninsecticidal but environmentally stable chemical that comprises the major portion of DDT-type pollution. The arylchlorine bonds of these substances make them an environmental hazard. They are stored in living tissue instead of being metabolized and eliminated from the body. Robert L. Metcalf of the University of Illinois at Urbana reported on attempts to produce biodegradable analogues of DDT that would not be stored and would not be fed up the ecological chain.

Reporting on synthesis and testing of several of these chemicals, Metcalf said a single biodegradable handle on one of the phenyl rings of the DDT-type molecule should provide a pathway for conversion to water-partitioning derivatives and consequent excretion in animals. One chemical in particular, 2-(p-methoxyphenyl)-2-(p-methylthiophenyl)-1,1,1,trichlorethane, was fed into a model ecosystem. It showed only trace concentrations in fish and demonstrated pronounced biodegradability.

Productive herbicides

Regrowth of forests can be accelerated with controlled-release herbicides that attack weeds and bushes that compete with trees for water and nutrients. G. G. Allan, C. S. Chopra and R. M. Wilkins of the University of Washington in Seattle reported that such a herbicide has been developed. It is allowed to link chemically to the bark of trees and is released slowly into the surrounding area. It was tested in a Washington State forest. Bush and weed levels were down threefold and the growth of seedlings was twice that of untreated seedlings.

Kidney machine membrane

A gelatin-like material, called a heparin hydrogel, has been developed that could reduce the danger of blood clotting in artificial kidney machines. It contains the natural anticoagulant drug heparin, and is called a hydrogel because it is 86 percent water. Used as a membrane, it allows fluid wastes to pass out of the blood but retains the larger protein molecules. Edward W. Merrill of the Massachusetts Institute of Technology says the material could possibly be used in artificial veins and other devices that come into contact with blood.