

CAN YOU PREVENT
CANCER?

**REALISTIC GUIDELINES
FOR DEVELOPING
CANCER-PREVENTIVE
LIFE HABITS**

**The Claire Zellerbach Saroni Tumor Institute of
Mount Zion Hospital and Medical Center, San Francisco**

ERNEST H. ROSENBAUM, M.D.

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Foreword

Hippocrates (ca. 460–370 BC) first described cancer with the terms “carcinos” and “carcinoma” and noted its grave prognosis. He also was the first to describe the general concept of environmental influences on disease by relating what he knew as the four basic elements of fire, air, water, and earth to biologic counterparts that produced the qualities of heat, cold, wetness, and dryness. The first link between cancer and occupational exposure has been ascribed to the observation of scrotal cancer in British chimney sweeps in 1775 by Sir Percival Pott, a practicing English surgeon. Another practicing surgeon, Alton Ochsner, noted the association between cigarette consumption and squamous cell cancer of the lung in men who had served in World War I. Until then, lung cancer was a medical curiosity. A great leap in revealing how the environment relates to cancer took place about two decades ago, when studies of Japanese migrants to the United States were initiated by William Haenszel. The modern recognition that common fatal cancers occur in large part as a result of life-style and other environmental factors and are therefore, in principle, preventable, came in the form of a World Health Organization report by an expert committee in 1964. Much fine tuning of the concept has been done, and much more attempted, in the almost 20 years since that report, but all of the major elements were presented then.

So much for the past. The contributions of environmental factors to cancer causation are well established. Controlling those factors is now the problem at hand, and this book focuses on the two most important persons in the process of controlling cancer: the primary care physician and the person who wants to do everything he or she can to avoid cancer. The primary care physician, through providing services and encouraging behavior modification, can offer first-line cancer control. In addition, there is a broadening public awareness of the role of prevention in determining health outcomes. The public is examining health alternatives and seems willing to assume greater responsibility for individual health care decisions, and the news media are replete with health-related issues.

Traditionally, the clinician's training has been oriented toward the symptomatic patient rather than to the care of well people. Only in the relatively recent past has the concept of disease prevention, as practiced by the public health specialist, been adopted by the clinical practitioner and incorporated into comprehensive patient care. The reason for the change is simple: the primary care physician now assumes responsibility for maintaining the health of his or her patients as well as the responsibility for treating their diseases. This will eventually change the role of the family physician into one

of more participation in clinical research and more history taking oriented toward risk factors for cancer. This, in turn, will lead to individual health-risk appraisals with recommendations for constructive changes on the part of the patient.

The two major arms of cancer prevention are the identification of the contributors to the causes of cancer, usually practiced by epidemiologists and astute clinicians, and the action taken in response to this knowledge, usually enacted by legislative control or preferably by voluntary actions taken on the part of concerned individuals. It is a sobering fact that we could possibly know the cause of every neoplasm and, at the same time, not be able to prevent a single case of cancer. Persons who continue to consume cigarettes, for example, epitomize this potentially tragic situation.

There are several important messages in this volume that come through clearly. First, cancer prevention is a series of several positive actions; taken together, these actions are greater than the sum of their individual components. Second, cancer prevention has not one but two natural constituencies: the primary care physician, whose responsibility is now to keep people well, and those people who have more financial resources and leisure time to devote to staying well. Working together, this combination can create an enormous positive force. Third, everything does not cause cancer, but those things that do should be considered extremely seriously. Substances that might cause cancer (usually reported by the news media from incomplete information) should be carefully con-

sidered but should not excite overreaction. They should, instead, be considered with guarded skepticism because our scientific knowledge is woefully incomplete. Fourth, fundamental research is still required and should be supported with enthusiasm by the public both conceptually and financially. Fifth, cancer is not one disease but hundreds of diseases, each with a personality and endurance of its own. However, three kinds of cancer account for 46% of all human cancers: lung, breast, and large bowel cancer. If every person adopted a prudent anticancer life-style, we could begin reducing the toll of cancer among Americans tomorrow, if not today. These include primary prevention by abstinence from tobacco consumption and adherence to proper diet, coupled with a program of secondary prevention for early detection of breast cancer in women and bowel cancer in men and women.

In summary, this book is edited by a nationally recognized expert in cancer management for the understanding of cancer prevention by primary care physicians and especially for persons who want to be a part of the movement toward helping themselves minimize their risks of getting cancer. Cancer is not an inevitable part of aging or of living. Knowledge and its proper application can go a long way toward helping one stay healthy and free from the disease dreaded most by the American public.

Guy R. Newell

*Director of Cancer Prevention,
Professor of Epidemiology,
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Preface

Of the three most feared diseases in the United States—heart disease, cancer, and stroke—cancer is the most dreaded. According to public opinion polls, Americans fear cancer more than they do war. For over a century scientists have probed for the cause of cancer in hopes of defeating this disease or at least improving the number of cancers that can be cured. The search for a miracle cure, a magic bullet, or a preventive vaccine is by now legend, but so far nothing miraculous has come of it. The cure rate has improved, but cancer is still rampant, striking one in every four Americans. Meanwhile, researchers, philanthropic organizations, private societies, and various government agencies continue the quest.

One of the facts about cancer after more than 30 years of research is that several different factors probably interact to cause cancer: the environment, nutrition and diet, genetics, exposure to viruses, and life-style choices. As more and more information is gathered, it is also clear that many cancers—probably up to 60% to 80%—are preventable. This book addresses the issue of cancer and cancer prevention. My own work with people after they have developed cancer has been the motivating force for helping others to avoid this disease, which often is an unnecessary killer. Many cancers *can* be prevented, primarily through life-style changes and appropriate screening techniques.

We have summarized the latest information available on the various factors known or believed to cause cancer: smoking, diet, and alcohol, environment, genetics, and life-style, which includes sexuality and stress (or the effect of the mind on cancer). Chapter One discusses what cancer is, how it develops, and its probable causes. The succeeding chapters are on each of the cancer-related components, explaining the cancer risk factors and making specific recommendations with health guidelines for prevention.

The sources for this information have been the latest research findings on cancer reported in medical journals and at medical conferences as well as recommendations from the Committee on Diet, Nutrition and Cancer (National Life-Sciences Council), the U.S. Senate Committee on Nutrition and Human Needs, the McGovern Committee, and the yearly United States Surgeon General's report on smoking, especially *The Health Consequences of Smoking for Women* and *The Health Consequences of Smoking: Cancer*.

Analysis of the vast amount of data gathered so far pinpoints two factors that probably contribute to over 50% of the cancers today—smoking and diet. Other known contributing factors appear to be immoderate use of alcohol, overexposure to sunlight, and exposure to other environmental factors, including chemicals, in-

dustrial wastes, and radiation, in our occupations and in our homes.

On the whole, it appears that our affluence—our “good” way of life—is the major contributor to the high death rates we have from cancer, as well as heart disease, stroke, emphysema, and obesity. The enemy, it seems, is us. The “miracle cure” for cancer available to all of us turns out to be *prevention*—our own ability to make the right choices in our nutrition, our smoking and drinking habits, and our other life-style behaviors.

The public is bombarded daily with stories and articles, amounting to a fear campaign, that state we live in a sea of carcinogens. People inundated by this media campaign question whether it is really worthwhile to change some of their daily habits of drinking, eating, and smoking to save their lives when they are surrounded by cancer-causing agents they cannot control. Many people say it's just not worth the effort. Therefore, it is important that we be not only convincing but factual as well. Unfortunately, all the facts on cancer causation are not yet in. There has to be some meeting ground between the two opposing sides: the one that says everything causes cancer so why try, and the other that believes there are preventive measures against cancer that work. We take the second side and believe preventive measures do exist. This book presents a sequence of data to help the person who wishes to make some changes to reduce his or her cancer risk factors and thus avoid illness and possible death from a disease that may largely be preventable. The topic is highly emotional, inflamed on all sides by those who participate in this “game of life.”

Until we unlock some of the secrets of why one of two similar people gets cancer and the other does not and until we can understand the genetic patterns better, we are going to have to use general guidelines involving avoidance of certain substances, products, or chemicals, as well as recommend efforts to reduce the risks and alter our life-styles. It will not be as simple

as John Snow turning off the Broad Street pump valve in 1849 in London, thus stopping sewage-contaminated water from infecting that part of the city with cholera. Snow had found the exact cause of the cholera epidemic, and by removing the offending agent, he cut off the source of further infection.

Solving the riddle of cancer has certainly not been easy, since there are hundreds of different forms of cancer. Just as is the case with cancer, cholera did not occur in everyone who drank water from the Broad Street pump because some people had a certain “internal resistance” to cholera. There is also a genetic resistance in many people against cancer, which we do not yet understand.

Sometimes, epidemiologists* can broadly determine what substances or exposures cause cancer by analyzing populations exposed to certain agents and comparing them to others. An association between certain viruses and specific types of cancer has been found, but whether the virus itself causes the cancer is still unknown. Looking at the data of the American Cancer Society, we note *there is an increase in the general cancer rate, but this is primarily a result of smoking*. If one examines age-adjusted death rates and removes smoking and the subsequent increase in lung cancer, one can see a general improvement in the cure rates for cancer. In other words, there has been no recent epidemic of cancer.

Since each chapter is a unit unto itself, there is some necessary overlap of information. However, the purpose of this book is to clear up as much confusion about cancer as possible, to dispel fear, and to provide a practical approach to help prevent cancer.

*Those whose job is to search and analyze the association and causes of cancer—the “cancer detectives.”

Ernest H. Rosenbaum

The list of terms below are included to help the reader understand some common cancer concepts; other terms can be found in the glossary at the end of the book.

benign	A tumor that is not malignant.	epidemiology	The study of a disease and its relationship to other diseases through such factors as cause, rate or occurrence, and distribution in a human community.
cancer	The proliferation of malignant cells that have the capability for tissue or organ invasion.	malignant	Having the potentiality of being lethal if not successfully treated; all cancers are malignant by definition.
carcinogen	A cancer-producing agent or substance.	metastases	The spread of cancer from one part of the body to another; cells in the new cancer are like those in the original tumor.
carcinoma	A cancer that begins in tissue lining, an organ, or duct.	mutagen	A factor that can make a normal cell transform into a malignant cell.
cocarcinogen	An agent that increases the effect of carcinogens.		

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CHAPTER 1

An Overview of Cancer and Cancer Prevention

Prevention is so much better than healing because it saves the labor of being sick.

THOMAS ADAMS

17th-century physician

ERNEST H. ROSENBAUM

When the disease is cancer, prevention is particularly desirable—you can avoid a disease that alters your life and is debilitating, potentially painful, costly to treat, and fatal in 50% of cases. Most people believe that either avoiding or getting cancer is something outside of their personal control. Cancer is often viewed as a thunderbolt of fate, striking at random with no cure or cause. This is *not* true. Many effective ways of treating cancer now exist, and more are being researched all the time. We also know more about the causes of cancer and that certain substances or life-style habits greatly increase the risk of cancer or actually cause cancer. Thus individuals can take specific steps to reduce their risk of cancer.

Oddly enough, there is a growing body of scientific information that has in itself led to confusion and even despair on the part of many people. "Why bother?" asked a young male friend. "Every day you read about something else that causes cancer. It's too much, so I don't even think or worry about it any more." Many people have come to share this attitude: if it isn't the saccharin *in* the coffee, it's the coffee; if it's not the nitrates in hot dogs, it's the nitro-

samines in beer. These are all substances about which the media have warned, and it is no wonder that the average person feels confused and helpless.

The other side of the coin is that current American Cancer Society data already state that we can improve the cure rate this year by approximately 10%—more than 100,000 lives can be saved by using some of the already known and accepted prevention principles (see Table 1-1).

In this book experts in cancer treatment and prevention discuss various aspects of cancer so that you can learn what scientists currently know about cancer, including the possible causes and means of prevention. The basic belief of these experts is that you can make choices that will help protect you from cancer. Simply put, the risk of cancer can be significantly reduced by taking practical, straightforward steps. But before discussing how to protect yourself against cancer, we need to look more closely at the sources of the confusion that most people have about what does and does not cause cancer.

Sometime during the 1970s the World Health Organization announced that medical science had conquered smallpox—a deadly disease that

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TABLE 1-1 Estimate of preventable cancers (1980)

Association	Site	Incidence	Preventable
Cigarette smoking plus alcohol	Lung and larynx	90,000	80,000
	Head and neck and esophagus	13,500	8500
Industrial exposure	Bladder	9000	5000
Diet	Breast	30,000	10,000
	Colon	30,000	10,000
Sex	Cervix	7500	7500
Sunlight	Melanoma and other skin	5000	1500
Total		185,000	122,500

Modified by Guy Newell and based on National Cancer Institute data (Schneiderman).

had killed and disfigured people all over the world for generations. This worldwide major medical triumph was briefly mentioned in a half-column notice in a major New York paper; other papers gave the good news about the same notice. However, in March 1981 the *New England Journal of Medicine* carried an article by several researchers that indicated an *association* between coffee consumption and pancreatic cancer. These scientific findings were presented with *due restraint*, which was not true of the media coverage that followed. The original tentative findings were reported on the covers of major magazines, the front pages of newspapers, and on television news programs. Any caution about the research results was deleted, and coffee was directly linked as a cause of pancreatic cancer. This relationship has thus far *not* been verified or confirmed.

The finding of some association between coffee drinking and pancreatic cancer certainly deserves *follow-up research* to prove or disprove any actual relationship. In the meantime the general public thinks that coffee causes cancer because of the overblown media coverage on a preliminary research report. The same hype has occurred with other substances. Calum S. Muir, a noted epidemiologist, sums up this media perversity: "Good news is no news, and bad news is good news." In this case the good

news that was no news was the conquest of smallpox. The bad news that became such "good" news was the *association* between pancreatic cancer and a popular American drink, coffee.

This astute Scottish physician goes on to describe the entire process:

A new risk is discovered. There is a scientific paper which appears after peer review and it is full of the normal caveats and cautions, needs to be repeated, etc. Then increasingly frequently there is a press or television conference in which these entirely proper warnings about the findings are thrown to the winds. There is public alarm, and then after a while, the public begins to think, 'You know, these people keep telling us that this is dangerous, that's dangerous, and then I just don't believe it.'

Muir's analysis was borne out by a study reported in the July 1982 *New England Journal of Medicine*. More than 500 randomly selected subjects were questioned about their coffee-drinking habits. Of the 70% who were coffee drinkers, only one person had specifically reduced coffee consumption because of the findings linking coffee to pancreatic cancer, although 50% had heard about the reputed findings.

The unfortunate result of these overblown false alarms is that they take away from the truth of what is, in fact, known about cancer. For example, although it is now a scientific fact

that smoking is linked directly to lung cancer, some people still reject this as speculative theory or a mere alarmist approach. They disregard this fact that may have life-or-death consequences for them.

To be able to make intelligent life-style choices, people must first have good information. They have to be able to sort out the latest media hype from basic sound knowledge. This is not always easy because new findings are turning up every day, and some are tentative and some certain. Yet the truth is that cancer remains in many ways a mystery even to those deeply involved in studying it. Despite any mysteries of cancer that remain, we currently know enough about cancer to establish workable guidelines for risk reduction. We know that certain habits or exposures either cause or encourage the risk of cancer. We also have many working theories about what cancer is and how it operates.

WHAT IS CANCER?

To discuss what cancer is, we first need to understand the term. When they hear the word "cancer," most people think of a single disease, such as measles or whooping cough. In fact, the term "cancer" is used to refer to more than 200 diseases that can originate in any cell or organ in the body. But all cancers do have something in common: they always involve the production of abnormal cells that are capable of irregular, independent growth and that invade healthy body tissue.

It is this malignant, uncontrolled, and invasive growth of normal, healthy cells that make cancer what it is, no matter where it occurs. Cancers that arise in different parts of the body are given different names, such as lung cancer and breast cancer. But there can be different types of cancer with different characteristics in one location, such as several kinds of breast cancer or lung cancer.

Cancer appears as tumors in the body, but

not all tumors are malignant or cancerous. Tumors are abnormal masses of tissue, and they can appear anywhere in the body. Benign tumors, however, do not invade or destroy surrounding structures or tissues; they remain local. Malignant or cancerous tumors do invade the surrounding tissues, the lymphatic system, or the bloodstream and thus may spread to distant areas of the body.

Specific cancers are named for the body tissues in which they originate. Three general categories are:

1. **Sarcomas**, which arise from bone and soft or fibrous tissues such as muscles, or blood vessels
2. **Carcinomas**, which arise from the epithelium—the cells that make up the skin and lining of the body organs—including lung, breast, ovarian, colon, pancreatic, and cervical cancers
3. **Leukemias and lymphomas**, which arise from the blood cells of the bone marrow or lymph node cells

Treatment of cancer can start as soon as a malignant tumor is discovered, the extent evaluated (staged), and the type properly defined. However, a tumor has to be roughly the size of a pea—approximately 1 centimeter ($\frac{3}{8}$ inch) in diameter—for it to show up on an x-ray film or in a careful physical examination. By the time a cancer has become this size, it has been around for some time; this is what creates many of the problems. The indirect cause of these problems is the delay between the time when a tumor starts and the time it finally becomes noticeable, using current techniques. Cancer starts with one abnormal cell that divides, becoming two cancerous cells. These two cells divide, becoming four; the four become eight, the eight sixteen, and so on. It may take from 1 to 5 years for this duplication process to take place 20 times to the point where the tumor contains 1 million cells. By this time, after being in the body for up to 5 years, the cancerous tumor is still only the size of a pinpoint and weighs only 1/100 of a gram (35/100,000 ounce).

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A tumor this size is still too small to be detectable, but not too small to spread the disease. While it has been growing, the tumor may have been releasing cancer cells. Hundreds of thousands of these cancerous cells may spread to other parts of the body, or *metastasize*. Fortunately, many of these metastasized cells die. Because they do not implant—like a seed that does not grow—they do not actually become cancers when they reach another part of the body. Some may become implanted, however, and grow; this means cancer has started developing in another location in the body.

It is only by the time that the original cell has divided 30 times that the tumor has reached pea size and so may be detected by an x-ray film or a good physical examination. Cancers that start in the abdomen or chest cavity have to grow even larger, to a size that will cause both interference with organ function and some symptoms before they are suspected. This is why cancers in these locations are usually detected late and are more difficult to treat successfully. *Successful treatment is linked to early detection.*

Since cancer always involves the production of *abnormal* cells, the essential question is what makes that first cell become cancerous and start duplicating itself. In other words, what causes cancerous growth to begin from a normal cell? Despite several differing theories about what causes this, the experts agree on some points. For a cell to become cancerous, some basic change has to take place in its genetic code (DNA—deoxyribonucleic acid). The genetic change is then transmitted to the newborn cells. A limited analogy might be that of a pattern used for stamping out cookies. Once the pattern is changed, all subsequent cookies are changed. The DNA of a cell holds the cell's genetic code or pattern. DNA is a protein that makes up the chromosomes, tiny threads in a cell nucleus that contain genes. The genes are where the genetic pattern or information of a cell is located, and it is here that a change takes place. About 15 readily identified genes are

known to cause cancer. These are *transforming genes* or *cancer (onco-) genes*, since they can transform laboratory tissue cells into a cancerous state as compared to normal cells. Recent research thus suggests that we all have normal cells in our body containing *oncogenes*, which are inactive. Following certain cellular assaults, stimuli or chemical agents may “turn on” a genetic “light switch” that will activate these genes and thus transform a normal cell into a cancerous cell.

For example, the MYC gene, found in cancers of chickens, has been identified in the chromosomes of a patient with Burkitt's lymphoma (the cancer of the lymphatic system common in equatorial regions of Africa). This may represent an important step in identifying gene/chromosome changes that make a normal cell turn into cancer. Thus a gene known to be involved in cancer of birds, has been linked to human cancer.

The change from a normal cell to a malignancy is thought to be a two-step process. First, the DNA is somehow initially changed. Then a second, more decisive change takes place in the DNA that transforms the now receptive cell into an actual tumor cell. This explains the diagnostic value of the Pap smear for cervical cancer. The smear can reveal abnormal cells (dysplasia) before they have become cancerous. These suspicious cells serve as an early warning sign of cancer potential, which indicates a need for more frequent medical checkups.

But what causes these changes in the cellular DNA in the first place? Cancers may develop from perfectly normal cells, and until recently scientists believed that a normal cell became cancerous after receiving multiple injuries over a period of years. These assaults, known as *hits* or *insults*, were thought to work like the proverbial straws on a camel's back; they accumulate over the years until the final straw—the one that breaks the camel's back—hits the cell and causes a transition to a malignant cell. The cell then abandons its original genetic pattern and

grows independently and irregularly, invading surrounding healthy tissue.

Dr. Takeo Kakunaga reported at the Thirteenth International Cancer Conference in Seattle in September 1982 that chemicals could transform a normal cell into cancer by a genetic DNA mutation. He observed more than 20 different proteins in the induced cancerous cells of laboratory mice, which are believed to result from gene (chromosomal) alterations. Thus a genetic, *molecular event at the gene level* occurred, with progression into a cancer cell. This suggests that events changing a normal cell into cancer may be caused by a series of chemical mutations.

Traditionally, cancers are believed to take long periods to develop, from 1, 10 to 30, or more years. Thus there may be a time lag between the accumulating hits or exposures and the changeover to actual malignant growth. This makes it difficult to pinpoint the agents that cause the cancer to occur. In addition to the multiple-hit theory, cancers have been caused in animals by exposure to certain viruses. This suggests that viruses may also play a role in human cancer, but only one virus so far has been shown to have a direct causal relationship to cancer in humans, the *Epstein-Barr virus*. However, other viruses have been associated with certain cancers in humans. Five DNA viruses are now being linked to human malignancy, including the hepatitis B virus, cytomegalovirus, herpesvirus (both I and II), and the papilloma virus. Current evidence involving viruses is discussed in Chapter 10.

Recently, there has also been some evidence that a single assault on a cell can cause cancerous change. According to this view, it may be possible that a "single carcinogenic bullet" hitting a cell in the appropriate spot can change the cell so that it is genetically susceptible to cancer or becomes cancerous.

These three theories—the multiple hit, the viral cause, and the single hit—all differ, yet it is possible that they are all correct. There are

also many other mechanisms and theories currently being evaluated by research. It is highly unlikely that research will ever unearth a single cause or cure because there are so many types of cancer. This does not mean, however, that most cancers cannot be effectively prevented, treated, and cured. Proof of this is that the cure rate for cancer has been improving steadily since 1930, when it was 20%. The current cure rate is now at 50%.

To dwell on what is unknown about cancer is to open the door for speculation about the causes and cures for cancer, with wilder claims such as cancer being contagious or being caused by use of aluminum cookware, neither of which is true. The advance in the cure rate has been matched by an increase in reliable knowledge about substances and exposures that can lead to increased risk of cancer and specific substances that are *carcinogens*, or cancer-causing agents. Some understanding of how scientists track down a definite relationship between a particular agent and cancer can help you develop confidence in the results of scientific findings.

HOW WE KNOW WHAT WE KNOW

In 1775 a physician named Percival Pott studied the abnormally high incidence of scrotal cancer among London chimney sweeps. He described these young men and boys "thrust up narrow and sometimes hot chimneys, where they are bruised, burned and almost suffocated; and when they get to puberty, become particularly liable to a noisome, painful, and fatal disease," scrotal cancer. The sweeps often worked naked, rarely bathed, and were full of soot, especially in their groin areas. Pott concluded that the soot was the cause of their scrotal cancer.

In 1915, 140 years after Pott published his observations, Drs. Katsu Saburo Yamagiwa and Koichi Ichikawa at the Imperial University of Tokyo tested the effects of coal tar on the ears of rabbits. Cancer developed on the tar-