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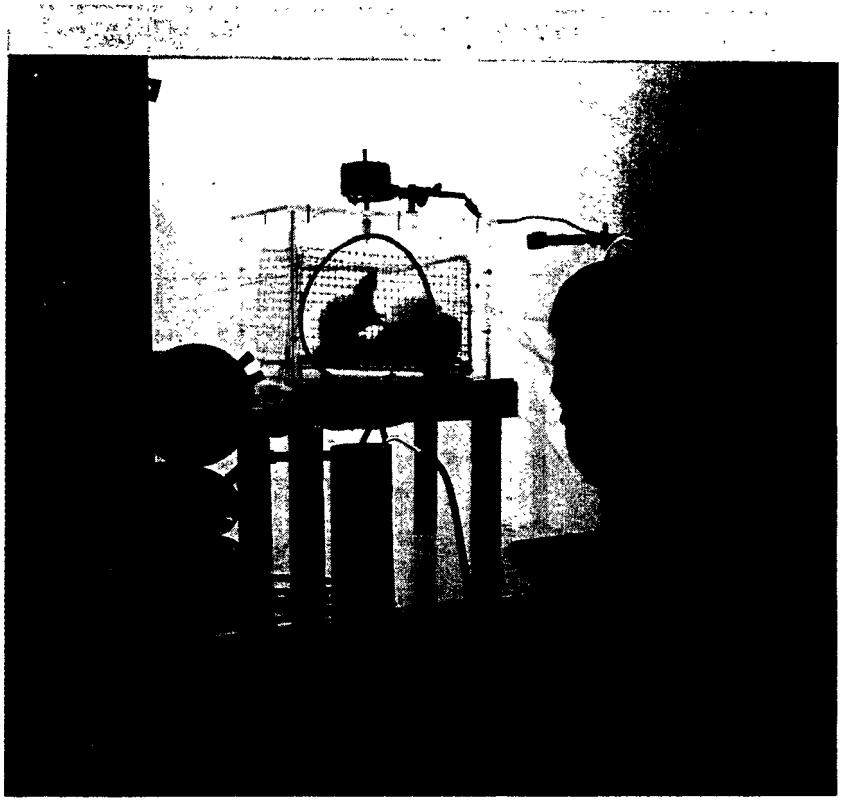
Smog — San Francisco.



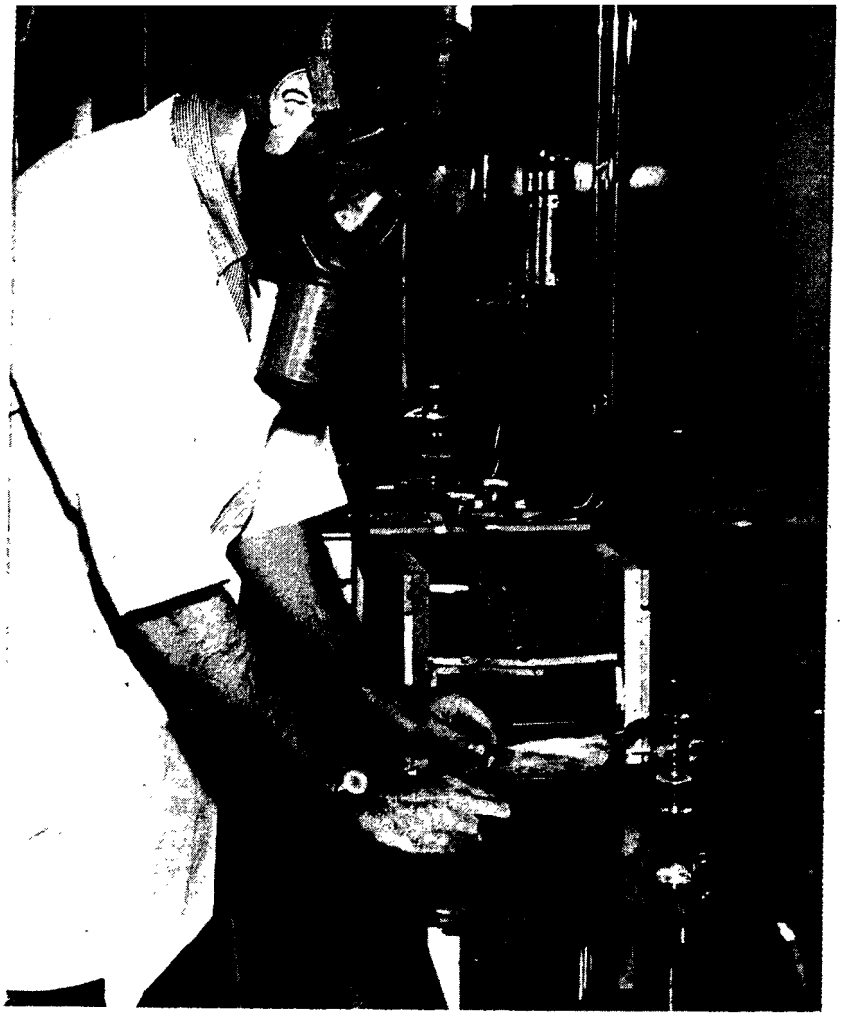
Smog studies on rats: New York Institute of Industrial Medicine.

nvironmental cancer—

Sugar, white flour, preserves, spices, cheese, canned goods, cooked foods and tomatoes all cause cancer, we hear. Grapes, on the other hand, can ward off cancer and even cure it. These are some of the misconceptions about cancer which various food fanatics and crackpots have held throughout the ages. None of them, of course, is true. Science has not found that any dietary item can lessen one's chances of getting cancer or recovering from cancer. Aluminum cooking utensils were once thought by some to cause cancer. A lot of people still believe that chemical fertilizers, used instead of the old-fashioned organic kind, make people more susceptible to cancer. Another myth which has grown only in comparatively recent years is that water fluoridation causes cancer.

"MODERN LIVING," with its rapid tempos and nervous tensions, is held by many people to be a cause for the increase in cancer which has been noted since the first World War. This, actually, can be considered to have some slight basis in fact, since modern living—in the sense of modern science—has contributed to the greater longevity of our people, making it possible for more of them to live on to old age when cancer strikes most frequently.

On the other hand, modern man sometimes *does* unwittingly create an environment conducive to the growth and development of certain cancers. Man in his unceasing quest to add to or improve upon his creature comforts and conveniences has already developed, as an offshoot or by-product of his present industrial civilization, more than 400 chemical substances which have



Air pollution analysis:
University of Southern California.

Studying mist particles as a factor
in atmospheric pollution

been identified as carcinogens — meaning they can cause cancer in human beings or, experimentally, in animals. Hence, as regards cancer, the so-called "blessings of civilization" would appear to be not unmixed.

The very air we breathe may contain cancer-causing particles. Science has known for a long time that certain hydrocarbons cause cancer. These exist in coal tar products, soot, incompletely combusted gasolines and oils. Traces of them have been reportedly found in cigarette smoke, and they exist in smog and industrial dust. A scientist working under an American Cancer Society grant at the University of Southern California and Los Angeles County Hospital has recently induced cancers in mice merely by having them live in and breathe an atmosphere contaminated with these compounds.

However, there is a vast—and reassuring—difference in the carcinogenic potential of the air we breathe as compared to the extremely dense smogs in which the laboratory mice were reared. The analogy might be that of breathing concentrated poison gas in a closed chamber as against inhaling minute quantities of it in the open air; the difference is that of degree and length of exposure. Federal, state and municipal governments as well as private agencies, are becoming increasingly aware of the smog problem, and industry and labor are working right along with them to protect us. As yet science has not proved that any human being has ever gotten cancer by the act of breathing.

The effects of environmental influences on cancer become more clear when we get down into specific industries where the workers employ materials which are known to be carcinogenic. The conclusion is inescapable that certain chemical agents, particularly of industrial origin, are important factors in the causation of certain types of human cancer. It has been noted that there are at least 400 such chemicals known to be carcinogenic to some degree, and it is probable that others will crop up as the result of continuing scientific laboratory experimentation. In short, as our research progresses and industrialization grows we will continue to find more cancer causes in our occupational environment.

In general, the occupational agents known to cause cancer do so only in specific organs of the body. The list of well-established to proved causes of occupational cancer is impressive. Arsenic, tar, creosote, crude paraffin oil, ionizing radiation (x-rays, radium), and sunlight can, if the contact is intense enough and long enough, result in skin cancer. Asbestos, chromate compounds, nickel carbonyl, tar fumes and ionizing radiation increase the likelihood of cancer of the lung. Nickel carbonyl, isopropyl oil (not to be confused with isopropyl alcohol, which is made from it), and radioactive dusts and gases are accepted causes of cancer of the nasopharynx and sinuses. Aromatic amines used in the manufacture of synthetic dyes cause cancer of the bladder. Radium and mesothorium, radioactive elements, produce sarcoma of bone. Benzene and radiations can cause the malignant diseases of the blood-forming tissues, such as the spleen, lymph nodes, bone marrow, which we call leukemia.

All the causes of cancer listed here are well-demonstrated and widely accepted causes encountered in specific occupations. Many other causes are suspected on the basis of statistical and experimental research. And these are under constant study.

One point should be remembered: In general, the agents mentioned as causing occupational cancer are hazardous only *in the form and in the amount* in which they are handled in manufacturing processes.

For instance, in the little town of Ampere, N. J., toward the end of World War I, a number of women were employed at painting the radium hands and numbers on watch dials—to make them glow in the dark. It was their common practice to twirl the brush between their lips in order to get a fine point on it, between dippings into the radium-containing liquid. In time these workers had swallowed and absorbed into their systems minute quantities of radium which ultimately found its way into their bones. Years later many of the women had developed cancer of the bone, which proved fatal in almost all cases. This is a well known and even notorious case of cancer in industry. Since then, of course, other techniques of radium application have been adopted and safeguards for workers installed.

Pitchblende miners in Czechoslovakia were developing lung cancer at an alarming rate until it was discovered that the air of the mine contained a fine radioactive dust which, inhaled over the years, produced such cancer. Vineyard workers in France sometimes get skin cancer from contamination with arsenic used to spray the fields. Some workers in the synthetic azo dye industries of Germany and Switzerland contracted cancer of the bladder; later it developed that these dyes contained two strong carcinogens—betanaphthylamine and benzidine. In the oil industry, high boiling fractions of petroleum and petroleum products, shale oil, coal tar and related compounds are established inciters of cancer of the skin. Leukemia is seen more frequently in physicians who work with x-rays than in those who are not exposed so heavily to radiation. The problem of bladder cancer in Egypt is believed due to the marked infestation with schistosoma, a parasitic ailment, that occurs there, particularly among farmers. Skin cancer is seen more frequently in sailors, ranchers and farmers than in people who are not so heavily exposed to sunlight. In the manufacture of products from propylene gas there appears to be a higher than expected

incidence of cancer of the nasal sinuses—perhaps due to inhalation of irritating fumes.

"In general, there is no difference between a cancer caused by an occupational poison and one of unknown cause," says Dr. Herbert K. Abrams, Medical Director of the Building Service Employees Union, Local 25, Chicago. "Cancers of the bladder, lung or skin, for example, are the same whether caused by inhalation of a certain chemical in the factory, or resulting from an unidentified cause. The most important tool to aid the doctor in making the diagnosis of occupational cancer is a thorough occupational history.

"Occupational cancers usually require years of exposure to develop. The time will depend upon the intensity of exposure, potency of the chemical or physical agent, and the relative susceptibility of the individual affected. Occupational cancers have been reported to occur in from one to many years of exposure. It is possible for a cancer to become manifest years after the worker has left the place of employment where the exposure occurred. This is another reason why a thorough history is so important."

Mine worker — 1900 feet underground.

(FREELANCE PHOTO GUILD)

Cancer-causing agents are discovered in two ways: experimentation with animals, and epidemiological investigation. Epidemiological research works theoretically like this: it is known that in a certain state only 0.02 per cent of the population get cancer of the bladder, but in one county of that state 0.1 per cent of the population is affected. In a single plant in that county, it is discovered that 5 per cent of the employees get bladder cancer. Further research then reveals that 50 per cent of the employees in one specific department of the plant, and over 90 per cent of the workers employed in one phase of this operation get this type of the disease; it also may be observed that these workers get cancer at an earlier age than persons in the general population. So now there is a solid basis for a detailed study of the chemicals and processes to which those workers are exposed.

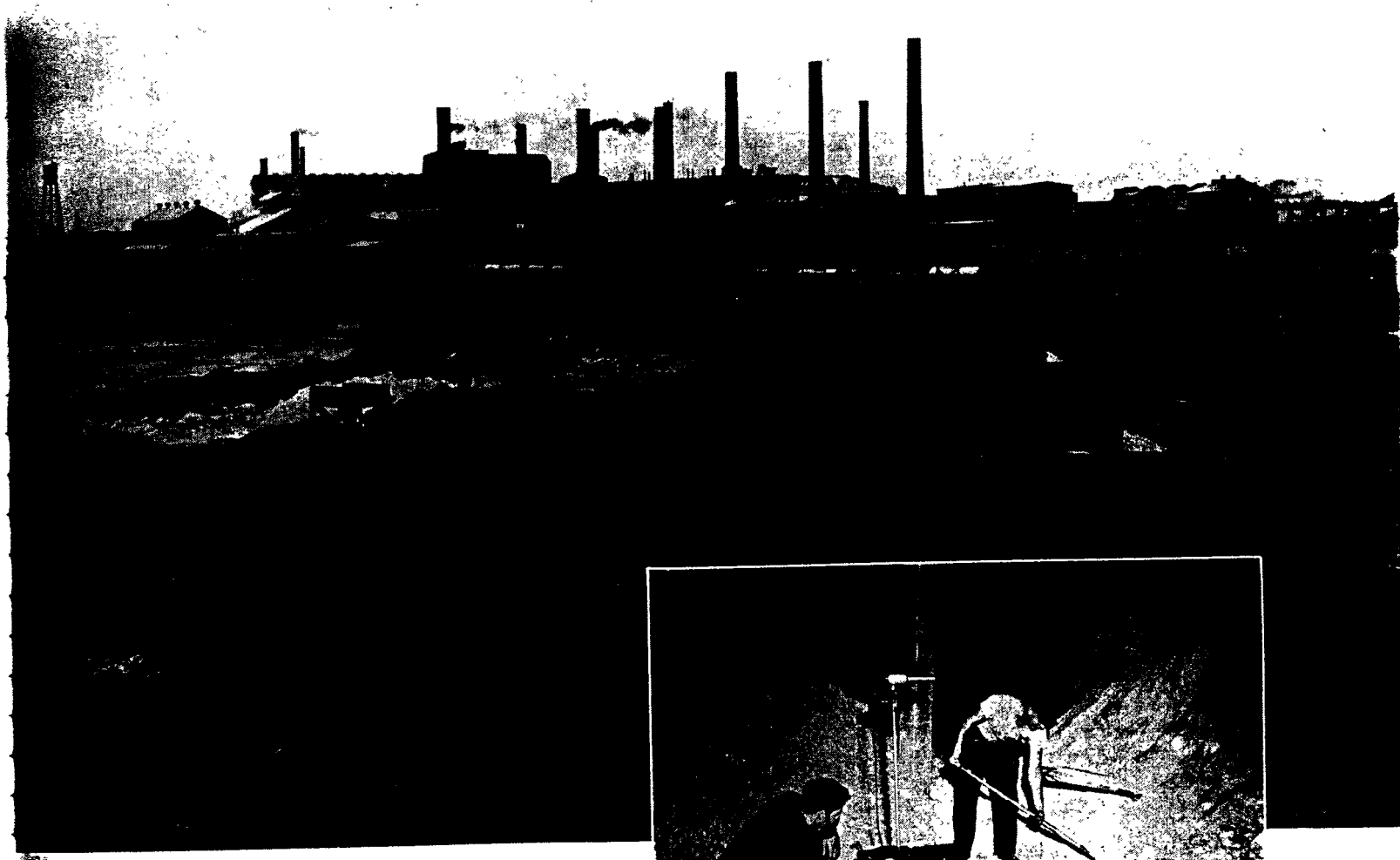
The outlook for reducing cancer in industry is more hopeful than that for the general population because exposure to the carcinogenic agent can be controlled. Prevention is based on the same principles as is prevention of other occupational diseases. Some notable safeguards are:

1. Substitution, where possible, of a less harmful chemical or process for a harmful one. For example, replacement of benzol by a less dangerous solvent.
2. Introduction of a production system to prevent escape of noxious dusts, fumes, and gases into the air.
3. Exhaust ventilation to remove noxious dusts, fumes, and gases.
4. Protective clothing, goggles, gloves, and respirators, for the worker. Change of work clothing daily with showers at the end of the day.
5. Medical supervision of the workers with periodic examinations to detect early signs of trouble.
6. Education of the worker. Unless he knows what he is doing and handling, and how to protect himself, all other measures are apt to fail.

"The primary purpose of medicine in industry is to guard the worker's health so he can continue to earn a livelihood uninterruptedly," adds Dr. Leo Price, Director of the Union Health Center, New York City. "One great safeguard of good health is the periodic medical examination and prompt medical treatment following early signs of disease. The worker who takes advantage of this service can usually maintain good general health and be free from fear of disability. With medical supervision and treatment, even chronic diseases and conditions are no bar to continued employment. Therefore medical service on or near the job helps the worker take care of his immediate requirements while he keeps on working. The purpose of labor health centers is to provide this direct medical service.

"Regular periodic medical examinations help identify cancer early when it is most easily controlled. In 1954 the following different types of that malady were found among garment workers who attended the Union Health Center: 55 cancers of the skin, 31 cancers of the rectum, 24 cancers of the colon, 20 lung cancers, 14 breast cancers, 13 stomach cancers, 8 of the cervix."

And how many American industries are cooperating in the safeguarding programs of their workers health? A great many—although the number could and should be increased. Among some examples of



Chromate plant: ore storage piles and testing chromate dust with particle accumulator-analyzer. (below) Coding health records of chromate workers.

participating industries cited by the National Cancer Institute of the U. S. Public Health Service are:

The Monsanto Chemical Company discontinued manufacturing 4-amino diphenyl which was used as an anti-oxidant after it was discovered that this chemical is highly carcinogenic and had caused cancers of the bladder among the workers within a relatively short period of years.

Several chromate manufacturers, such as the Mutual Chemical Company and the Diamond Alkali Company, have constructed during recent years new plants in order to reduce the lung cancer hazard among chromate workers.

The Union Carbide and Carbon Company has made some fundamental changes in the technological aspects of the production of isopropyl alcohol to obviate the cancer hazards affecting the nasal sinuses,

larynx and lung of producers of isopropanol.

The American Petroleum Institute has been financing, over the last five or six years, an extensive research program for the determination of carcinogenic derivatives of petroleum. Some twelve manufacturers, processors and users of coal tar and related products (pitch, asphalt, creosote oil, anthracene oil, methylated naphthalene) have banded together to provide financial support for the study of carcinogenic hazards related to these products.

Improvements have been made in the processing of asbestos by some of the American manufacturers, thereby reducing the hazard of asbestosis as well as of asbestosis cancer of the lung.

Manufacturers of household detergents have financed, during recent years, a large-scale investigation of the raw products of chemicals provided by the petroleum industry used in the manufacture of detergents, to determine their possible harm—if any.

How one specific company took cognizance of and action on this problem is illustrated in the well-rounded program of the Esso Standard Oil Company of New Jersey. Extensive studies carried out by the Esso Research and Engineering Division had shown that the residual material left over after the company's high boiling catalytic cracking process had taken off the gasoline, kerosene, heating oils and diesel oils, was highly carcinogenic to lower animals. It was concluded that a potential cancer hazard existed where man came into contact with these residual oils. Some 4,000 Esso refinery employees were engaged in working with or handling them. Prompt steps were taken to 1) expand the experimental biological studies to obtain additional information relative to the carcinogenic properties of the oils; 2) initiate physical and chemical studies to eliminate or diminish the carcinogenic qualities of the oils; 3) put all employees exposed to these oils under close medical supervision; 4) institute measures throughout the company to eliminate or diminish contact of employees with the oils.

The company, under the direction of Dr. Leo Wade, Medical Director of Esso Standard, and with the advice of Dr. Robert E. Eckardt, Medical Director of the Research and Engineering Division, restricted the number of men exposed to the oils and put into effect a program to make physical examination obligatory four times a year. Protective clothing is required on these jobs—aprons, boots, gloves, whole suits. Employees are obliged to shower before leaving the plant and to don clean work clothes daily. All equipment used in the production of the more carcinogenic oils is painted bright orange. Assisting Dr. Eckardt in the basic studies have been Dr. Horace W. Gerarde, head toxicologist; Nathan B. Hendricks, head industrial hygienist; Dr. Bertrand E. Bennison, chief clinical research physician.

How a whole industry took action on the problem was demonstrated within the past two years. Extensive studies had shown a close association between cigarette smoking and deaths from lung cancer. American tobacco interests were naturally concerned, and set up a Tobacco Industry Research Committee supported by a half million dollar fund contributed by various companies. Dr. Clarence Cook Little, head of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Me., and one of the foremost cancer researchers in the country, was called in to head the tobacco research group—whose funds have since been swelled another million dollars.

Meanwhile, Dr. Ernest L. Wynder, a scientist heading an ACS-supported smoking study at the Memorial Center for Cancer and Allied Diseases, New York City, has, within months, announced the separation of a fraction of the condensate from tobacco smoke representing approximately 1.0 per cent of the total tar. This fraction causes skin cancer in 9 out of 10 mice, and may well contain the agent which is concerned in the production of many cases of human lung cancer. The studies of Dr. Wynder and his associates have been supported thus far by $35,509 in American Cancer Society grants, and his group is only one such ACS-supported team looking into the growing seriousness of the lung cancer problem. The ACS has allocated a million dollars to the lung cancer study during the past

two years, and in March 1955 established an Ad Hoc Advisory Committee on Lung Cancer, composed of America's foremost doctors and scientists, to guide its research.

The increase in lung cancer death rates—greatest of any cancer site over the past few decades—is attributable to many possible causes. The evidence which links smoking is no more than circumstantial at present. The existence of respiratory cancer hazards has, on the other hand, been reliably demonstrated among those who inhale hot coal tar fumes during the manufacture of gas and coke, workers exposed to certain petroleum mists and fogs, others exposed to vapors from isopropyl oil, refinery workers having contact with nickel dust and nickel carbonyl vapors, workers who breathe in chromium-containing compounds, asbestos workers with pulmonary asbestosis.

Doctors working with wet x-ray film use protective aprons, goggles. Rays from radium in glass dish furnished only light for inset photo.

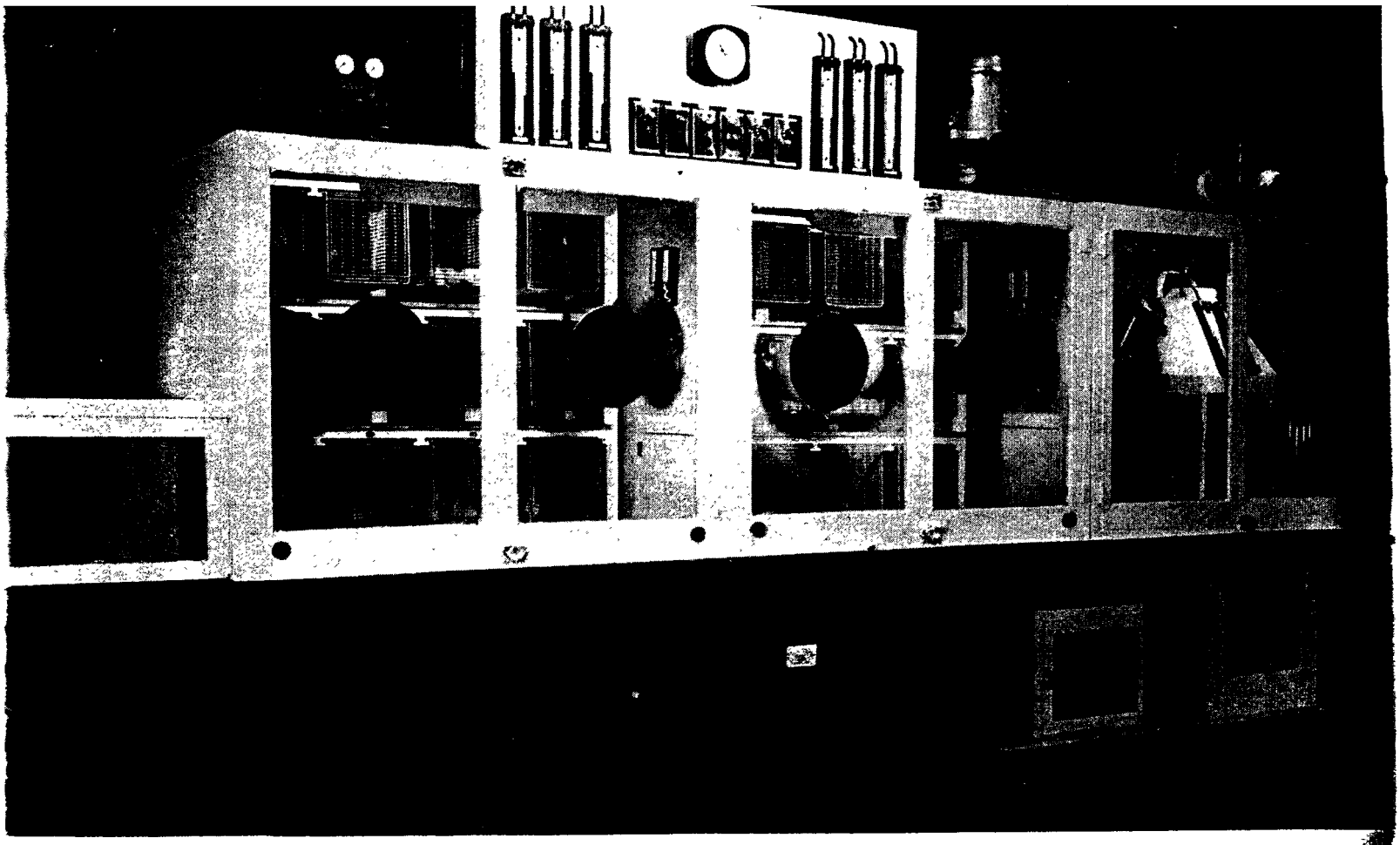
Investigators working on one research project at the University of Pittsburgh, supported by the American Cancer Society and the National Cancer Institute, have challenged several common scientific concepts of cancer induction. They suggest that "co-carcinogens" — agents which have been regarded as harmless by themselves but capable of increasing the potency of cancer-causing substances — themselves cause cancer if exposure is great enough. Once again, it may all be a matter of dosage and length of exposure, they contend.

The Pittsburgh scientists report that the cancer-causing potency of an agent can be varied at will by the experimenter, since it is dependent on dosage, time, and concentration. They found that a single application of 0.01 cc. of 1.25 per cent solution of 3,4 benzpyrene—a total of 125 micrograms of the substance—will not cause cancer when painted on the shaved skin of a mouse. If a *lesser* amount, 120 micrograms, is given over a *longer* (40-week) period, however, it causes tumors in the mice. Most of these disappear if exposure is stopped, but continued exposures produce cancers which kill the test animals.

The results of this and other research make questionable the idea of "sub-minimal" single doses of a carcinogen being entirely harmless. They indicate that very slight exposures have a cumulative effect which can add up to cancer if the doses are repeated often enough.

This line of research has significance for humans. It suggests that a single slight exposure to cancer-causing agents may not be harmful, but repeated slight exposures could lead to cancer.

Lending further credence to this theory, Volume 70, No. 3 (March '55) of *Public Health Reports* issued by the U. S. Department of Health, Education and Welfare, carries an



Inhalation chambers for atmospheric experiments on mice: New York University-Bellevue Medical Center.

article titled, "Relationship of Industrial Carcinogens to Cancer in the General Population," which states:

> *"A rapidly growing accumulation of evidence suggests that industry-related or occupational cancer hazards carry as a corollary a similar, though diluted or attenuated hazard for the general population. The industrialization of society during the past half century has resulted in certain new socio-economic phenomena, one of which has been the concentration of population in close proximity to industrial sources of environmental pollution. This concentration of population and the recent advent of the atomic age, the era of synthetics and the petroleum economy when combined with epidemiological observations, indicate that a general population hazard is of more than theoretical significance."*

Such an everyday essential to life as drinking water has been known to carry cancer-causing factors. An endemic appearance of skin cancers due to the consumption of drinking water polluted with arsenicals has been reported from such divergent places as Reichenstein, Silesia, and Cordoba, Argentina. In Reichenstein, the arsenic which entered the drinking supply originated from water seeping through arsenic-containing slag heaps from the mines, while in Cordoba the water had a naturally high arsenic content. Attention has also been called to the pollution of water supplies through the discharge of wastes from chemical factories, paper plants, cellulose manufacturing establishments, gas works, rayon plants, textile dyeing plants, tanneries, steel plants, oil refineries, and similar industrial establishments, and to the introduction of substances from freshly tarred or oiled roads into the rain water, or of arsenicals used for the spraying or dusting of fields, orchards and woods, or released from copper smelters into the air and thus carried down by rain.

Concerning definition and types of environmental carcinogens, Dr. W. C. Hueper, Chief of the Environmental Cancer Section of the National Cancer Institute, has said in a *Public Health Report*, Supplement 209, titled "Environmental and Occupational Cancer":

"Any physical, chemical, or parasitic agent forming a part of our natural or artificial environment that, on proper exposure, directly or indirectly elicits cancerous growths in one, several, or all types of human tissues represents an environmental carcinogen. Exposure to these factors is related to a great number of highly diverse environmental conditions, such as occupational activities, diets, medicines and medicinal devices, cosmetics, wearing apparel, building materials, habits and customs, climate, fauna, contaminants in drinking water, atmospheric air, foodstuffs, and—in recent years—procedures of warfare.

"Some of the evidence is of cir-

cumstantial character, derived from statistical observations showing definite differences in the incidence rates of cancers. These appear in different regions, among different races, sexes, and social and occupational groups, and with different climates, and also are to be noted in marked variations in the relative distribution of cancers upon the different organs in different countries and population groups. Another type of evidence is of a more definite nature, and applies to the environmental tumors proper."

Dr. Hueper has assessed the relative significance of various chemical carcinogens from the public health viewpoint, and has proposed a priority formula for the screening of suspected materials.

He would give the highest priority rating to those chemicals with which the largest part of the general population has the most contact. Agents of this nature include chemical additives and contaminants of foodstuffs; industrial and military pollutants of the air, water, and soil; wrapping and packaging agents of foodstuffs; cosmetics; household drugs (over-the-counter items); cleaning and polishing agents (waxes, dry cleaning fluids, detergents, metal-, furniture-, and silver-polishes, etc.); sanitary goods; paints; herbicides; pesticides, etc.; i.e., any chemical which enters the general human environment in the form of consumer goods or as an environmental contaminant.

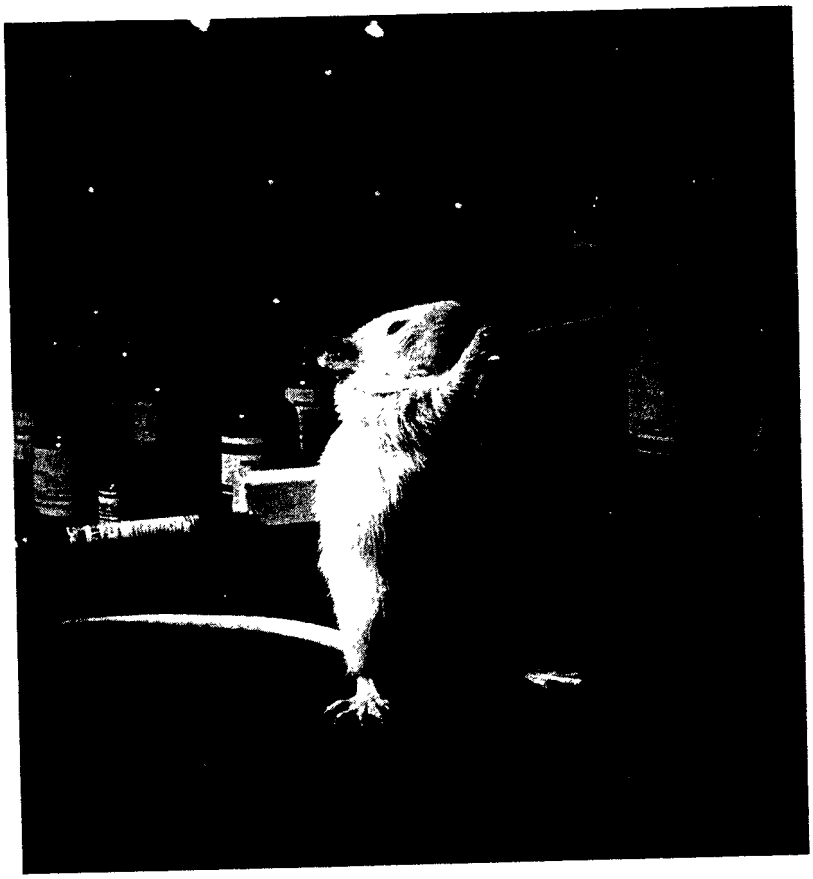
The second highest priority would be given to chemicals to which large worker groups employed in producing, processing, and consuming industries become exposed, but which either are not incorporated into consumer goods or may be present only in inactive form.

The lowest priority would go to potentially carcinogenic chemicals of relatively less significance from a public health viewpoint, such as medicinal agents dispensed only upon prescription, and industrial chemicals with numerically restricted occupational contacts and no general environmental human exposures.

As has been pointed out previously, certain segments of American industry are being most conscientious about the growing problem of environmental cancer. Other segments are not so cooperative. Some industries which have instituted studies of the problem are not publishing data on the symptomatology and epidemiology of cancers within their industries. Through such secretiveness the medical profession is thereby deprived of the benefit of factual evidence which is essential for an intelligent approach to a preventive control of cancer by medical and technological procedures. In fact, some companies have taken active steps to prevent the publication of incriminating evidence obtained by investigators in their several fields. A few industrial concerns and certain industrial consultants have even gone to the length of endeavoring to undermine the professional standards of workers in the field of occupational cancer. Considerably more educational work remains to be done in this area.

One state health official recently visited a small asphalt plant where there was a known carcinogen hazard. He tried to persuade the owner to improve his ventilating system and provide other safeguards. The owner, who worked in the plant himself, scoffed at the idea, said he'd been working with asphalt for over 20 years, declared that no bureaucrat was going to persuade him it was dangerous. "Even as he spoke," the state official reported later, "I could clearly see half a dozen wart-like growths on his face and hands —a kind that are often precancerous—and I recognized what was probably an actual cancer the size

Synthetic diet tests.



of a dime growing just above his cheekbone."

A half a dozen bills are now pending in Congress which would help safeguard the foods we eat—not from carcinogens alone, but from all potentially dangerous or untried additives. These would require processors adding new chemicals to foods to test them for their chronic effect on animals before they are put on the market. Secretary of Health, Marion B. Folsom, has stated, "There is no responsible group in either the food or the chemical industries which, so far as we know, opposes the objectives of such legislation." There has been some delay in passage, however, while committees are determining just how strict the new law should be and how it should be enforced.

Indian natives often get cancer from chafing of fibrous clothing—gathered at waist.
(FREELANCE PHOTO GUILD)

Our ancestors often developed lip cancer from smoking clay pipes—too hot.
(CULVER SERVICE)

Meanwhile the man on the street, the plain American citizen interested in maintaining the health and welfare of his family, is concerned with keeping himself and his loved ones free of cancer. But no amount of Congressional legislation will free him of his own personal responsibility. Knowledge of cancer and its symptoms, and an awareness of the necessity of early protection and prompt treatment, will still be his first safeguards against the disease. Many types of cancer are preceded by recognizable conditions, and many cancers are incurable only because they are detected too late. The once-yearly medical examination for adults and the alertness to cancer's well-known seven danger signals remain the best precautions.

Modern man in his modern environment can take solace from one fact. Environmental cancer is not at all new, and is not at all unique to our present industrial civilization. Cancer of the lip was a hearthside hazard among our ancestors who smoked clay pipes—too hot. Scalp tumors prevail among Moslem males whose religious practices inspire them to shave their skulls with blunt—and hence chronically irritating—instruments. In The Philippines the natives get mouth cancer by sucking on a leaf-wrapped betel nut. Certain natives of India develop cancer from the constant chafing of their fibrous clothing—gathered at the waist. Then there is a cancer found in the people of Northern China who sleep on a perforated mat under which is placed hot bricks to keep them warm: they gradually develop low-grade burns which later become tumorous. Thus, literally, they get cancer from going to bed.

cancer news

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