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Air Pollution Ingredients Are Suspect for Mutation

MANY OF THE effects of radiation on living cells can be mimicked in laboratory tests with derivatives of hydrogen peroxide and other chemically active forms of oxygen. During the last 25 years we have learned to take a critical view about radiation and have set increasingly suspicious standards for regulating our exposure to it. Were we quite logically consistent, we would be just as critical about peroxides.

Just the reverse has happened, however, and active forms of oxygen are an increasingly important part of our environment. Much of this rise in exposure is an unintended by-product of urban life. For example, much of the eye-irritating part of Los Angeles-type smog comes from ozone and PAN (peroxyacetyl nitrate), typical peroxide-like compounds.

PEROXIDES are, however, also used very widely

in industry. They were, for example, introduced for bleaching flour in the 1950s to take the place of nitrogen trichloride when this compound was found to generate a nerve poison that caused convulsions in dogs (not, in low doses, in other species). The peroxides received government approval as a food additive on the strength of a limited number of tests on rats and dogs. The required tests do not begin to reach the possibilities of genetic or fetal effects.

On the other hand, a much more searching inquiry has been demanded of radiation sterilization of foods, and after many years, approval is still withheld from this process. There is good theoretical reason to believe that the treatment of foodstuffs by radiation and peroxides will yield very similar kinds of chemical products, and it is preposterous that one and not the other should be subject to such critical scrutiny.

In testimony before Sen. Edmund S. Muskie's subcommittee on air pollution last year, Dr S. S. Epstein of the Children's Cancer Research Foundation summarized what was known of the mutational effects of air pollution—namely, almost nothing: "With the exception of ozone, which has been found to cause chromosome breaks, there are no published data . . . all the more surprising as certain fractions of air pollutant extracts are known to contain poorly defined compounds which are generally both carcinogenic and mutagenic."

It is painfully obvious that the air of many cities could not meet the quality standards, feeble as they are, for food additives. As far as I know, PAN has not been directly tested for mutational potency. My personal experience with organic peroxides, goes back, however, more

than 20 years, and they are indeed powerful mutagens according to a wide variety of tests. On elementary chemical principles, it would be incredible to expect PAN and ozone to behave otherwise.

OZONE IS a natural constituent of the atmosphere at high altitudes and supersonic passengers are likely to experience modest amounts of it unless special methods are used to exclude it from the cabin of the SST. It is also being advocated for the treatment of sewage, water supplies and even conditioned air with no thought of the kind of biological testing it ought to have.

Carefully used, ozone may be an advantageous oxidant for cleaning up dirty water, but before it is allowed to pervade the environment we must learn its potential hazards — and especially the kinds of less active, intermediate products it may form with a variety of substances in the environment and in the body.

Our main defense against peroxides is the enzyme catalase, which occurs in most tissues and causes the rapid

breakdown of hydrogen peroxide. (This causes the familiar foaming when "peroxide" is applied to a wound.) In normal people, it is supposed (we hope) to minimize the chance of genetic damage.

However, a few rare individuals are lacking in catalase from a genetic defect, and the enzyme may also be altered in certain diseases and under the influence of some drugs. Also, given the variety of reactive compounds formed by peroxides, not all of them equally quickly neutralized by catalase, we cannot afford to be complacent about these compounds as potential causes of mutations and cancer.