

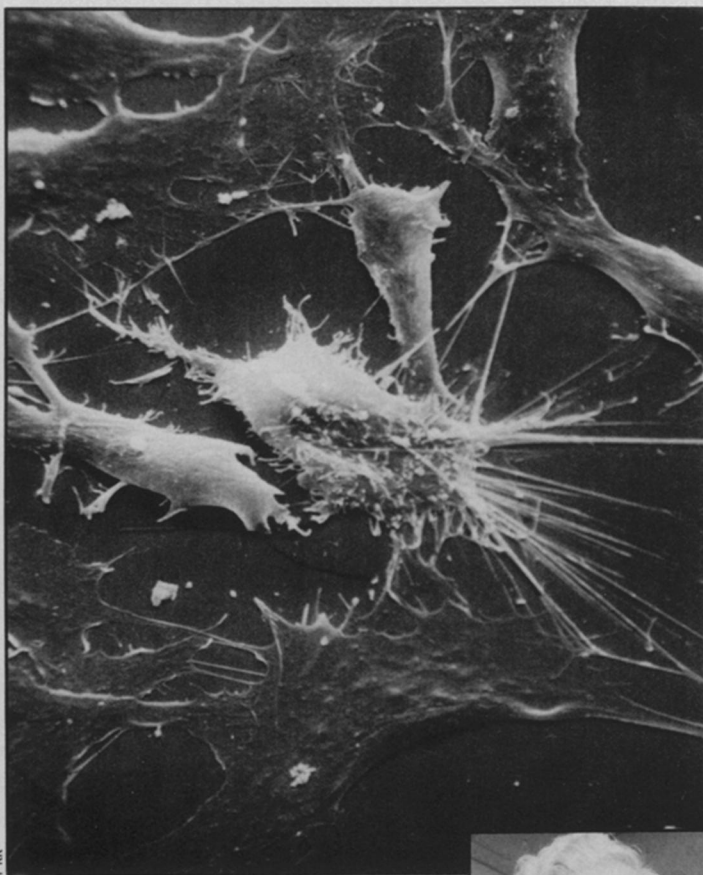
CHEMICAL CARCINOGENS: Part of the Problem

Even if all cancer-causing chemicals were removed from our air, food, drugs and workplaces, cancer would probably still be prevalent

BY JOAN AREHART-TREICHEL

Ever since scientists, during the early 1970s, failed to confirm viruses as widespread causes of human cancer, the hunt has been on for other possible culprits, notably chemicals introduced artificially into the environment. The public might conclude from this biomedical research pursuit that chemical carcinogens are swamping our air, food, drugs and work environments, and that if we could simply remove these compounds from our surroundings, the incidence of cancers would fall off dramatically. The situation, however, is much more complex than that, as was pointed out at a recent chemical carcinogen symposium in New York City. The symposium was organized by Harry Demopoulous, a pathologist at New York University Medical Center, and by other university scientists who felt that the public, as well as scientists, needed a better perspective on the subject.

Contrary to public opinion, for instance, most artificial chemicals in air, foods, drugs and workplaces are *not* carcinogenic. Charles Heidelberger of the University of Southern California Cancer Center in Los Angeles points out that only 15 to 20 percent of all chemicals tested are cancer-causing, and those compounds are assayed in the first place because they are suspect on the basis of structure or some other grounds. And even those chemicals that are carcinogenic under certain test conditions do not necessarily lead to human cancers. Potency and dose may explain this: Low exposure to low-potency carcinogens will yield few tumors. Another possible explanation is that cancer is a multi-step process, and if any one of the steps is missing, cancer will not result. Elizabeth C. Miller, professor of oncology at the University of Wisconsin in Madison, explains: First the chemical carcinogen has to enter a person's body. Then it has to be metabolized to a reactive electrophile, after which it can seek out electron-rich molecules such as DNA, RNA and proteins and bind to them. (The one thing that seems to unite chemical carcinogens is that, in their ultimate forms, they are all electron-deficient and thirsty for electrons [SN: 6/4/77, p. 362].) Then the bound chemical initiates cancer by some yet-to-be-discovered process (perhaps muta-

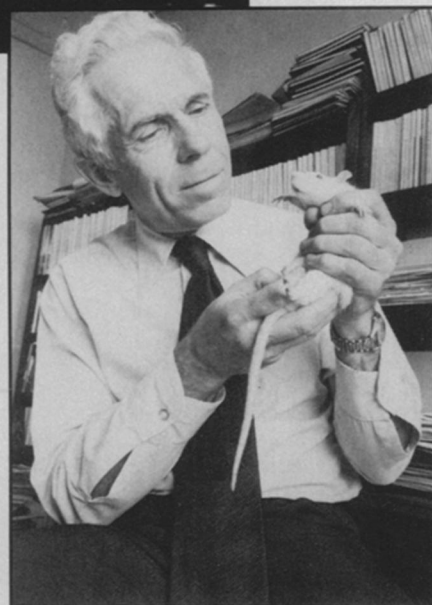


Normal cells that have been converted to cancerous cells by a polycyclic hydrocarbon, the same sort of carcinogen that occurs in cigarette smoke. Cigarette smoke and other lifestyle-imposed chemical carcinogens apparently contribute more to cancer risk than do industrially imposed carcinogens.

genesis). Finally, with the help of some promoter chemical, abnormal cell growth occurs. Cell division then could create more cells with abnormal cell growth, resulting in a tumor.

Still a third reason that chemical carcinogens in the human body do not necessarily lead to human cancers, Henry Pitot of the University of Wisconsin at Madison points out, is that enzymes, especially in the liver, can destroy many carcinogens.

Researchers at the symposium admitted that industrial carcinogens may be important causes of cancer for certain insulation workers, chemical workers, steel workers and some other select groups and should definitely be removed from the environment where they pose a threat, but it was emphasized that most cancers do not appear to be due to industrial carcinogens. Some chemical carcinogens, for instance, are known to be present in urban air. Yet as John Goldsmith of the California Department of Health Services in Berkeley reports, when adjustments for cigarette smoking are made, one finds that the highest death rates for lung cancer are not in large cities with lots of air pollution but in smaller cities with less of it. Thus chemical carcinogens in the air do not seem to be a



Carroll: Unsaturated fats can be more co-carcinogenic (in rats) than saturated fats.

major cause of lung cancer. Goldsmith also points out that if air pollution were a major cause of lung cancer, it would strike women as often as it does men. But it doesn't. Yet another indication that air pollution is not a significant source of human

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SCIENCE ON TV

SCIENCE NEWS prints the latest written word of scientific developments and noteworthy news. We've set this space aside to inform our readers of programs of scientific interest that are scheduled on television. Check your local listings for exact times.

- **"Skylab is Falling"** (CBS) Scheduled to be shown in late June or early July (depending on when the crippled space vehicle re-enters the atmosphere).

- July 19 (ABC) **"Infinite Horizons: Space After Apollo"** coincides with the tenth anniversary of the Apollo 11 landing on the moon and will forecast the future of the space program.

Benefits and hazards of continuing attempts to conquer space will be examined, based on the thoughts and projections of NASA scientists, academics, and "futurologists." Both live action and animation will be employed to present a review of past achievements and a look at future

... Carcinogens

cancers comes from the work of Bernard Wagner of Columbia University College of Physicians and Surgeons. He and his colleagues examined pets in the highly industrialized regions of New Jersey and found no excess cancers among them. Asserts Merrill Eisenbud of New York University Medical Center: "Contrary to popular belief, there is no cancer epidemic in the United States. The only type of cancer that is increasing significantly is lung cancer, and this is due overwhelmingly to cigarette smoking."

Cancer in the United States, in fact, appears to be due less to industrial chemicals than to lifestyle-imposed chemicals — those found in cigarettes, alcohol and high-fat diets. For instance, the fact that lung cancer has increased dramatically in recent years, making it the most common lethal cancer in the United States, can be largely attributed to the rapid growth of cigarette use during the 20th century, conference speakers concurred. Heavy use of alcohol may explain susceptibility to cancers of the esophagus and larynx, since these kinds of tumors have been linked with alcohol abuse combined with smoking. The preference for high-fat diets might explain high vulnerability to cancers of the breast, ovaries, prostate, intestine and rectum since, as Kenneth Carroll of the University of Western Ontario in London, Ontario, points out, a high-fat diet has been associated with these kinds of tumors, and a diet rich in unsaturated fats is even more co-carcinogenic, at least in rats, than a saturated fat diet is.

Roland Phillips of Loma Linda University in Loma Linda, Calif., further reports that Seventh Day Adventists who eat a low-fat diet have only 70 percent the risk

possibilities extending to the year 2010.

- July 23 (CBS) **"The Body Human: The Vital Connection,"** the award-winning exploration of the brain and nervous system, will be rebroadcast.

- NOVA (PBS) This month's programs — all reruns — are:

- July 5 **"The End of the Rainbow"** An examination of the potential of controlled nuclear fusion as an energy source. Attempts at harnessing the power that fires the sun and stars and creates the H-bomb's megaton blast have proved unsuccessful in the three decades that they have been underway. The program visits Princeton to discuss the potential of the tokamak (SN: 11/27/76, p. 340), and Livermore and Los Alamos to examine the use of laser machines such as SHIVA (SN: 6/16/79, p. 391).

- July 12 **"The Beersheva Experiment"** An examination of a program currently underway at the Ben-Gurion University Center for Health Sciences to train physicians to care for the patient as a person rather than a set of symptoms. The five-

other Americans have of developing numerous types of cancers.

From the data presented at the symposium, it would appear that indiscriminately banishing artificial chemical carcinogens from the environment is not the way to reduce cancer. It might be more effective to encourage people to alter their lifestyles so as to safeguard themselves against cancer-causing chemicals. Or in the words of Joseph Cimino, president of New York Medical College in Valhalla, N.Y., and past Commissioner of Health of New York City: "We have wasted time and money going after too many possible industrial chemical carcinogens, such as the artificial sweetener saccharin. We need to pay more attention to lifestyle."

So what can be done to reduce the risk of developing chemically caused cancers? Stop smoking, drink alcohol moderately and eat a low-fat diet as a starter.

Yet another safeguard against chemically caused cancers is to consume a high-fiber diet because, as David Kritchevsky of the Wistar Institute of Philadelphia explains, dietary fiber has been linked with low levels of colon cancer, and fiber also appears to interfere with the action of bacteria on chemical carcinogen precursors in the colon in such a way that the precursors do not become cancer-causing. A diet rich in vegetables, too, may help to protect against chemically caused cancers, since vegetarian diets have been linked with resistance to breast cancer, and vegetables of the cabbage family are known to contain certain chemicals called indoles that facilitate the degradation of some chemical carcinogens. Another possible protection against chemically induced tumors is the consumption of the recommended daily requirements of vi-

year-old center is part of a consortium that includes the predominant health agencies in the area. Their goal is to integrate the regional health care system with the training of the area's doctors.

July 19 **"Einstein"** A portrait that examines the myth and the reality of the man who revolutionized the world of science. Interviews and rarely seen archival footage are included to present a picture of Einstein the rebel and visionary.

July 26 **"The Keys of Paradise"** A look at the promise endorphins hold to revolutionize the treatment of pain. Manufactured in the brain, endorphins and their component enkephalins perform the same painkilling function as analgesics such as morphine. The discovery of the existence of endorphins (meaning "morphine within") was made almost by accident — during research into the mechanism of morphine addiction. Their discovery has begun to solve many physiological mysteries, such as why acupuncture works and how placebos can relieve symptoms, and it is hoped that the neuroleptics may someday be successful in treating depression and schizophrenia.

tamin A. As Michael Sporn of the National Cancer Institute in Bethesda, Md., stresses, persons deficient in vitamin A are known to be especially at risk for cancer. (Vitamin A should not be taken in large amounts, however, because it can be highly toxic to the liver when taken in excess.)

Precisely how much the usual nutritionally adequate daily doses of vitamin A protect against chemically induced tumors remains to be seen, but several years from now vitamin A may be replaced by a retinoid that has vitamin A's cancer-countering abilities but not its toxicity in large amounts. Retinoids, which are analogs of vitamin A, can reduce the activity of chemical carcinogens in mouse cells. Retinoids, in fact, have already been successfully used to prevent cancer in animals, and a nontoxic retinoid is being tested clinically for the first time as a cancer preventive, Sporn says. It is being given to patients who had noninvasive cancer of the bladder and who are at high risk of getting new bladder cancers. Scientists are also considering testing nontoxic retinoids on other persons particularly at risk for chemically caused cancers, notably asbestos workers and heavy smokers.

Whether nontoxic retinoids and other lifestyle measures discussed above can dramatically reduce cancer depends, of course, on how many cancers are caused by chemicals in general. And here medical researchers simply don't have the answer. In fact, as Wagner points out, "Just as cancer scientists become disenchanted with viruses as a cause of cancer, I predict they will eventually become disenchanted with chemicals, and by the mid 1980s will be caught up with another enchantment, say molecular genetics. Cancer is extremely complex." □