BIOMEDICINE

Nonsmokers affected by tobacco smoke

You may be sharing someone else's cigarette — whether you like it or not. And the smoke does more than get in your eyes. James R. White and Herman F. Froeb of the University of California at San Diego report in the March 27 NEW ENGLAND JOURNAL OF MEDICINE that tobacco smoke in a room can reduce the airways in the lungs of nonsmokers in that room.

White and Froeb evaluated the long-term involuntary inhalation of tobacco smoke in the workplace and long-term voluntary smoking on more than 2,000 middle-aged subjects. They found that nonsmokers had a highly significant reduction in small-airways function compared with nonsmokers not exposed on a regular basis to tobacco smoke in the workplace. The reduction in small-airways function in the nonsmokers was similar to that seen in light smokers and smokers who did not inhale — but was not as severe as that seen in heavy smokers. Chronic exposure to tobacco smoke in the work environment significantly reduces small-airways function, the researchers conclude.

In an accompanying editorial, Claude Lenfant and Barbara Marzetta Liu of the National Heart, Lung and Blood Institute write: "The question must be asked whether White and Froeb's new evidence is sufficient to initiate new legislative actions that would further restrict smoking in public places. This is, of course, a difficult and delicate question. On the one hand, the evidence presented here is statistically sound and significant; on the other hand, there is no proof as yet that the reported reduction in airways function has any physiological . . . consequences."

X-rays make human cells cancerous

For years scientists have been able to convert animal cells to cancer cells with radiation. Not so with human cells. But now that feat has finally been achieved by Carmia Borek of Columbia University College of Physicians and Surgeons. She reported her findings last week at the American Cancer Society's 22nd Science Writers' Seminar in Daytona Beach, Fla.

Borek used human skin cells subjected in a glass dish to an X-ray dose of 400 rads — a dose that could be fatal to a person in a whole body exposure. To show that the normal cells had been made cancerous by radiation, she injected them into mice. The cells produced tumors.

Now that human cells can be made cancerous by X-rays, it will help scientists to better understand the risks associated with low doses of radiation and to evaluate compounds such as vitamin A (SN: 11/17/79, p. 341) that might protect against radiation damage.

A talking wheelchair

A "talking wheelchair" that gives speech to persons unable to communicate because of cerebral palsy, strokes and other disabilities has been developed by Carol A. Simpson and colleagues of Psycho-Linguistic Research Associates in Menlo Park, Calif., and Stanford University Medical Center.

The device consists of a wheelchair combined with a computerized word processor and speech synthesizer. A patient uses a keyboard, joystick or even a single switch to construct sentences on a video screen attached to the wheelchair and then directs the microprocessor to "speak" from a box containing the synthesizer. So far six patients with various degrees of speech disabilities have used the wheelchair on a trial basis with relative success. One of the patients used the wheelchair to "read" to her son for the first time.

The talking wheelchair has evolved from research by the National Aeronautics and Space Administration on synthesized speech displays for use in aircraft cockpits.

PHYSICAL SCIENCES

Dietrick E. Thomsen reports from New York at the meeting of the American Physical Society

Neutral to ionic phase change

One of the ways in which condensed matter (solids and liquids) can be classified is with the terms ionic or neutral. The distinction is whether the atoms or complexes of atoms that build a substance's structure exist within it as electrically charged ions or neutral species. The distinction leads to a difference in the forces that hold the molecule together and build up its crystal structure (if it has any). Many bulk physical effects depend on those forces.

Although there is a continuum ranging from extremely ionic (a substance like sodium chloride, for instance) to very neutral (many organics), scientists had thought that nothing crossed the boundary. Now substances that cross the boundary under pressure (or chilling) are reported by J.B. Torrance and eight others of the IBM Research Laboratory in San Jose. The first substance was the organic solid tetrathiafulvalene (TTF)-chloranil, which exists as a neutral under ordinary conditions, but changes to ionic under pressures greater than 8.5 kilobars or at temperatures lower than 83°K.

The change is readily visible as a switch from yellow to red color. The switch is reversible: The yellow returns when the extreme conditions are eased. Optical and structural studies indicate that the change is in fact a phase transition between a solid made of neutral TTF molecules and neutral chloranil molecules and one made of positively charged TTF ions and negatively charged chloranil. Since that discovery the group has found a number of other organics, all of them near the neutral-ionic boundary, that can be similarly pushed over the line. Searches for more substances and investigations of the causes of the transition and its effects on bulk properties are more than likely. "[The neutral-to-ionic transition] is expected to generate considerable research and increased understanding of these two fundamental states of matter," the researchers write.

Polyacetylene: Cold conductivity

Plastic sandwich wrap is found in a lot of refrigerators. Polyacetylene is a substance that looks and feels like sandwich wrap, and it is found in more than one laboratory refrigerator — not holding lunch, but having its electrical conductivity studied.

Polyacetylene has a relatively simple chemical structure: long chains of carbon atoms with hydrogen atoms attached at the side, formula $(CH)_x$. The fascinating thing about polyacetylene is that, unlike other plastics, it changes from a good electrical insulator to a good conductor when certain impurities or dopants are added. Its conductivity can change by factors of up to a trillion.

Polyacetylene has been subjected to all kinds of tests in attempts to find out why it does this. C.M. Gould, D.M. Bates and H.M. Bozler of the University of Southern California and A.J. Heeger and A.G. MacDiarmid of the University of Pennsylvania report subjecting polyacetylene doped with arsenic pentafluoride to a temperature of 4 millidegrees Kelvin (4/1,000 of a degree above absolute zero). They wanted to find out whether polyacetylene would become a superconductor at those temperatures. (It didn't.) They also wanted to test some theories of one-dimensional conductors. Polyacetylene's chain structure makes it a good approximation of a theoretical substance in which conduction electrons can travel along only one direction. (Metals are three-dimensional conductors.) But polyacetylene's conductivity did not follow the relationship to temperature prescribed by the one-dimensional theory. The lack of superconductivity may be due to an impurity rather than a property of polyacetylene, these investigators suggest, so both superconductivity and the question of one-dimensional theory are subject to further experiment.