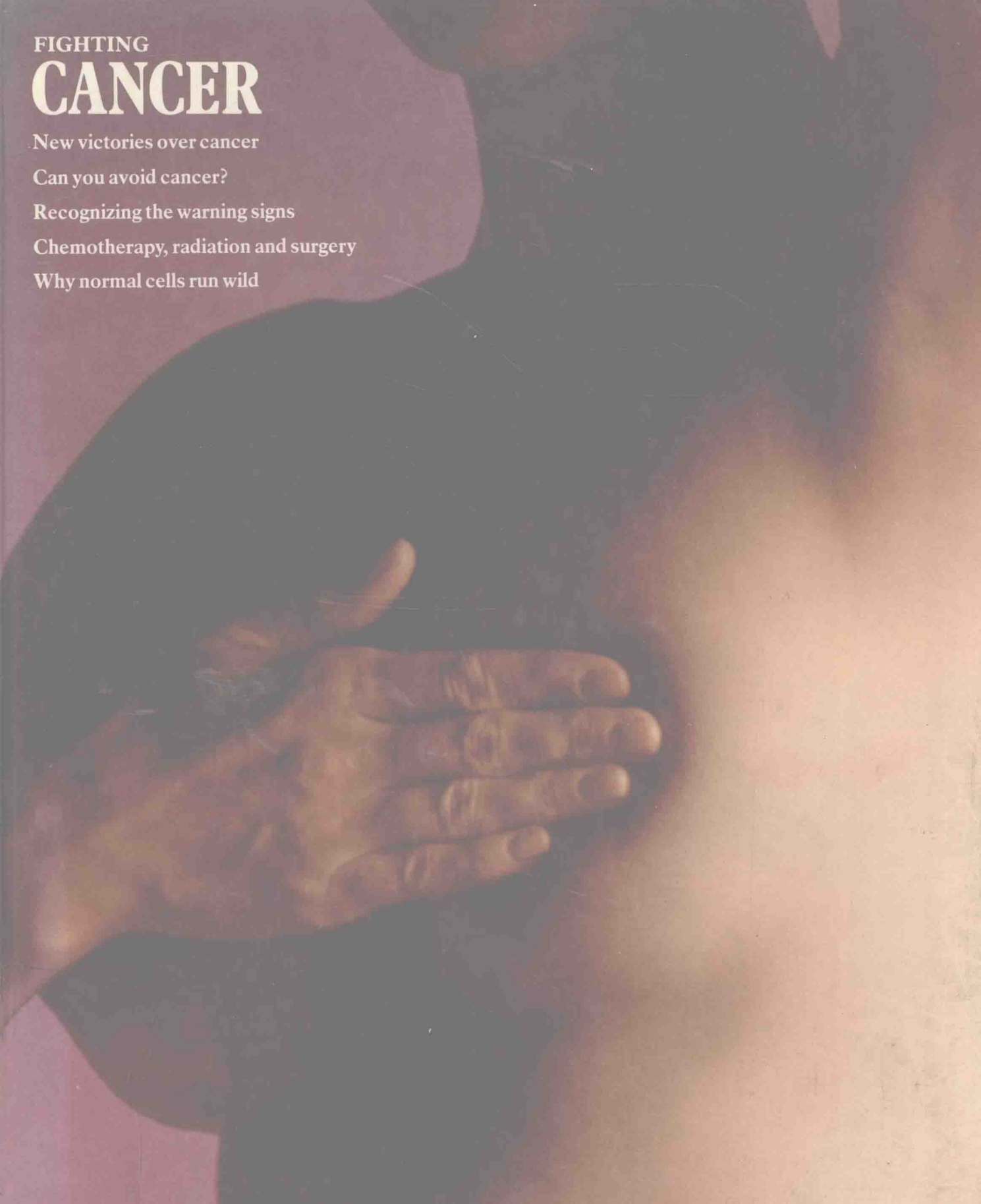


FIGHTING

CANCER

New victories over cancer

Can you avoid cancer?

Recognizing the warning signs

Chemotherapy, radiation and surgery

Why normal cells run wild

FIGHTING CANCER

BY THE EDITORS OF TIME-LIFE BOOKS

LIBRARY OF HEALTH / TIME-LIFE BOOKS / ALEXANDRIA, VIRGINIA

THE CONSULTANT:
Dr. David Schottenfeld is Chief of Epidemiology and Preventive Medicine at the Memorial Sloan-Kettering Cancer Center in New York City. He is also Professor of Public Health at Cornell University Medical College, where he received his M.D. degree in 1956.

For information about any Time-Life book, please write:
Reader Information, Time-Life Books,
541 North Fairbanks Court, Chicago, Illinois 60611.

First printing.
Published simultaneously in Canada.
School and library distribution by Silver Burdett Company, Morristown, New Jersey.

TIME-LIFE is a trademark of Time Incorporated U.S.A.

Library of Congress Cataloguing in Publication Data
The Editors of Time-Life Books
Fighting Cancer
(Library of Health)
Bibliography: p.
Includes index.
1. Cancer I. Time-Life Books. II. Series.
RC263.F48 616.99'4 81-8799
ISBN 0-8094-3764-3
ISBN 0-8094-3763-5 (lib. bdg.)
ISBN 0-8094-3762-7 (retail ed.)

CONTENTS

FIGHTING CANCER

Other Publications:

CLASSICS OF THE OLD WEST
THE EPIC OF FLIGHT
THE GOOD COOK
THE SEAFARERS
THE ENCYCLOPEDIA OF COLLECTIBLES
THE GREAT CITIES
WORLD WAR II
HOME REPAIR AND IMPROVEMENT
THE WORLD'S WILD PLACES
THE TIME-LIFE LIBRARY OF BOATING
HUMAN BEHAVIOR
THE ART OF SEWING
THE OLD WEST
THE EMERGENCE OF MAN
THE AMERICAN WILDERNESS
THE TIME-LIFE ENCYCLOPEDIA OF GARDENING
LIFE LIBRARY OF PHOTOGRAPHY
THIS FABULOUS CENTURY
FOODS OF THE WORLD
TIME-LIFE LIBRARY OF AMERICA
TIME-LIFE LIBRARY OF ART
GREAT AGES OF MAN
LIFE SCIENCE LIBRARY
THE LIFE HISTORY OF THE UNITED STATES
TIME READING PROGRAM
LIFE NATURE LIBRARY
LIFE WORLD LIBRARY

FAMILY LIBRARY:
HOW THINGS WORK IN YOUR HOME
THE TIME-LIFE BOOK OF THE FAMILY CAR
THE TIME-LIFE FAMILY LEGAL GUIDE
THE TIME-LIFE BOOK OF FAMILY FINANCE

FIGHTING CANCER

BY THE EDITORS OF TIME-LIFE BOOKS

LIBRARY OF HEALTH / TIME-LIFE BOOKS / ALEXANDRIA, VIRGINIA

THE CONSULTANT:
Dr. David Schottenfeld is Chief of Epidemiology and Preventive Medicine at the Memorial Sloan-Kettering Cancer Center in New York City. He is also Professor of Public Health at Cornell University Medical College, where he received his M.D. degree in 1956.

For information about any Time-Life book, please write:
Reader Information, Time-Life Books,
541 North Fairbanks Court, Chicago, Illinois 60611.

First printing.
Published simultaneously in Canada.
School and library distribution by Silver Burdett Company, Morristown, New Jersey.

TIME-LIFE is a trademark of Time Incorporated U.S.A.

Library of Congress Cataloguing in Publication Data
The Editors of Time-Life Books
Fighting Cancer
(Library of Health)
Bibliography: p.
Includes index.
1. Cancer I. Time-Life Books. II. Series.
RC263.F48 616.99'4 81-8799
ISBN 0-8094-3764-3
ISBN 0-8094-3763-5 (lib. bdg.)
ISBN 0-8094-3762-7 (retail ed.)

CONTENTS

Victories over a dread disease

The many cancers that can be prevented
How malignancy begins
A universal plague in many guises
Who falls victim and why
Tracking killers in the laboratory
Triumphs of treatment
The worldwide army of cancer fighters

"Cancer," wrote Dr. Vincent DeVita, Director of America's National Cancer Institute, in 1980, "is one of the most curable chronic diseases in this country today."

The statement may seem surprising. If any disease has the reputation of being incurable, it is cancer. The very word has had the force of an epitaph, a synonym for death. For centuries—and in some places, even today—victims were not told the name of their disease. Families refused to acknowledge the presence of cancer in their midst, even after fathers, mothers or children had succumbed, and newspaper obituary writers sidestepped the dreaded word with a common euphemism: death "after a long illness." These bitter heritages of aversion and fear are becoming meaningless. In sober truth, Dr. DeVita's apparently bold claim is reality today. It is a claim based largely upon the rate of improvement in "five-year survival"—the period after diagnosis when, if the patient is kept free of symptoms, most types of cancers are considered cured. For most common types of cancer, this rate jumped spectacularly in the decades between World War II and the end of the 1970s. The change in the statistics over this period is little short of miraculous:

- For cancer of the colon, the five-year survival rate rose from about 32 per cent to nearly 49 per cent.
- Among women suffering from breast cancer, barely one out of two formerly survived for five years; a generation later more than two out of three recovered.
- For prostate cancer the rate went up from 37 per cent to nearly 63 per cent.
- Cancer of the bladder had a 42 per cent five-year survival rate; the rate climbed to 61 per cent.
- Five-year survival for cancer of the cervix, or mouth of the womb, rose from 47 per cent to 64 per cent; for cancers within the womb, from 61 per cent to 81 per cent.
- Hodgkin's disease, a cancer of the body's infection-fighting system, was practically conquered: The cure rate rose from a dismal 25 per cent to a heartening 67 per cent.
- The most common type of acute leukemia, a cancer of the blood-forming tissues so virulent that all victims used to die within months after its detection, was made curable for 28 per cent of its victims.

Underlying such specific examples are the overall figures for cancer cure. In the 1930s, 25 per cent of all those stricken by cancer in the United States were treated and cured. By 1955 the figure was up to 33 per cent. By 1980 medical scientists estimated that among those who developed all types of cancer, 58 per cent could be cured, with a life expectancy equal to that of someone who had never been stricken at all.

These triumphs of treatment are only part of the story. It now is possible not only to cure a wide variety of cancers, but to prevent many of the types that are difficult to cure. Lung cancer is an outstanding example of a deadly, essentially preventable cancer. More men in the industrialized world suffer from it than from any other type, aside from easily curable skin cancers. Among women, it is increasing faster than any other type of cancer. Because lung cancer is usually far advanced when first detected, its overall cure rate remains

The crab, depicted above in a 15th Century illustration for an Italian book of prayers, gave mankind's dreaded disease its name. The hard center and clawlike projections of a spreading tumor seemed to Hippocrates, the ancient-Greek physician, to resemble the crustacean, and he named the disease "karkinoma," after the Greek word for "crab." "Cancer" is the Latin translation.

low: about 10 per cent. But much of it is easy to prevent—and not getting it in the first place is better than any cure. The villain, of course, is smoking. Heavy smokers are 20 times more likely to develop lung cancer than nonsmokers. In a country such as the United States, where lung cancer is common, the implications are clear. If the last cigarette in the United States were smoked today, the rate of lung-cancer attacks would drop from 56 to 14 per 100,000 in 30 years.

The many cancers that can be prevented

Smoking is only one among many avoidable causes of cancer. Alcohol is another; so are certain foods, and certain substances added to foods to preserve or flavor them. Overexposure to the sun's radiation can produce a skin cancer, and the penetrating radiation of X-rays can cause cancers deep in the body. Most insidious and diverse of all are the cancer-causing chemicals encountered in factories, mines and almost every other area in which materials are processed or chemically changed. Hardly a month passes in which cancer detectives do not identify a new suspect for this rogues' gallery or find a new outbreak of a known criminal.

Substances and forces that cause cancer are called carcinogens. The hunt for them goes on, and campaigns to eradicate them are only beginning to have an effect. But if every carcinogen now recognized could be eliminated overnight, the incidence of cancer would be cut in half by the year 2000.

It is in the light of such hard facts that Dr. Vincent DeVita's statement on cancer's curability assumes its full dimensions. Half of all cancers can be prevented; more than half of those that cannot be prevented can be cured. Over the next generation, because of these two facts alone, the annual number of cancer deaths in the industrialized world can be reduced from 183 to 55 per 100,000. The estimate is conservative; further—and almost certain—advances in prevention and cure would improve it. Clearly, the war against cancer is winnable, and it is being won.

The war is far from over. Cancer remains a major killer: In the United States, it takes about 390,000 lives a year; in England, 122,000; in West Germany, 155,000; in the Soviet Union, 360,000—the worldwide figure may be a staggering four million. On many fronts, campaigns against the disease falter or do not move at all. Avoiding carcinogens in everyday life means giving up cherished habits; eliminating them from the workplace has heavy economic consequences—lost jobs, lost revenues and increased costs. Early detection and diagnosis, which offer the best chance of curing a cancer, are often neglected or ignored; and some types of cancer still stubbornly resist the best available treatments.

The battles that have been won in the desperate war on cancer are almost entirely victories of recent years. Until the end of the 19th Century, the disease was indeed essentially incurable; some superficial cancers could be removed by surgery, but nothing more. At the turn of the 20th the range of therapy broadened to include X-ray treatments, which can burn away both surface and deep cancers; the nature and causes of the disease, however, were still matters of speculation. Then, with the explosive growth of medical knowledge following World War II, scientists and physicians acquired four major resources in their unending battle, all new and all further strengthened with each passing year. They know how to prevent most cancers. They have superb diagnostic tools to catch it early, often long before any ordinary symptoms of illness appear. They have an arsenal of marvelously effective weapons against it—treatments by surgery, radiation and drugs that far surpass anything the world has ever known. And perhaps most important, they know what cancer is.

How malignancy begins

Cancer had been such a dark and fearful mystery because it takes so many forms. It can strike any organ, any tissue, anywhere in the body. But despite this diversity, all cancers share certain characteristics. They are all diseases of individual cells, the basic building blocks of plants and animals.

No multicelled organism is immune to these diseases. A growth called crown gall, which appears on a number of plants, including daisies and tomatoes, exhibits certain characteristics of cancer. Insects get cancer; the fruit fly, a favorite creature of experimenters because it reproduces so rapidly—more than 35 generations per year—suffers from both brain tumors and blood cancers. Fish that swim through har-

Six years after the amputation of his cancerous right leg, Ted Kennedy Jr., son of the U.S. Senator from Massachusetts, competes in a ski race, using one regular ski and, for balance, "outriggers" made from short skis on poles. With such devices to help compensate for lost limbs or organs, more and more cancer victims, like Kennedy, lead normal, even athletic, lives.

bors polluted by tars and oil that cause cancer in human beings develop cancers similar to human cancer. Dogs, cats, cows and horses get cancers of various types. Some wild animals, such as cheetahs and certain Asiatic bears, were once thought to be immune. They are not. Protected in a laboratory or a zoo from disease and their natural enemies, so that they consistently reach an age old for their species, they too develop the disease.

In all of these living things, a cancer starts when something goes awry inside a cell, the smallest unit of living tissue. An error is somehow introduced into the genetic code, the complex pattern of molecules that normally ensures the reproduction of a new cell perfectly fitted to its function in the body. The genetic error may be caused by a chemical; by radiation, such as that of the sun or of X-rays; or by the tiny agents of disease called viruses. In addition, many genetic disruptions are simply random slippages of the cell's machinery, with no discernible cause. The result is the same: a new-born freak cell called a mutant.

Few mutant cells survive long enough to do any damage. Some are so deformed or deficient that they wither and die; others are destroyed by the body's natural defenses. In a cancer victim, however, at least one such cell hangs on to life and eludes the body's defenders. The cell divides into two, the two into four. Eventually, a billion or more may form a tumor—a swollen lump perceptible to the touch.

Rarely do swellings indicate the growth of new tissue, and even more rarely are they dangerous. The hard knot that follows a bump on the head is simply an accumulation of fluid beneath the skin; other swellings are caused by pus at the site of an infection. Even a tumor consisting of mutant cells is seldom cancerous; most tumorous lumps are classified as benign and generally can be ignored. Only malignant, or cancerous, tumors inevitably pose a threat to life.

The two types of tumors differ in a variety of ways. A benign tumor—the wart is a familiar example—is almost always enclosed in a capsule or sheath of fibrous tissue. Malignant tumors are rarely so well confined, and tend to invade adjacent tissues. Some exceptions to this rule do exist. Wilms' tumor, for example, a cancer that strikes at the kidneys in children, is encapsulated, like a benign growth.

When the outward appearance of a tumor does not reveal its nature, the distinction between benign and malignant can be seen through a microscope. If a kidney tumor is benign, the cells within it closely resemble those of the kidney itself, in patterning and structure. In Wilms' tumor—and in all other cancerous tumors—the cells have only a rough resemblance to those of the tissues in which they originally grew. Instead, they take on characteristics of their own. A normal cell has a single small body, the nucleus, at its center; a cancer cell may have a huge nucleus, or two or more nuclei. Like the nucleus, other components of the cell's interior may be deformed or multiplied. An entire cancer cell is usually

misshapen, and groups of them grow helter-skelter, lacking the orderly arrangements of normal cells.

There is a third difference between the two types of tumor—the most important distinction of all. Benign tumors are localized; they grow, generally quite slowly, but they stay at their original sites. Cancer tumors establish outposts elsewhere in the body, by a process called metastasis.

Benign tumors can be harmful despite their name. A small benign tumor inside the skull may block the blood supply to the brain, causing a stroke. Larger tumors can be dangerous anywhere in the body—and benign tumors weighing 70 pounds have been recorded. A medium-sized or large tumor can deform vital organs and interfere with their functions.

Malignant tumors can have the same effects, but their real menace lies in metastasis. The process begins when a cancer cell breaks away from the tumor. The malignant cell may enter the bloodstream and be swept to a distant site almost anywhere in the body. Wherever this wandering parasite comes to rest, it is dangerous. "What no normal cell is capable of," wrote the French cancer researcher Dr. Lucien Israël, "every cancer cell can do. It grows, regardless of local conditions, and its descendants reproduce more or less crudely the tissue from which it came. Thus fragments of intestine, bone or stomach will be found in the lung."

The bloodstream is only one of the pathways of propagation. Cells from a malignant tumor may be absorbed directly by a clear, watery fluid called lymph that is conveyed throughout the body by a network of lymphatic vessels. The malignant cells picked up by lymph may then lodge in filter-like structures called lymph nodes *(pages 106-107)*. (Ironically, the lymphatic system normally serves to protect the body against disease.) Malignant cells can even work their way through solid tissue; a cancer in the lining of the stomach, for example, can grow through the stomach wall to establish colonies elsewhere in the abdominal cavity.

It is after metastasis that cancer is most deadly. Thousands of individual cells or microscopic tumors may lie hidden in the body and, as Dr. Ronald Glasser of the University of Minnesota wrote, "each and every one must be hunted down and killed. If just one is left anywhere, it will grow again and again, until it finally wins." Having grown, a cancer may take over an artery, blocking the flow of blood to such vital organs as the kidneys, liver and heart. Cancer in the pancreas or the bone marrow may reduce the blood's ability to clot; if internal bleeding begins elsewhere in the body—possibly from a blood vessel ruptured by a metastasized tumor—the victim may die of it. Cancer colonies in the lymphatic system so weaken the body's defenses that an ordinary fungus infection, usually simple and easy to cure, will rage out of control.

Of all cancer's effects, the best known and most disturbing may be a pattern of symptoms called cachexia. It begins with an inexplicable loss of appetite. Weight drops off—sometimes slowly, sometimes with frightening speed—muscles become weak, sleep elusive. Pain is constant. As the malnourished body deteriorates, wastes within it reach toxic levels. Eventually the victim goes into a deep, terminal coma.

A universal plague in many guises

Such are the ravages of advanced cancer—the ultimate effects of a single diseased cell. The disease is both ancient and universal. Examinations of Egyptian mummies have revealed bone cancer in people who lived 5,000 years ago. The Incan Indians who inhabited Peru 24 centuries ago developed not only bone cancer, but a virulent form of skin cancer called melanoma. Among both peoples, the incidence of the disease was apparently low—only a few cancers have been seen in the thousands of mummies and skeletons that have been studied. The ancient Egyptians and Inca were short-lived peoples; most of them presumably died of other diseases or of injuries long before cancer had time to develop.

In the modern world, no branch of the human family tree is known to be free of cancer, though rumors to the contrary keep popping up. In 1977, for example, the United Nations Educational, Scientific and Cultural Organization reported that the people of Pakistan's remote Hunza Valley showed no signs of the disease. The U.N. report was proved wrong; the Hunzas have insignificantly fewer cases of cancer than other populations of similar size, environment and occupation.

Farmers in the uplands of Soviet Georgia, near the Black Sea, have long been an even richer source of health myth.

They were once said to be not only cancer-free, but even immune to the aging process; tales abounded of people still active at the age of 125. But the accounts of fantastic longevity turned out to be based on provincial chauvinism and bad record-keeping. And the Soviet government, after an intensive study of the Georgians, reported in 1980 that they suffer as much breast, lung and cervical cancer as other Soviet peoples; in fact, only the incidence of stomach and esophageal cancer proved substantially lower than the average.

The facts about the Soviet Georgians illustrate an important truth about cancer: Although the affliction is universal, there are strange variations in its incidence, as a whole and by type. World Health Organization statistics showed that in 1974 and 1975 Scotland had a higher cancer death rate than any other country in the world—more than five and a half times higher than that of Thailand, the country with the fewest cases. Variations among types of cancer were even wider. Japan and Norway had much the same total cancer death rates, but the Japanese suffered three times more stomach cancer than the Norwegians; on the other hand, the death rate from breast cancer among Norwegian women was nearly four times higher than among the women of Japan.

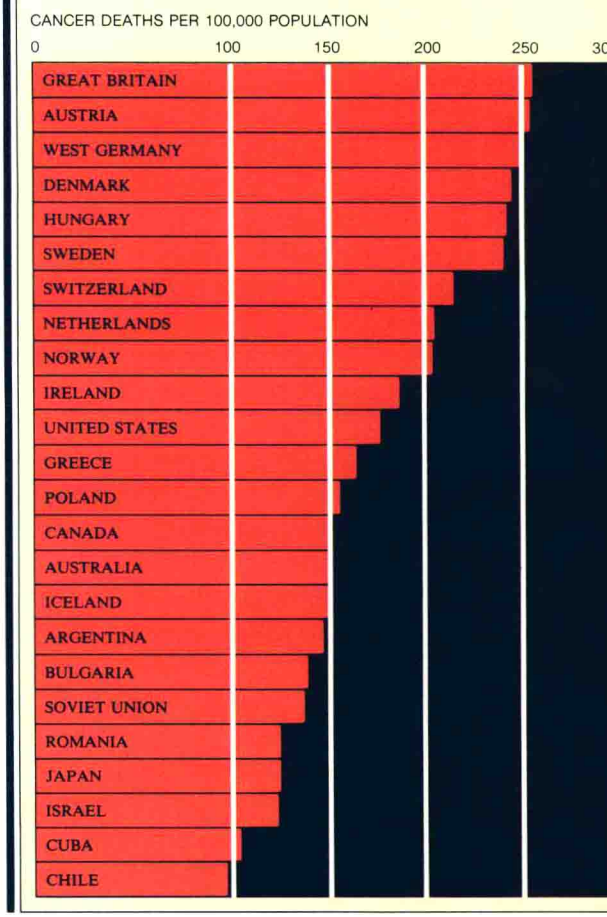
Scientists can explain some of the variations in cancer incidence, including the appalling rate of stomach cancer in Japan. They are virtually certain that the Japanese diet, high in smoked and salted foods and in a known carcinogen called bracken fern, is a major cause of that cancer. Elsewhere, specific cancers have been attributed to specific foods and other agents *(pages 13-15)*. But anomalies and mysteries remain. No one yet knows, for example, why the cancer death rate is highest in Scotland. And no one knows why the breast-cancer death rate is higher in Norway than in Japan, though some scientists have suggested that differences in childbearing or breast-feeding customs may be the key.

Who falls victim and why

To explain why some people get a particular cancer and others do not, or why cancer is more prevalent in one society than in another, medical investigators known as epidemiologists painstakingly compare the dissimilar groups. The tech-

A surprising gamut of vulnerability

Cancer affects all nations, but some more than others. The graph shows death rates from cancer, by number of deaths per 100,000 population, for 24 countries in the late 1970s. A pattern emerges: The rates are generally higher in densely populated and industrialized countries, such as Great Britain and West Germany, and lower in sparsely settled, agrarian or developing nations, such as Canada and Chile. These differences probably come from higher rates of smoking and more exposure to cancer-causing chemicals in urbanized countries and, in developing nations, a lower life expectancy—death comes from other causes before cancer can strike.



niques of epidemiology, based on comparative medical examinations, health records and interviews, have dominated much of 20th Century cancer research, but the seeds of these techniques were planted nearly three centuries ago. In 1700, the Italian doctor Bernardino Ramazzini noted that nuns, who lead lives very different from those of the general population, have a high susceptibility to breast cancer. He concluded—correctly—that it was in some way related to their celibacy.

Among the first to use the techniques was an 18th Century English surgeon, Percivall Pott. A prominent figure in the London of his day, Pott treated such patients as the actor David Garrick and the man of letters Samuel Johnson. He was also a medical scholar, with interests ranging from hernias to broken legs, and in 1775 he turned his attention to a curious phenomenon among London chimney sweeps. At an early age, and to a degree far beyond that of their contemporaries, they were susceptible to cancer of the scrotum.

In "A Short Treatise of the Chimney Sweeper's Cancer," Pott described the work of these boys and young men, "thrust up narrow, and sometimes hot chimnies, where they are bruised, burned, and almost suffocated; and when they get to puberty, become peculiarly liable to a noisome, painful and fatal disease." To get through those narrow chimneys, they often worked naked. They rarely bathed—the practice was considered unhealthful—and soot lay thick upon their skins, especially in the groin area. That soot, Pott pointed out, represented a substance peculiar to the chimney sweeps' trade. In a bold leap of speculation, he declared that the soot was the cause of their cancer.

Pott could never prove his case, but his primitive methods became the foundation of modern cancer epidemiology. This medical specialty now offers the best opportunities for learning what causes cancer in human beings. Like Pott, epidemiologists have linked specific occupations and chemicals to particular cancers; similar studies have implicated diet, sexual habits and heredity as well. In the course of their studies, they have developed two main branches of their science, one essentially retrospective, the other prospective.

Retrospective epidemiologists follow Pott's method, but at a much higher level of thoroughness and sophistication. Having identified a group especially high in a specific cancer or in cancers generally, they probe the lives both of the victims and of those who have escaped the disease. They analyze medical records and personal histories, and the personnel and health records kept by employers. Survivors are questioned on every conceivable detail of their working and living habits, and the investigators search through death certificates to identify earlier cases.

In one typical retrospective project, conducted in 1981, a team of researchers led by Dr. Brian MacMahon of the Harvard School of Public Health studied 369 victims of pancreas cancer and 644 subjects who were free of that cancer. The epidemiologists asked all the subjects about their use of tobacco, alcohol, tea and coffee, in an attempt to discover whether any of these factors increase the risk of developing the disease. One important connection emerged: Pancreas cancer patients were more likely to be coffee drinkers than were the controls. Neither alcohol nor tea increased the risk; cigarette smoking increased it only slightly. What was more, the more coffee a person drank, the greater the risk: Those who drank one or two cups a day were twice as likely to develop pancreas cancer as those who drank no coffee at all; those who drank five or more cups tripled their risk. Obviously, the effects of such a study can be vital to cancer prevention. In the United States, more than half of the population over the age of 10 drinks coffee every day, and Dr. MacMahon estimated that more than half of all pancreas cancer could be linked to coffee drinking.

Unlike Dr. MacMahon, who worked backward from existing records, prospective epidemiologists follow large numbers of people into the future. These people are not necessarily ill when the project starts; the epidemiologist simply records their medical histories and their life styles in great detail, then waits to see what happens to them. The waiting is expensive: Hundreds or even thousands of technicians may keep close track of the subjects for decades. But the findings, based upon identical, exhaustively detailed observations of many people over a long period, are especially valuable.

Perhaps the best known of these elaborate projects is the

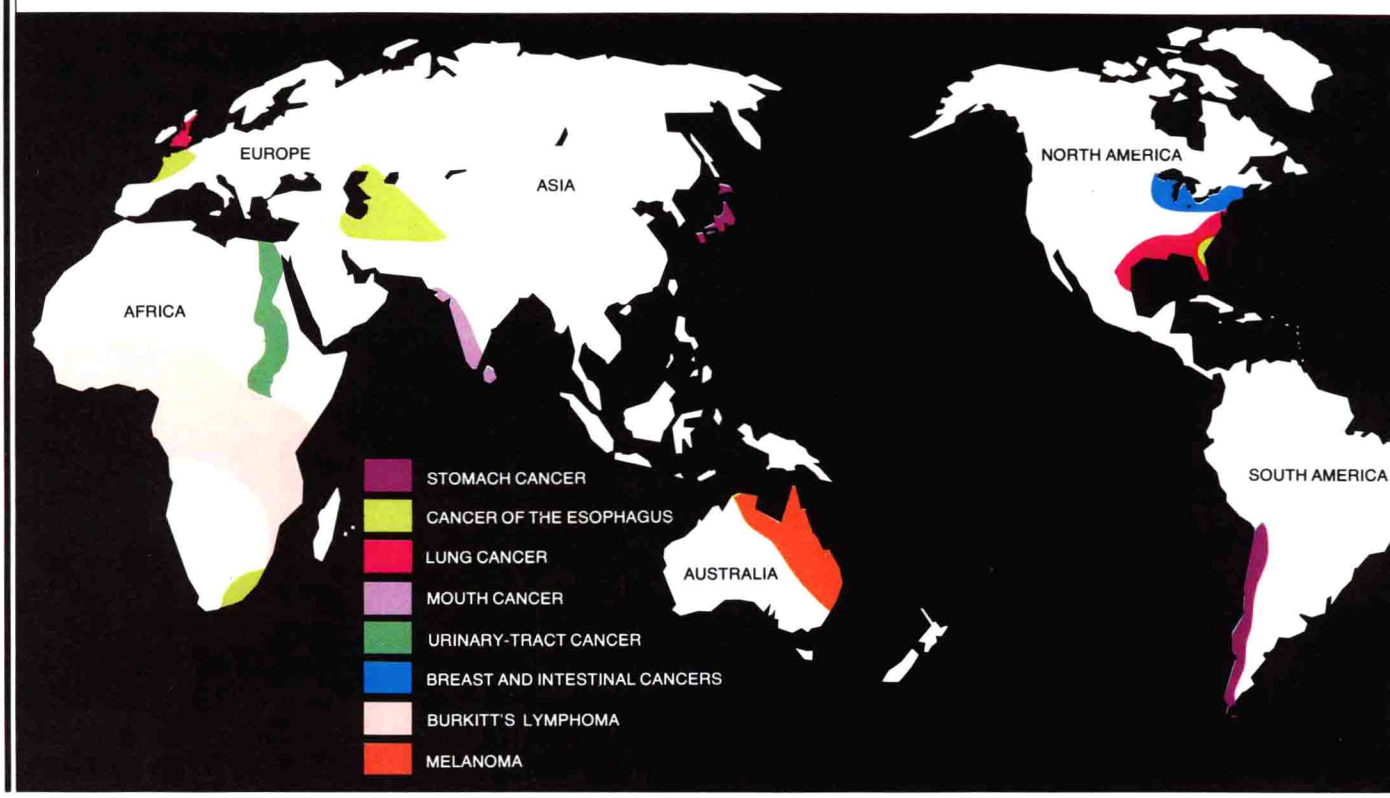
Curious pockets of cancer around the world

Cancer plays favorites: Certain forms strike more virulently in certain places. Although most of these geographical concentrations remain to be explained, they often provide clues to a custom or climate that causes the peculiarly local disease.

One form of cancer traced to specific causes, Burkitt's lymphoma *(pages 104-105)*, is linked to environment. Six other factors fairly conclusively established as causes of distinctive cancers are illustrated on the following pages. These causes are surprisingly diverse: local foodstuffs or food-preparation techniques, personal habits and a parasite that lives mainly in the Nile River.

Among the most puzzling cancer pockets are those where breast cancer is unusually prevalent. The disease is apparently influenced by many factors—heredity, childbearing, possibly viruses and, according to some authorities, a diet high in fats. None of these suspected causes, however, explains why in all the United States, breast cancer is most common around the Great Lakes.

The concentration of lung cancer in Great Britain and the Southern United States is attributed to cigarette smoking—an almost universal habit—and to industrial pollution in those areas. But no one knows why the states of Georgia and South Carolina should suffer so from esophageal cancer—a widely scattered disease whose suspected causes elsewhere have been isolated. In the Transkei region of South Africa, many Bantu men contract this cancer because, it is speculated, they drink a maize beer that contains a cancer-causing nitrosamine. Alcohol consumption, perhaps in combination with smoking, may be the reason for esophageal cancer in France. And among Iran's nomadic Turkomans, the cause could be their regular fare of sooty bread.



Nine forms of cancer occur with very high incidence in particular places around the globe, a peculiarity that often suggests their causes. Burkitt's lymphoma, a jaw cancer, confined to mosquito-ridden equatorial Africa, is triggered by malaria and other mosquito-borne infections. But in other pockets, causes remain mysterious and cancers overlap.