Fight ozone with a breath of vitamin E?

California researchers studying how the photochemical oxidants in smog affect lung tissue think they've stumbled onto a way of augmenting the body's natural defense against these pollutants: inhale a spray of vitamin E.

James Mead and colleagues at the University of California at Los Angeles' Laboratory of Biomedical and Environmental Sciences have been studying how certain air-pollution constituents in ozone, known as "free radicals," affect the body. Free radicals are molecules that either lack an electron or carry an extra one. To stabilize their chemical structure, free radicals will attempt to either steal an electron or donate one to an adjacent molecule, "and in doing so they destroy that neighboring molecule," Mead says.

As "spectacular" as it may sound, Mead says, "of all the damaging things we eat, drink and breathe, the one that's the most damaging is oxygen." That's why it's no coincidence, he says, that of the free radicals in smog, "almost all of them that are damaging contain oxygen."

Cells throughout the body have developed a number of natural defenses against oxidation — reactions in which electrons are transferred. Vitamin E, for example, is a premier "free-radical quencher," Mead points out, explaining that it sits within cell membranes, waiting to neutralize any oxidizing chemical that attempts to penetrate a cell.

In the past, hoping to boost the body's defenses, researchers have fed rats huge doses of the vitamin. It appears the regimen had some effect, Mead says, because untreated animals subsequently developed more lung damage from oxidants when exposed to chemicals representative of smog. "The trouble," Mead points out, "is that the more vitamin E you eat, the smaller the percentage of it that the body will absorb." As a result, he says, it is almost impossible to eat enough to develop protection from pollutants.

However, Judy Berliner, an electron microscopist in Mead's lab, recently hit upon what appears to be a more workable alternative—topical application of the vitamin with an aerosol. Working with rats, Berliner and Mead delivered the vitamin treatment to the lungs in a mineral-oil based aerosol. Afterwards, the animals were subjected to the primary oxidizing constitutents of smog at exposure levels of 0.4 parts per million in air for 30 minutes.

Viewed under an electron microscope, tissue taken from animals that had not received the vitamin treatment looked about as bad as tissue from the lungs of chronic smokers, Mead says. By contrast, tissue from the vitamin E treated animals "looked almost normal," he says.

Together with Nabil Elsayed, Mead has focused on identifying what types of chemical changes occur in smog-exposed tissue. Currently they are comparing samples taken from rats with and without a vitamin E treatment. The free radicals themselves are too short-lived to view in this study, Mead says, "so we isolate the final product of their reaction with tissue — peroxides, which are oxidizing agents; epoxides, small, three-membered rings containing oxygen that can be terrible carcinogens; and various damaged, cell membrane lipids." To date he has found that the vitamin's protection against serious oxidation can last five days.

Might this work with humans too? "I would think so," Mead says, "but practically speaking, we must first work out everything with the rat." As things look now, he says, that means human trials could begin within a year. *—J. Raloff*

Mauna Loa fire curtains

Mauna Loa, the world's largest active volcano, awakened from a nine year rest this week, sending fountains of lava as high as 600 feet into the sky. Scientists at the Hawaii Volcano Observatory had forecast an eruption within the next year or so (SN: 12/17/83, p.392) but the sensitive seismic instruments gave no short-term signal until two hours before fiery lava curtains burst out along 1500 feet of the volcano's northeast rift. By Wednesday lava was streaming in four separate flows, with an average output four to six times as great as that of Kilauea, an observatory spokesperson said. One lava river advancing more than one-half mile per hour was headed toward Hilo, the largest city on the island of Hawaii. □

New findings establish impact occurred

Signs that an asteroid or comet hit the earth 65 million years ago, leading many kinds of life to become extinct, are accruing mightily, but the final proof—a crater of the right size and age—may never be found. In the absence of such a "smoking gun" some scientists are analyzing what physical evidence there is, including the clay layer deposited at the 65-million-year-old Cretaceous-Tertiary boundary, and small glassy particles called spherules.

At the recent Lunar and Planetary Science meeting in Houston, two groups of researchers reported that the clay and the particles bear definite signs of the sudden shock caused by an impact with an extraterrestrial body.

Scientists long have wondered what happened at the boundary, but the inquiry took off in a new direction in 1980 when researchers from Lawrence Berkeley Laboratory and the University of California at Berkeley reported strangely high levels of the metal iridium in boundary clay from Italy. Iridium and other elements, such as platinum, osmium and gold, are concentrated in the earth's core but are rare on the surface. They are abundant in extraterrestrial bodies. The Berkeley scientists suggested that the clay layer formed after an asteroid or comet hit the earth, covering the world with dust and other debris. They predicted that anomalous iridium levels also would be found in boundary clays at other locations. So far more than 50 such anomalies have been reported. Geochemistry alone does not prove an impact, though, because little is known about how these elements behave on the earth's surface.

At the meeting, Bruce Bohor and colleagues from the United States Geological Survey in Denver described a sample of iridium-rich boundary clay from Brownie Butte in Montana. The clay is notable in part because it is only the second boundary clay sample known to have formed in a nonmarine location—a swamp or lake.

When researchers removed the clay from the rock and looked at the residue they saw quartz particles with crystals parallel to one another in a way peculiar to quartz grains found in impact craters or at nuclear explosion sites. Such planar features indicate shock and pressure, Bohor says, and are not due to tectonic events such as mountain-building. The researchers conclude that the quartz grains are particles of the target rock that was hit by the asteroid or meteorite, and sent to great height. They found that boundary clays from Denmark, Italy and Spain also contain the grains with planar features. Says Bohor: "This is direct mineralogical evidence that an impact did occur."

Another line of direct evidence for an impact was reported by Jan Smit and Frank Kyte of the University of California at Los Angeles. They examined spherules, small spherical particles less than one millimeter in diameter, rich in a silicate mineral called sanidine. Scientists assumed the spherules formed when droplets of earth, melted by the heat of an impact, cooled quickly and were strewn far afield. Over millions of years the original glass changed into sanidine.

The reseachers analyzed spherules from two locations. The particles contain magnetite, as well as iridium and other rare elements. They found that the magnetite has a "striking texture consisting of long, leafy strings of individual mineral grains which grew in a radiating fashion." This kind of magnetite forms only when high-temperature liquid crystallizes rapidly. The researchers say the crystals are the "first conclusive evidence that small droplets of very high temperature were involved in deposition of the boundary sediments." They also report that the magnetite grains may be the only material remaining from the impact that has not been altered since that long-ago collision with a foreign body. *—C. Simon*