Lifetime Physical Fitness & Wellness
A Personalized Program

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“Our science looks at a substance-by-substance exposure and doesn’t take into account the multitude of exposures we experience in daily life. If we did, it might change our risk paradigm. The potential risks associated with extremely low-level exposure may be underestimated or missed entirely.”

Heather Logan

Objectives

▶ Define cancer and understand how it starts and spreads.
▶ Cite guidelines for preventing cancer.
▶ Delineate the major risk factors that lead to specific types of cancer.
▶ Assess the risk for developing certain types of cancer.
▶ Learn everyday lifestyle strategies that you can use immediately to decrease overall cancer risk.

Visit www.cengagebrain.com to access course materials and companion resources for this text including quiz questions designed to check your understanding of the chapter contents. See the preface on page xv for more information.
Can a healthy diet reduce cancer risk? Much research is currently under way to examine the effects of foods in preventing and fighting off cancer. There is strong scientific evidence that a healthy diet and maintenance of recommended body weight reduce cancer risk. The current state of knowledge, however, cannot indicate that a certain dietary pattern will absolutely reduce your cancer risk. Years of research will be required to unravel most of this knowledge. Moreover, science may never be able to provide conclusive evidence that a certain diet will prevent cancer in most cases. Many of the foods that are currently recommended in a cancer-prevention diet, nonetheless, are similar to those encouraged to decrease disease risk and enhance health and overall well-being. If you are truly adhering to healthy dietary guidelines (see the Behavior Modification Planning box on page 370), you are most likely eating the right foods to decrease your cancer risk.

Does regular physical activity affect cancer risk? Regular physical activity has been shown to decrease the risk for developing certain types of cancer, in particular cancers of the colon, breast, endometrium, and prostate gland. Research shows that as little as 15 minutes of exercise three times per week decreases breast cancer risk by up to 40 percent in persons of all races and ethnicities. Other research suggests that strength training at least twice per week cuts the risk of dying from cancer in men up to 40 percent. Physical activity also prevents type 2 diabetes and obesity. The latter have been linked to colon, pancreatic, gallbladder, ovarian, thyroid, cervical, and possibly other types of cancers. The American Cancer Society recommends that you aim for at least 30 minutes of moderate to vigorous physical activity five or more days per week, although 60 to 90 minutes of intentional activity are preferable. For most non–tobacco users, a healthy dietary pattern and regular physical activity are the two most significant lifestyle behaviors that reduce cancer risk.

Does aspirin therapy protect against cancer? A 2011 study published in the journal The Lancet indicated that a regular daily dose of aspirin may decrease cancer risk up to 58 percent in some cases (esophageal cancer) and reduced total cancer deaths by 34 percent after 5 years. Even 15 years later, death rates were still lower by 20 percent among aspirin users with the biggest drop in cancer deaths seen in esophageal, colorectal, lung, and prostate cancers. Low-dose therapy (75 to 81 mg) was as effective as a larger dose. It is believed that aspirin inhibits the effects of enzymes (COX-2) that promote potential cancer-causing cell damage. Aspirin also decreases low-grade inflammation, thought to play a role in cancer development and growth. Aspirin therapy, however, is not recommended for healthy people because of the small risk of gastrointestinal (GI) bleeding and ulcers. About 50,000 yearly deaths in the United States are attributed to GI bleeding caused partially by aspirin and other nonsteroidal anti-inflammatory drug (NSAID) use. Aspirin-therapy damage to the GI tract may not cause any noticeable symptoms and a fecal occult blood test may be necessary to detect possible bleeding. Hemorrhagic strokes have also been linked to low-dose aspirin therapy. If you are at high risk for cancer (and cardiovascular disease), you are encouraged to talk to your doctor before starting aspirin therapy. If you take aspirin, do so with warm water as such helps dissolve the tablet faster, making it less likely to cause serious bleeding.

Real Life Story  
Karen’s Experience

I always disliked how my skin would get pale in the winter because I know I looked better with a tan. During the summer, my friends and I would lay out by the pool in our bathing suits. We wouldn’t even mind if we got a little sunburned, because we would just say “the burn will turn into a tan!” Before our senior prom, we all went to the tanning salon and used the tanning beds. I never thought anything of it, because that’s what everyone was doing. But then my older sister was diagnosed with melanoma, a deadly form of skin cancer. She was only in her early thirties. It turns out that the repeated sunburns she had gotten in the past, and the fact that she spent a lot of time hiking and doing other outdoor activities without ever using sunscreen, had caught up with her. She had to have surgery and go through six months of treatments that made her feel like she had the flu and caused a lot of her hair to fall out. It was a really scary time for our entire family: We didn’t know if she would live. Thankfully, my sister recovered. Now, everyone in our family tries to spread the word about sun safety and reducing the risk of skin cancer. My friends now call me the “sunblock police,” because I am always reminding everyone to use sunscreen when we are out in the sun for an extended period of time. People may think that a tan looks good, but in the end it is just not worth the risk of getting cancer.
Under normal conditions, the 100 trillion cells in the human body reproduce themselves in an orderly way. Cell growth (cell reproduction) takes place to repair and replace old, worn-out tissue. Cell growth is controlled by deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), found in the nucleus of each cell. When nuclei lose their ability to regulate and control cell growth, cell division is disrupted and mutant cells can develop (see Figure 11.1). Some of these cells might grow uncontrollably and abnormally, forming a mass of tissue called a tumor, which can be either benign or malignant. Benign tumors do not invade other tissues. Although they can interfere with normal bodily functions, they rarely cause death. A malignant tumor is a cancer. More than 100 types of cancer can develop in any tissue or organ of the human body.

The process of cancer actually begins with an alteration in DNA. Within DNA are oncogenes and tumor suppressor genes, which normally work together to repair and replace cells. Defects in these genes—caused by external factors such as radiation, chemicals, and viruses, as well as internal factors such as immune conditions, hormones, and genetic mutations—ultimately allow the cell to grow into a tumor.

A healthy cell can duplicate as many as 100 times in its lifetime. Normally, the DNA molecule is duplicated perfectly during cell division. In the few cases when the DNA molecule is not replicated exactly, specialized enzymes make repairs quickly. Occasionally, however, cells with defective DNA keep dividing and ultimately form a small tumor. As more mutations occur, the altered cells continue to divide and can become malignant. A decade or more might pass between exposure to carcinogens or mutations and the time that cancer is diagnosed.

The process of abnormal cell division is related indirectly to chromosome segments called telomeres (see Figure 11.2). Each time a cell divides, chromosomes lose some telomeres. After many cell divisions, chromosomes eventually run out of telomeres and the cell then invariably dies.

**Key Terms**

- **Deoxyribonucleic acid (DNA)** Genetic substance of which genes are made; molecule that contains cell’s genetic code.
- **Ribonucleic acid (RNA)** Genetic material that guides the formation of cell proteins.
- **Benign** Noncancerous.
- **Malignant** Cancerous.
- **Cancer** Group of diseases characterized by uncontrolled growth and spread of abnormal cells.
- **Oncogenes** Genes that initiate cell division.
- **Suppressor genes** Genes that deactivate the process of cell division.
- **Telomeres** A strand of molecules at both ends of a chromosome.

Human tumors make an enzyme known as telomerase. In cancer cells, telomerase keeps the chromosome from running out of telomeres entirely. The shortened strand of telomeres (see Figure 11.3) now allows cells to reproduce indefinitely, creating a malignant tumor. Telomerase seems to have another function that is still under investigation: After many cell divisions, cancer cells grow old by nature, but telomerase is what apparently keeps them from dying. If scientists can confirm that telomerase plays such a crucial role in forming tumors, research will be directed to finding a way to block the action of telomerase, thereby making cancerous cells die.

Cancer starts with the abnormal growth of one cell, which then can multiply into billions of cancerous cells. A critical turning point in the development of cancer is when a tumor reaches about a million cells. At this stage, it is referred to as carcinoma in situ. The undetected tumor may go for months or years without any significant growth. While it remains encapsulated, it does not pose a serious threat to human health. To grow, however, the tumor requires more oxygen and nutrients.

In time, a few of the cancer cells start producing chemicals that enhance angiogenesis, or capillary (blood vessel) formation into the tumor. Angiogenesis is the precursor of metastasis. Through the new blood vessels formed by angiogenesis, cancerous cells now can break away from a malignant tumor and migrate to other parts of the body, where they can cause new cancer (Figure 11.4).

Most adults have precancerous or cancerous cells in their bodies. By middle age, our bodies contain millions of precancerous cells. The immune system and blood turbulence destroy most cancer cells, but only one abnormal cell lodging elsewhere is enough to start a new cancer. These cells grow and multiply uncontrollably, invading and destroying normal tissue. The rate at which cancer cells grow varies from one type to another. Some types grow fast, and others take years.
Once cancer cells metastasize, treatment becomes more difficult. Although therapy can kill most cancer cells, a few cells might become resistant to treatment. These cells then can grow into a new tumor that will not respond to the same treatment.

Incidence of Cancer

According to the most recent mortality statistics from the National Center for Health Statistics, cancer causes about 23 percent of all deaths in the United States. It is the second leading cause of death in the country and the leading cause in children between ages 1 and 14. The major contributor to the increase in incidence of cancer during the last five decades is lung cancer. Tobacco use alone is responsible for 30 percent of all deaths from cancer. Another third of all deaths from cancer are related to unhealthy nutrition, physical inactivity, and excessive body weight (fat). Death rates for most major cancer sites are declining, except lung cancer in women (see Figure 11.5).

Worldwide, experts predict that cancer will be the number one cause of death in the near future. This rise in cancer deaths is due primarily to the large increase in tobacco use in developing countries, particularly in India and China, home to 40 percent of the world’s smokers.

Cancer will develop in approximately 1 of every 2 men and 1 of 3 women in the United States, affecting approximately 3 of every 4 families. About 570,000 Americans died from cancer in 2010, and approximately 1.5 million new cases were diagnosed that same year. The incidence of cancer is higher in African Americans than in any other racial or ethnic group. Statistical estimates of the incidence of cancer and deaths by sex and site for the year 2010 are given in Figure 11.6. These estimates exclude nonmelanoma skin cancer and carcinoma in situ.

Critical Thinking

Have you ever had, or do you now have, any family members with cancer? • Can you identify lifestyle or environmental factors as possible contributors to the disease? • If not, are you concerned about your genetic predisposition, and, if so, are you making lifestyle changes to decrease your risk?

Like coronary heart disease, cancer is largely preventable. As much as 80 percent of all human cancer is related to lifestyle or environmental factors. The American Cancer Society released updated guidelines on nutrition and physical activity for cancer prevention. These guidelines recommend that people:

1. Maintain healthy body weight throughout life
2. Adopt a physically active lifestyle

Key Terms

Telomerase An enzyme that allows cells to reproduce indefinitely.

Carcinoma in situ Encapsulated malignant tumor that has not spread.

Angiogenesis Formation of blood vessels (capillaries).

Metastasis The movement of cells from one part of the body to another.

Nonmelanoma skin cancer Cancer that spreads or grows at the original site but does not metastasize to other regions of the body.
3. Adopt a healthy diet
4. Limit alcohol consumption if they drink alcoholic beverages

Additional existing general guidelines for cancer prevention for several decades now indicate that people should not use tobacco in any form (and limit exposure to secondhand smoke) and avoid exposure to occupational hazards (see Figure 11.7). Most cancers could be prevented by following the previously listed positive lifestyle habits and reducing environmental contaminants that may cause cancer (see box on the next page).

Research sponsored by the American Cancer Society and the National Cancer Institute showed that individuals who have a healthy lifestyle have some of the lowest cancer mortality rates ever reported in scientific studies. In a landmark study, a group of about 10,000 members of the Church of Jesus Christ of Latter-day Saints (commonly referred to as the Mormon church) in California was reported to have only about one-third (men) to one-half (women) the rate of cancer mortality of the general white population3 (see Figure 11.8). In this study, the investigators looked at three general health habits in the participants: lifetime abstinence from smoking, regular physical activity, and sufficient sleep. Healthy lifestyle guidelines (encouraged by the church since 1833) include abstaining from all forms of tobacco, alcohol, and drugs, and adhering to a well-balanced diet based on grains, fruits, and vegetables, and moderate amounts of poultry and red meat.

Additional 2009 data from more than 23,000 German participants indicated that people who never smoked, had a BMI lower than 30, exercised at least 3.5 hours per week, and consumed a diet rich in fruits and vege-

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**Figure 11.6** Year 2010 estimated cancer incidence and deaths by site and sex.

**Figure 11.7** Your estimates of the relative role of the major cancer-causing factors.

<table>
<thead>
<tr>
<th>Male Cancer Cases and Deaths By Site</th>
<th>Female Cancer Cases and Deaths By Site</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cases</strong></td>
<td><strong>Deaths</strong></td>
</tr>
<tr>
<td>Prostate — 217,730 (28%)</td>
<td>Lung &amp; bronchus — 62,220 (29%)</td>
</tr>
<tr>
<td>Lung &amp; bronchus — 116,750 (15%)</td>
<td>Prostate — 32,050 (11%)</td>
</tr>
<tr>
<td>Colon &amp; rectum — 72,090 (9%)</td>
<td>Colon &amp; rectum — 26,580 (9%)</td>
</tr>
<tr>
<td>Urinary bladder — 52,760 (7%)</td>
<td>Pancreas — 18,770 (6%)</td>
</tr>
<tr>
<td>Melanoma of the skin — 38,870 (5%)</td>
<td>Liver &amp; intrahepatic bile duct — 12,720 (4%)</td>
</tr>
<tr>
<td>Non-Hodgkin’s lymphoma — 35,380 (4%)</td>
<td>Leukemia — 12,660 (4%)</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis — 35,370 (4%)</td>
<td>Esophagus — 11,650 (4%)</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx — 25,420 (3%)</td>
<td>Non-Hodgkin’s lymphoma — 10,710 (4%)</td>
</tr>
<tr>
<td>Leukemia — 24,690 (3%)</td>
<td>Urinary bladder — 10,410 (3%)</td>
</tr>
<tr>
<td>Pancreas — 21,370 (3%)</td>
<td>Kidney &amp; renal pelvis — 8,210 (3%)</td>
</tr>
<tr>
<td><strong>All sites — 789,620 (100%)</strong></td>
<td><strong>All sites — 299,200 (100%)</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Cases</strong></th>
<th><strong>Deaths</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast — 207,090 (28%)</td>
<td>Lung &amp; bronchus — 71,080 (26%)</td>
</tr>
<tr>
<td>Lung &amp; bronchus — 105,770 (14%)</td>
<td>Breast — 39,840 (15%)</td>
</tr>
<tr>
<td>Colon &amp; rectum — 70,400 (10%)</td>
<td>Colon &amp; rectum — 24,790 (9%)</td>
</tr>
<tr>
<td>Uterine corpus — 43,470 (6%)</td>
<td>Pancreas — 18,030 (7%)</td>
</tr>
<tr>
<td>Thyroid — 33,930 (5%)</td>
<td>Ovary — 13,850 (5%)</td>
</tr>
<tr>
<td>Non-Hodgkin’s lymphoma — 30,160 (4%)</td>
<td>Non-Hodgkin’s lymphoma — 9,500 (4%)</td>
</tr>
<tr>
<td>Melanoma of the skin — 29,260 (4%)</td>
<td>Leukemia — 9,180 (3%)</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis — 22,870 (3%)</td>
<td>Leukemia corpus — 7,950 (3%)</td>
</tr>
<tr>
<td>Ovary — 21,880 (3%)</td>
<td>Liver &amp; intrahepatic bile duct — 6,190 (2%)</td>
</tr>
<tr>
<td>Pancreas — 21,770 (3%)</td>
<td>Brain &amp; other nervous system — 5,720 (2%)</td>
</tr>
<tr>
<td><strong>All sites — 739,940 (100%)</strong></td>
<td><strong>All sites — 270,290 (100%)</strong></td>
</tr>
</tbody>
</table>

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.

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3. Adopt a healthy diet
4. Limit alcohol consumption if they drink alcoholic beverages

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.
Reducing Environmental Contaminants that May Cause Cancer

Since its creation in 1971, the U. S. President’s Cancer Panel monitors exposure by the public to potential environmental cancer risks in daily life. The public remains by and large unaware of most of these widespread and underestimated risks, factors that are critical in any cancer prevention efforts. Exposure to environmental contaminants pose a threat to health because they may alter or interfere with a variety of biologic processes. Among the recommendations released in 2010 by the presidential panel are:

1. Filter tap water or well water and whenever possible use filtered water instead of commercially bottled water.
2. Properly dispose of pharmaceuticals, household chemicals, paints, and other products to minimize drinking water and soil contamination.
3. Eliminate exposure to secondhand smoke (and tobacco use in general).
4. Use stainless steel, glass or BPA-free plastic water bottles.
5. Microwave in ceramic or glass instead of plastic containers.
6. Remove shoes before entering a home to avoid bringing in toxic chemicals, including pesticides.
7. Limit the consumption of food that is grown with pesticides and meats from animals raised with antibiotics and growth hormones.
8. Limit the consumption of processed, charred, or well-done meats which are high in heterocyclic amines and polyaromatic hydrocarbons.
9. Practice safe-sun exposure and avoid over exposure to ultraviolet light when the sunlight is most intense.
10. Reduce radiation exposure (X-rays) from medical sources.
11. Avoid exposure to three highly carcinogenic chemicals: formaldehyde, benzene, and radon.*
12. Use headsets and text, instead of talking on cell phones, and keep cell-phone calls brief to reduce exposure to electromagnetic energy. Although not scientifically proven, there is concern that frequent exposure to electromagnetic energy from cell phone use increases cancer risk.
13. Contaminant exposure in children is of significant concern because per pound of body weight they take in more food, water, air, and other substances than adults do. Toxic chemicals remain active longer in their developing brain and organs, placing them at far greater risk through chemical exposure.

*Formaldehyde is used in particle board, plywood, carpet, draperies, foam insulation, furniture, toiletries, and permanent press fabrics. Exposure is highest when newly installed. Benzene exposure is widespread and found primarily in vehicle exhaust. Radon exposure, which forms naturally and collects in homes, should be checked on a regular basis.

Equally important is that approximately 11.4 million Americans with a history of cancer were alive in 2010. Currently, 6 in 10 people diagnosed with cancer are expected to be alive five years after their initial diagnosis.\(^5\)

Guidelines for Preventing Cancer

The biggest factor in fighting cancer today is health education. People need to be informed about the risk factors for cancer and the guidelines for early detection. The most effective way to protect against cancer is to change negative lifestyle habits and behaviors. Following are some guidelines for preventing cancer. For most Americans who do not use tobacco, increased physical activity and dietary choices are the most important modifiable risk factors.

Dietary Changes

The American Cancer Society estimates that one-third of all cancer in the United States is related to nutrition and lack of physical activity. A healthy diet, therefore, is crucial to decrease the risk for cancer. The diet should be...
Predominately vegetarian. **Cruciferous vegetables**, tea, vitamin D, soy products, calcium, and omega-3 fats are encouraged. If alcohol is used, it should be used in moderation. Obesity should be avoided.

Green and dark yellow vegetables, cruciferous vegetables (cauliflower, broccoli, cabbage, brussels sprouts, and kohlrabi), and beans (legumes) seem to protect against cancer. Folate—found naturally in dark green leafy vegetables, dried beans, and orange juice—may reduce the risk for colon and cervical cancers. Brightly colored fruits and vegetables also contain **carotenoids** and vitamin C. Lycopene, one of the many carotenoids (a phytonutrient—see the following discussion), has been linked to lower risk for cancers of the prostate, colon, and cervix. Lycopene is especially abundant in cooked tomato products.

The evidence for vitamin D in protecting against cancer continues to mount each day. Vitamin D is the most powerful regulator of cell growth and keeps cells from becoming malignant. The protective effect of vitamin D appears to be strongest against breast, colon, and prostate cancers and possibly lung and digestive cancers. You should strive for “safe sun” exposure, that is, 10 to 20 minutes of unprotected sun exposure, on most days of the week between the hours of 10:00 a.m. and 4:00 p.m. For people living in the northern United States and Canada with limited sun exposure during the winter months, a vitamin D3 supplement of up to 2,000 IUs per day is strongly recommended. The cancer-protective benefits of this vitamin have already been discussed in detail in Chapter 3 (see “Vitamin D,” page 103).

Some researchers believe that the antioxidant effect of vitamins and the mineral selenium helps to protect the body. During normal metabolism, most of the oxygen in the human body is converted into stable forms of carbon dioxide and water. A small amount, however, ends up in an unstable form known as oxygen-free radicals, which are thought to attack and damage the cell membrane and DNA, leading to the formation of cancers. Antioxidants are thought to absorb free radicals before they can cause

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Tips for a Healthy Cancer-Fighting Diet

**I. Increase intake of phytonutrients, fiber, cruciferous vegetables, and more antioxidants by**

- Eating a predominantly vegetarian diet
- Eating more fruits and vegetables every day (six to eight servings per day maximize anticancer benefits)
- Increasing the consumption of broccoli, cauliflower, kale, turnips, cabbage, kohlrabi, Brussels sprouts, hot chili peppers, red and green peppers, carrots, sweet potatoes, winter squash, spinach, garlic, onions, strawberries, tomatoes, pineapple, and citrus fruits in your regular diet
- Eating vegetables raw or quickly cooked by steaming or stir-frying
- Substituting tea and fruit and vegetable juices for coffee and soda
- Eating whole-grain breads
- Including calcium in the diet (or from a supplement)
- Including soy products in the diet
- Using whole-wheat flour instead of refined white flour in baking
- Using brown (unpolished) rice instead of white (polished) rice

**II. Limit saturated and trans fats by**

- Using primarily unsaturated fats (olive oil, canola oil, nuts, seeds, avocado, fish, flaxseeds, and flaxseed oil)

**III. Balancing caloric input**

- Balancing caloric input with caloric output to maintain recommended body weight

**Try It** Make a copy of these “Cancer-Fighting Diet” tips and each week incorporate into your lifestyle two additional dietary behaviors from the above list.
Cancer Prevention

Compounds found in fruits and vegetables

Substances that contribute to the formation of cancer by preventing the rapid growth of cells in the colon, especially in people with colon polyps. Potentially cancer-causing compounds formed when nitrites and nitrates, which prevent the growth of harmful bacteria in processed meats, combine with other chemicals in the stomach.

Phytonutrients

Phytonutrients are compounds found in abundance in fruits, vegetables, beans, nuts, and seeds. These nutrients may prevent cancer by blocking the formation of cancerous tumors and perhaps even disrupting the process once it has started. Each plant contains hundreds of phytonutrients. Examples of these nutrients and their effects are found in Table 11.1. To obtain the best possible protection, a minimum of five servings of a variety of fruits and vegetables should be consumed each day. Fruits and vegetables should be consumed several times a day (instead of in one meal) to maintain phytonutrients at effective levels throughout the day. Phytonutrient blood levels drop within 3 hours of consuming foods containing these nutrients.

Fiber

Initial studies linked low intake of fiber to increased risk for colorectal cancer. Recent data, however, have been inconclusive. While high fiber intake may not decrease the risk of colorectal cancer, a high-fiber diet is still encouraged because it decreases the risk for other chronic conditions such as cardiovascular disease and diabetes. Daily consumption of 25 (women) to 38 (men) grams of fiber is recommended. Whole grains are high in fiber and contain vitamins and minerals (folate, selenium, and calcium). Selenium protects against prostate cancer and, possibly, lung cancer. Calcium may protect against colon cancer by preventing the rapid growth of cells in the colon, especially in people with colon polyps.

Table 11.1

<table>
<thead>
<tr>
<th>Phytonutrient</th>
<th>Effect</th>
<th>Good Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulforaphane</td>
<td>Removes carcinogens from cells</td>
<td>Broccoli</td>
</tr>
<tr>
<td>PEITC</td>
<td>Keeps carcinogens from binding to DNA</td>
<td>Broccoli</td>
</tr>
<tr>
<td>Genistein</td>
<td>Prevents small tumors from accessing capillaries to get oxygen and nutrients</td>
<td>Soybeans</td>
</tr>
<tr>
<td>Flavonoids</td>
<td>Helps keep cancer-causing hormones from locking onto cells</td>
<td>Most fruits and vegetables</td>
</tr>
<tr>
<td>p-coumaric and chlorogenic acids</td>
<td>Disrupts the chemical combination of cell molecules that can produce carcinogens</td>
<td>Strawberries, green peppers, tomatoes, pineapple</td>
</tr>
<tr>
<td>Capsaicin</td>
<td>Keeps carcinogens from binding to DNA</td>
<td>Hot chili peppers</td>
</tr>
</tbody>
</table>

Phytonutrient Effect Good Sources

Tea

Polyphenols (a group of phytonutrients) are potent cancer-fighting antioxidants found in fresh fruits and vegetables and many grains. A prime source is tea. Green, black, and red tea all seem to provide protection. Evidence also points to certain components in tea that can block the spread of cancers to other parts of the body. Polyphenols are known to block the formation of nitrosamines and quell the activation of carcinogens. Polyphenols also are thought to fight cancer by shutting off the formation of cancer cells, turning up the body’s natural detoxification defenses, and thereby suppressing progression of the disease. Different types of tea contain different mixtures of polyphenols. White tea appears to have the highest amount, followed by green and black tea. Herbal teas do not provide the same benefits as regular tea.

Observational data on tea-drinking habits in China showed that people who regularly drank green tea had about half the risk for chronic gastritis and stomach cancer, and the risk decreased further as the number of years of drinking green tea increased. In Japan, where people drink green tea regularly but smoke twice as much as people in the United States, the incidence of lung cancer is half that of the United States.

The antioxidant effect of one of the polyphenols in green tea, epigallocatechin gallate, or EGCG, is at least 25 times more effective than vitamin E and 100 times more effective than vitamin C at protecting cells and DNA from damage believed to cause cancer, heart disease, and other diseases associated with free radicals. Other research suggests that green tea inhibits the growth of cancer cells. EGCG also is twice as strong as the red wine antioxidant resveratrol in helping to prevent heart disease.

Many of the benefits of regular tea consumption warrant further investigation. Optimistic results in animal studies are still unclear in humans. Drinking two or more cups of tea daily, preferably white or green, in place of popular high-sugar/nutrient-deficient sodas is encouraged.

Cruciferous vegetables Plants that produce cross-shaped leaves (cauliflower, broccoli, cabbage, Brussels sprouts, kohlrabi), which seem to have a protective effect against cancer.

Carotenoids Pigment substances in plants that are often precursors to vitamin A. More than 600 carotenoids are found in nature, about 50 of which are precursors to vitamin A, the most potent one being beta-carotene.

Phytonutrients Compounds found in fruits and vegetables that block formation of cancerous tumors and disrupt the progress of cancer.

Nitrosamines Potentially cancer-causing compounds formed when nitrites and nitrates, which prevent the growth of harmful bacteria in processed meats, combine with other chemicals in the stomach.

Carcinogens Substances that contribute to the formation of cancers.
Spices
Although still in the early stages, research is uncovering cancer-fighting phytonutrients in many traditional spices. These phytonutrients may alter damaging carcinogenic pathways, provide antioxidant effects, promote cancer-fighting enzymes, decrease inflammation, stimulate the immune system, and suppress the development of tumors. Ginger, oregano, curry, pepper, cloves, fennel, rosemary, and turmeric are all encouraged for use in cooking and at the table.

Sugar
New evidence indicates that frequent consumption of sugar and high-sugar foods may be associated with greater risk for pancreatic cancer, one of the most deadly forms of cancer. Sugar is rapidly absorbed into the blood, quickly raising glucose and insulin levels. Researchers theorize that excessive glucose poisons and kills pancreatic cells, increasing cancer risk. Excessive insulin results in insulin-like growth factor, believed to increase cell proliferation and cancer.

The data showed that people who consumed the most sugar, including creamed fruit, syrup-based drinks, soft drinks, and foods such as coffee, tea, and cereal to which sugar is added had almost a 70 percent higher risk of developing pancreatic cancer compared with those with the lowest sugar consumption. Individuals who drank more than two soft drinks a day almost doubled the risk for pancreatic cancer.

Dietary Fat
Although previously viewed as a risk factor, minimal evidence exists that total fat intake affects cancer risk. There is far greater evidence that being overweight or obese increases cancer risk. Excessive caloric intake leads to weight gain and high fat foods are typically calorie dense. Thus, indirectly, a high-fat diet can increase cancer risk through excessive body weight.

In any healthy diet, fat intake should be primarily monounsaturated and omega-3 polyunsaturated fats (found in flaxseed and several types of cold-water fish). These types of fat seem to offer protection against colorectal, pancreatic, breast, oral, esophageal, and stomach cancers. Omega-3 fats also block the synthesis of prostaglandins, bodily compounds that promote growth of tumors.

Processed Meat and Protein
Salt-cured, smoked, and nitrite-cured foods have been associated with cancers of the esophagus, stomach, colon, and rectum. Processed meats (hot dogs, ham, bacon, sausage, and lunch meats) should be consumed sparingly and always with vitamin C-rich foods such as orange juice, as vitamin C seems to discourage the formation of nitrosamines. These potentially cancer-causing compounds are formed when nitrites and nitrates, which are used to prevent the growth of harmful bacteria in processed meats, combine with other chemicals in the stomach. According to the American Institute for Cancer Research, a daily intake of 3.5 ounces of processed meat increases colorectal cancer risk by 42 percent.

The combination of the heme protein with iron, both found abundantly in red meat (but not poultry and fish), also contributes to the formation of nitrosamines in the large intestine, increasing the risk for colorectal cancer.

Further, nutritional guidelines discourage the excessive intake of protein. Too much animal protein appears to decrease blood enzymes that prevent precancerous cells from developing into tumors. According to the National Cancer Institute, eating substantial amounts of red meat may increase the risk for colorectal, pancreatic, breast, prostate, and renal cancer.

Cooking protein at high temperature should be avoided or done so only occasionally. The data suggest that grilling, broiling, or frying meat, poultry, or fish at high temperatures to “medium well” or “well done” leads to the formation of carcinogenic substances known as heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs). Individuals who prefer their meat medium well or well done have a much higher risk for colorectal and stomach cancers.

When proteins are cooked at high temperatures, amino acids are changed into HCAs that collect on the surface of meats. Charring meat increases their formation to an even greater extent. PAHs are formed when fat drips onto the rocks or coals of the grill. The subsequent fire flare-up releases smoke that coats the food with PAHs.

An electric contact grill such as a George Foreman grill is preferable when cooking meats because cooking temperatures are easily controlled. When cooking on an
outdoor grill, line the grill with foil to minimize flare-up damage. Microwaving the meat for a couple of minutes before barbecuing also decreases the risk, as long as the fluid released by the meat is discarded. Most of the potential carcinogens collect in this solution. Precooking in the microwave will also decrease grilling time.

For an occasional outdoor barbecue, what you grill and how you grill are the most important factors. Animal products (both red and white meat) are the culprits, whereas grilling fruit and vegetables does not produce HCAs or PAHs. When grilling meats, the following approach can decrease HCAs and PAHs up to 90 percent.

- Cook meats with natural antioxidants as such decrease or eliminate HCAs and PAHs. Always marinate meat for at least 4 hours using some combination of vinegar, oil (preferably olive oil), and herbs and condiments including red and black pepper, paprika, allspice, garlic, mustard, turmeric, thyme, rosemary, chives, oregano, basil, sage, or parsley, among others.
- Keep the meat moist and trim off all excess fat to avoid flare-ups.
- Cook at lower heat, under 350°F, to “medium” rather than “well” or “well done.”
- Cook over aluminum foil with small holes cut in the foil so that drippings can pass through.
- Turn the meat over frequently, every three to four minutes.
- Remove any skin before serving.

Soy

Soy protein seems to decrease the formation of carcinogens during cooking of meats. Soy foods may help because soy contains chemicals that prevent cancer. Although further research is merited, isoflavones (phyto-nutrients) found in soy are structurally similar to estrogen and may prevent breast, prostate, lung, and colon cancers. Isoflavones, frequently referred to as “phytoestrogens” or “plant estrogens,” also block angiogenesis. Presently, it is not known whether the health benefits of soy are derived from isoflavones by themselves or in combination with other nutrients found in soy.

One drawback of soy was found in studies in which animals with tumors were given large amounts of soy. The estrogen-like activity of soy isoflavones actually led to the growth of estrogen-dependent tumors. Experts, therefore, caution women with breast cancer or a history of this disease to limit their soy intake because it could stimulate cancer cells by closely imitating the actions of estrogen. No specific recommendations are presently available as to the recommended amount of daily soy protein intake to prevent cancer.

Based on the traditional diets of people (including children) in China and Japan who consume soy foods regularly, there doesn’t seem to be an unsafe natural level of consumption. Soy protein powder supplementa-

Alcohol Consumption

The general recommendation has been that people should consume alcohol in moderation, because too much alcohol raises the risk for developing certain cancers, especially when it is combined with tobacco smoking or smokeless tobacco. In combination, these substances significantly increase the risk for cancers of the mouth, larynx, throat, esophagus, and liver. The combined action of heavy alcohol and tobacco use can increase the odds of developing cancer of the oral cavity fifteen-fold.

A 2009 study of almost 1.3 million women between the ages of 45 and 75, however, indicated that as little as one drink of alcohol per day increases a women’s risk of cancer by 13 percent, including cancers of the breast, esophagus, larynx, rectum, and liver. The researchers concluded that even low- to-moderate alcohol consumption increases cancer risk in women and the risks outweigh any potential cardioprotective benefits. Based on these data, it is estimated that about 30,000 yearly female cancers in the United States are due to these low levels of alcohol consumption.

Nutrient Supplements

An expert panel of the World Cancer Research Fund and the American Institute of Cancer Research stated that unless recommended by your doctor, you should not use supplements to protect against cancer. There is strong evidence that high-dose supplements of certain nutrients increase the risk of certain cancers. The best source of nutrients is a healthy diet.

Excessive Body Weight

Maintaining recommended body weight is encouraged. Based on estimates, excess weight accounts for 14 to 20 percent of deaths from cancer. Furthermore, obese heavy drinking and smoking greatly increase the risk of oral cancer.
men and women have a more than 50 percent increased risk for dying from any form of cancer.\textsuperscript{13} Adult weight gain increases the risk for many cancers, including those of the breast, colon/rectum, endometrium, esophagus, and kidney. Obesity may also increase the risk for pancreatic, gallbladder, ovarian, thyroid, and cervical cancers. Investigators theorize that excess weight raises hormone levels in the body that stimulate tumor growth.

**Abstaining from Tobacco**

Cigarette smoking by itself is a major health hazard. The biggest carcinogenic exposure in the environment without question is tobacco use and exposure to secondhand smoke. If we include all related deaths, smoking is responsible for more than 470,000 unnecessary deaths and 170,000 lung cancer deaths in the United States each year. The World Health Organization estimates that smoking causes 5 million deaths worldwide annually. The average life expectancy for a chronic smoker is about 15 years shorter than for a nonsmoker.\textsuperscript{14}

Of all cancers, at least 30 percent are tied to smoking, and 87 percent of lung cancers are linked to smoking. Cigarette smoking contributes to at least 15 additional types of cancer, including oral, lip, nasal, pharyngeal, laryngeal, esophageal, uterine, stomach, and pancreatic. Use of smokeless tobacco can also lead to nicotine addiction and dependence, as well as increased risk for cancers of the mouth, larynx, throat, and esophagus. If you smoke or use any other tobacco products, STOP NOW! If you do not smoke, DON’T EVER START. If you are ever around people who are smoking, claim your right to clean air, or distance yourself from them as much as you possibly can.

**Avoiding Excessive Exposure to Sun**

Near-daily “safe sun” exposure, that is, 10 to 20 minutes of unprotected exposure during peak hours of the day is beneficial to health; but too much exposure to ultraviolet radiation is a major contributor to skin cancer. The most common sites of skin cancer are the areas exposed to the sun most often (face, neck, and back of the hands). Ultraviolet rays are strongest when the sun is high in the sky. Therefore, you should avoid prolonged sun exposure between 10:00 a.m. and 4:00 p.m. Take the shadow test: If your shadow is shorter than you, the ultraviolet (UV) rays are at their strongest.

The three types of skin cancer are:

1. Basal cell carcinoma
2. Squamous cell carcinoma
3. Malignant melanoma

Nearly 90 percent of the almost 1 million cases of basal cell or squamous cell skin cancers reported yearly in the United States could have been prevented by protecting the skin from excessive sun exposure. *Melanoma*, the most deadly type, caused approximately 8,700 deaths in 2010. One in every six Americans eventually will develop some type of skin cancer.

One to two blistering sunburns can double the lifetime risk for melanoma, even more so if the sunburn takes place prior to age 18, when cells divide at a much faster rate than later in life. Furthermore, nothing is healthy about a “healthy tan.” Tanning of the skin is the body’s natural reaction to permanent and irreversible damage from too much exposure to the sun. Even small doses of sunlight add up to a greater risk for skin cancer and premature aging. The tan fades at the end of the summer season, but the underlying skin damage does not disappear.

The stinging sunburn comes from ultraviolet B (UVB) rays, which are also thought to be the main cause of premature wrinkling and skin aging, roughened/leathery/sagging skin, and skin cancer. Unfortunately, the damage may not become evident until up to 20 years later. By comparison, skin that has not been overexposed to the sun remains smooth and unblemished and, over time, shows less evidence of aging.

Sun lamps and tanning parlors provide mainly ultraviolet A (UVA) rays. Once thought to be safe, they too are now known to be damaging and have been linked to melanoma. As little as 15 to 30 minutes of exposure to UVA rays can be as dangerous as a day spent in the sun. Similar to regular exposure to sun, short-term exposure
to recreational tanning at a salon causes DNA alterations that can lead to skin cancer.\textsuperscript{15}

Sunscreen lotion should be applied about 30 minutes before lengthy exposure to the sun because the skin takes that long to absorb the protective ingredients. Select sunscreens labeled “broad spectrum,” as these products block both UVA and UVB rays. A \textit{sun protection factor (SPF)} of at least 15 is recommended. SPF 15 means that the skin takes 15 times longer to burn than it would with no lotion. If you ordinarily get a mild sunburn after 20 minutes of noonday sun, an SPF 15 allows you to remain in the sun about 300 minutes before burning. Sunscreens with stronger SPF factors are not necessarily better. They should be applied just as often and they block only an additional 3 to 4 percent of ultraviolet rays. SPF 15 is adequate for most people.

When swimming or sweating, you should reapply sunscreens more often, because all sunscreens lose strength when they are diluted. Look for “water resistant” or “very water resistant” sunscreens, as such will adhere to the skin for 40 to 80 minutes, respectively. “Waterproof,” “sweatproof,” and “continuous protection” sunscreens are not as effective.

If you plan on being out in the sun for a lengthy period of time, even better than sunscreen, is wearing protective clothing, including long-sleeved shirts, long pants, and a hat with a two- to three-inch brim all the way around. This sun-protection strategy is even more critical for fair-skinned individuals who burn readily or turn red after only a few minutes of unprotected sun exposure, have a large number of moles, or have a personal or family history of skin cancer risk. Sun-protective fabrics, such as those manufactured by Coolibar\textsuperscript{®} or Sun Precautions\textsuperscript{®}, offer additional protection. You can also use RIT Sun Guard, a laundry additive that when used in washing penetrates the fibers and subsequently absorbs ultraviolet rays during sun exposure. The additive blocks up to 96 percent of UVA and UVB rays.

\textbf{Monitoring Estrogen, Radiation Exposure, and Potential Occupational Hazards}

Estrogen use has been linked to endometrial cancer in some studies. As to exposure to radiation, although it increases the risk for cancer, the benefits of x-rays may outweigh the risk involved, and most medical facilities use the lowest dose possible to keep the risk to a minimum. Occupational hazards—such as exposure to asbestos fibers, nickel and uranium dusts, chromium compounds, vinyl chloride, and bischloromethyl ether—increase the risk for cancer. Cigarette smoking magnifies the risk from occupational hazards.

\textbf{Physical Activity}

An active lifestyle has been shown to have a protective effect against cancer. Although the mechanism is not clear, physical fitness and cancer mortality in men and women may have a graded and consistent inverse relationship (see Figure 11.9). A daily 30-minute, moderate-intensity exercise program lowers the risk for colon, breast, and uterine cancers between 20 and 50 percent; and vigorous physical activity may lower the risk of more aggressive and fatal types of prostate cancer.\textsuperscript{16}

Research among 38,410 men followed for an average period of 17.2 years indicated a strong inverse relationships...
between cardiorespiratory fitness and cancer mortality; that is, the lower-fit men had greater cancer deaths rates than the higher-fit men. A 2009 study on more than 2,200 men 49 years of age and older that were followed up for more than 35 years found that at least 30 minutes a day of moderate- to high-intensity physical activity is inversely associated with the risk of premature death from cancer in men. The researchers concluded that the activity needed to be at least moderate-intensity to achieve the benefit of reducing overall cancer mortality. After 10 years, men who switched from low or medium to high physical activity (greater than 5.2 METs) were found to have half the risk of dying from cancer. There were no changes in mortality rate when switching from low to medium level physical activity. Other data suggest that in men 65 or older, exercising vigorously at least three times per week decreases the risk for advanced or fatal prostate cancer by 70 percent.

Data on more than 6,300 women indicate that regular exercise lowers the risk for breast cancer by up to 40 percent, regardless of race or ethnicity. Other studies have found similar results. Women who are active throughout life also cut their risk for endometrial cancer by about 40 percent. Those who started exercise in adulthood cut their risk by about 25 percent. Among women diagnosed with breast cancer, those who walk 2 to 3 miles per hour one to three times per week are 20 percent less likely to die of the disease. Those who walk three to five times per week cut their risk in half. Researchers believe that the decreased levels of circulating ovarian hormones through physical activity decrease breast cancer risk.

Regular strength-training also contributes to lower cancer mortality. A total of 8,677 men between the ages of 20 and 82 were tracked for more than two decades. The data indicated that men who regularly worked out with weights and had the highest muscle strength were up to 40 percent less likely to die from cancer, even among men with a higher waist circumference and BMI.

The risk for other forms of cancer may also decrease, but additional research is necessary before definitive statements can be made. Growing evidence suggests that the body’s autoimmune system may play a role in preventing cancer and that moderate exercise improves the autoimmune system.

## Early Detection

Fortunately, many cancers can be controlled or cured through early detection. The real problem comes when cancerous cells spread, because they become more difficult to destroy. Therefore, effective prevention, or at least early detection, is crucial. Herein lies the importance of periodic screening. Once a month, women should practice breast self-examination (BSE); and men, testicular self-examination (TSE). Men should pick a regular day each month (e.g., the first day of each month) to practice TSE, and women should perform BSE two or three days after the menstrual period is over.

### Other Factors

The contributions of many of the other much-publicized factors are not as significant as those just pointed out. Intentional food additives, saccharin, processing agents, pesticides, and packaging materials currently used in the United States and other developed countries seem to have minimal consequences. High levels of tension and stress and poor coping may affect the autoimmune system negatively and render the body less effective in dealing with the various cancers. Chronic stress increases cortisol and inflammatory chemicals that sustain cancer growth.

Genetics plays a role in susceptibility in about 10 percent of all cancers. Most of the effect is seen in the early childhood years. Some cancers are a combination of genetic and environmental liability; genetics may add to the environmental risk of certain types of cancers. “Environment” means more than pollution and smoke. It incorporates diet, lifestyle-related events, viruses, and physical agents such as x-rays and exposure to the sun.

### Warning Signals of Cancer

Everyone should become familiar with the following seven warning signals for cancer and bring any that are present to a physician’s attention:

#### Behavior Modification Planning

**Cancer Promoters**

- Use or exposure to tobacco products
- Physical inactivity
- Being more than 10 pounds overweight
- Frequent consumption of red meat
- A diet high in fat
- Charred/burned foods
- Frequent consumption of nitrate/nitrite-cured, salt-cured, or smoked foods
- Alcohol consumption
- Excessive sun exposure
- Estrogens
- Methyleugenol (flavoring agent in packaged foods)
- Radon, formaldehyde, and benzene
- Wood dust (high levels)

**Try It** In your Online Journal or class notebook, make a list of cancer promoters around you and note whether you take necessary actions to avoid them. If you do not, note what it would take for you to do so.
1. Change in bowel or bladder habits
2. Sore that does not heal
3. Unusual bleeding or discharge
4. Thickening or lump in the breast or elsewhere
5. Indigestion or difficulty in swallowing
6. Obvious change in wart or mole
7. Nagging cough or hoarseness

In Activity 11.1, you will be able to determine how well you are doing in terms of a cancer-prevention program. Activity 11.2 provides a questionnaire developed by the American Medical Association to alert people to symptoms that may indicate a serious health problem. Although in most cases nothing serious will be found, any symptom calls for a physician’s attention as soon as possible. Scientific evidence and testing procedures for the prevention and early detection of cancer do change. Studies continue to provide new information. The intent of cancer-prevention programs is to educate and guide people toward a lifestyle that will help prevent cancer and enable early detection of malignancy.

Treatment of cancer should always be left to specialized physicians and cancer clinics. Current treatment modalities include surgery, radiation, radioactive substances, chemotherapy, hormones, and immunotherapy.

**Cancer: Assessing Your Risks**

Figure 11.10 provides a self-testing questionnaire to help you assess your cancer risk. The factors listed in the questionnaire are the major risk factors for specific cancer sites and by no means represent the only ones that might be involved. Check your status against the factors contained in this questionnaire. Based on the number of risk factors that apply to you, rate yourself on a scale from 1 to 3 (1 for low risk, 2 for moderate risk, and 3 for high risk) for each cancer site. Explanations of the risk factors for each type of cancer follow. If you are at higher risk, you are advised to discuss the results with your physician. Record your risk level totals for each cancer site in Activity 11.3.

**Common Sites of Cancer**

**Lung Cancer**

Risk Factors

1. Smoking status. Tobacco smoke causes nearly 9 out of 10 cases of lung cancer (includes cigarette, cigar, and pipe smoking). Smoking low-tar or “light” cigarettes increases lung cancer risk as much as regular cigarettes. The rates for ex-smokers who have not smoked for 10 years, however, approach those for nonsmokers.
2. Amount and length of time smoked. The risk increases with the number of cigarettes smoked per day and years the individual has smoked.
3. Secondhand smoke. Exposure to secondhand smoke increases lung cancer risk. For example, nonsmoking spouses who live with a smoker have a 20 percent greater risk of developing lung cancer than do spouses of nonsmokers. Some individuals have a greater susceptibility to lung cancer as a result of secondhand smoke exposure.
4. Radon gas exposure. Radon, a radioactive gas that tends to build up indoors, is a potential cancer risk. The risk is also much greater for smokers. Homes and buildings should be tested periodically for radon content. State and local EPA offices provide information on radon testing.
5. Type of industrial work. Exposure to certain mining materials, uranium and radioactive products, or asbestos has been demonstrated to be associated with lung cancer. Exposure to materials in other industries also carries a higher risk.

Smokers who work in these industries have greatly increased risks. Exposure to arsenic, radiation from occupational/medical/environmental sources, and air pollution increase the risk for lung cancer.

**Colon/Rectum Cancer**

Risk Factors

1. Age. Colon cancer occurs more frequently after 50 years of age.
2. Family predisposition. Colon cancer is more common in families that have a previous history of this disease.
3. Personal history. Polyps and bowel diseases are associated with colon cancer.
4. Physical inactivity. Strong scientific evidence points to a higher risk for colorectal cancer in physically inactive individuals.
5. Race or ethnicity. African Americans and Jews of Eastern European descent have some of the highest colorectal cancer rates in the world.

In addition to the previously mentioned risk factors, smoking, alcohol consumption, a diet high in saturated fat and/or red meat, a diet low in fiber, inadequate consumption of fruits and vegetables, type 2 diabetes, and inflammatory bowel disease increase the risk for colon or rectal cancer.

**Skin Cancer**

Risk Factors

1. UV light exposure. Excessive UV light is a culprit in skin cancer. Always practice safe sun exposure, that is, only 10 to 20 minutes of daily unprotected sun exposure. For longer exposure, protect yourself with a sunscreen medication.
Cancer Prevention Guidelines

Name: ___________________________ Date: ___________________

Course: __________________________ Section: __________________________ Gender: ________ Age: ________

I. Cancer Prevention: Are You Taking Control?

Today, scientists think most cancers may be related to lifestyle and environment—what you eat and drink, whether you smoke, and where you work and play. The good news, then, is that you can help reduce your own cancer risk by taking control of things in your daily life.

12 Steps to a Healthier Life and Reduced Cancer Risk

1. Are you eating more cabbage-family vegetables?
   Yes No
   They include broccoli, cauliflower, Brussels sprouts, all cabbages, and kale.

2. Does your diet include high-fiber foods?
   Yes No
   Fiber is found in whole grains, fruits, and vegetables including peaches, strawberries, potatoes, spinach, tomatoes, wheat and bran cereals, rice, popcorn, and whole-wheat bread.

3. Do you choose foods with vitamin A?
   Yes No
   Fresh foods with beta-carotene, including carrots, peaches, apricots, squash, and broccoli are the best source—not vitamin pills.

4. Is vitamin C included in your diet?
   Yes No
   You’ll find it naturally in lots of fresh fruits and vegetables including grapefruit, cantaloupe, oranges, strawberries, red and green peppers, broccoli, and tomatoes.

5. Are you physically active for at least 30 minutes and do you avoid excessive sitting on most days of the week?
   Yes No
   Total number of daily steps: ________ Total minutes of daily physical activity: ________

6. Do you maintain healthy weight (a BMI between 18.5 and 25)?
   Yes No

7. Do you limit salt-cured, smoked, nitrite-cured foods?
   Yes No
   Choose bacon, ham, hot dogs, or salt-cured fish only occasionally if you like them a lot.

8. If you smoke, have you tried to quit?
   Yes No

9. If you drink alcohol at all, is your intake moderate?
   Yes No

10. Do you get almost daily “safe sun” exposure, and yet respect the sun’s rays?
    Yes No
    “Safe sun” exposure means 10 to 20 minutes of unprotected sun exposure (without sunscreen) to the face, arms, and hands during peak daylight hours on most days of the week. If not, do you take a daily vitamin D supplement?
    Yes No
    Do you protect yourself with sunscreen (at least SPF 15) and wear long sleeves and a hat, especially during midday hours (10:00 a.m. to 4:00 p.m.) if you are going to be exposed to the sun for a prolonged period of time?

11. Do you have a family history of any type of cancer? If so, have you brought this to the attention of your personal physician?
    Yes No

12. Are you familiar with the seven warning signals for cancer?
    Yes No
    If you answered “yes” to most of these questions, congratulations. You are taking control of simple lifestyle factors that will help you feel better and reduce your risk for cancer.

Adapted from the American Cancer Society, Texas Division.
Recognizing Early Signs of Illness

Many serious illnesses begin with apparently minor or localized symptoms that, if recognized early, can alert you to act in time for the disease to be cured or controlled. In most cases, nothing is seriously wrong. **If you experience any of the following symptoms, discuss the problem with your physician without delay.** Check only the conditions that apply.

1. Rapid loss of weight—more than about 4 kg (10 lbs) in 10 weeks—without apparent cause.
2. A sore, scab, or ulcer, either in the mouth or on the body, that fails to heal within about 3 weeks.
3. A skin blemish or mole that begins to bleed or itch or that changes color, size, or shape.
4. Severe headaches that develop for no obvious reason.
5. Sudden attacks of vomiting, without preceding nausea.
6. Fainting spells for no apparent reason.
7. Visual problems such as seeing “haloes” around lights or intermittently blurred vision, especially in dim light.
8. Increasing difficulty with swallowing.
9. Hoarseness without apparent cause that lasts for a week or more.
10. A “smoker’s cough” or any other nagging cough that has been getting worse.
11. Blood in coughed-up phlegm, or sputum.
12. Constantly swollen ankles.
13. A bluish tinge to the lips, the insides of the eyelids, or the nailbeds.
14. Extreme shortness of breath for no apparent reason.
15. Vomiting of blood or a substance that resembles coffee grounds.
16. Persistent indigestion or abdominal pain.
17. A marked change in normal bowel habits, such as alternating attacks of diarrhea and constipation.
18. Bowel movements that look black and tarry.
19. Rectal bleeding.
20. Unusually cloudy, pink, red, or smoky-looking urine.
21. In men, discomfort or difficulty when urinating.
22. In men, discharge from the tip of the penis.
23. In women, a lump or unusual thickening of a breast or any alteration in breast shape such as flattening, bulging, or puckering of skin.
24. In women, bleeding or unusual discharge from the nipple.
25. In women, vaginal bleeding or “spotting” that occurs between usual menstrual periods or after menopause.

### Assessing Your Risks for Cancer

Read each question concerning each site and its specific risk factors. Be honest in your responses. Your risk increases as you move beyond item 1 for each factor. For example, the risk for lung cancer increases progressively as you age. If none of the answers apply, skip to the next question. Based on the number of risk factors that apply to you, rate yourself on a scale from 1 to 3 (1 for low risk, 2 for moderate risk, and 3 for high risk) for each cancer site. Record your results in Activity 11.3.

#### Lung Cancer
- **Smoking status**
  - 1. Non-smoker
  - 2. Smoker
- **Amount of cigarettes smoked per day**
  - 1. NA
  - 2. Less than 1 pack
  - 3. 1–2 packs
  - 4. 2+ packs
- **Years smoked**
  - 1. None
  - 2. 1–15
  - 3. 15–25
  - 4. >25
- **Radon gas exposure**
  - 1. No
  - 2. Yes
  - 3. Yes and smoker
- **Type of industrial work**
  - 1. Mining
  - 2. Uranium and radioactive products
  - 3. Asbestos

#### Skin Cancer
- **Do you practice safe sun exposure?**
  - 1. Yes
  - 2. No
- **Complexion—fair and/or light skin**
  - 1. No
  - 2. Yes
- **Personal or family history**
  - 1. No
  - 2. Yes
- **Work in mines, around coal tar, radioactive materials, or arsenic?**
  - 1. No
  - 2. Yes
- **Radiation treatment**
  - 1. No
  - 2. Yes

#### Breast Cancer
- **Age**
  - 1. ≤35
  - 2. 36–50
  - 3. >51
- **Are you Caucasian?**
  - 1. No
  - 2. Yes
- **Family history**
  - 1. No
  - 2. One family member
  - 3. Two or more family members
- **Personal history of breast or ovarian cancer**
  - 1. No
  - 2. Yes
- **Maternity**
  - 1. First pregnancy before age 30
  - 2. First child after age 30
  - 3. No children
- **Hormone replacement therapy**
  - 1. No
  - 2. Short-term use
  - 3. Long-term use

#### Colon/Rectum Cancer
- **Age**
  - 1. ≤40
  - 2. 41–60
  - 3. >60
- **Family predisposition**
  - 1. No
  - 2. Yes
- **Personal history**
  - 1. No
  - 2. Polyps
  - 3. Bowel diseases
- **Are you physically active?**
  - 1. Yes
  - 2. No
- **Are you a Jew of Eastern European descent?**
  - 1. No
  - 2. Yes

#### Colon/Rectum Cancer (continued)
- **Are you African American or a Jew of Eastern European descent?**
  - 1. No
  - 2. Yes
- **Type of industrial work**
  - 1. Mining
  - 2. Uranium and radioactive products
  - 3. Asbestos
- **Radon gas exposure**
  - 1. No
  - 2. Yes
  - 3. Yes and smoker
- **Years smoked**
  - 1. None
  - 2. 1–15
  - 3. 15–25
  - 4. >25

#### Endometrial Cancer
- **Estrogen therapy**
  - 1. No
  - 2. Yes
- **Age**
  - 1. ≤40
  - 2. 41–49
  - 3. ≥50
- **Pregnancy**
  - 1. No
  - 2. Yes
- **Body weight**
  - 1. At recommended weight
  - 2. Overweight
  - 3. Obese
- **Diabetes**
  - 1. No
  - 2. Yes
- **Total years of menstrual cycles**
  - 1. “Normal”
  - 2. Greater than “normal” (early start and/or late cessation)
- **Are you hypertensive?**
  - 1. No
  - 2. Yes
- **Are you physically active?**
  - 1. Yes
  - 2. No

#### Cervical Cancer
- **Human papilloma virus (HPV) infection**
  - 1. Never been infected
  - 2. Previously or currently infected
- **Smoking status**
  - 1. Nonsmoker
  - 2. Ex-smoker
  - 3. Current smoker
- **HIV and chlamydia infections**
  - 1. Neither one
  - 2. HIV
  - 3. Chlamydia
  - 4. Both
- **Fruits and vegetables**
  - 1. ≥5 servings per day
  - 2. 3–4 servings per day
  - 3. 1–2 servings per day
  - 4. <1 serving per day
- **Are you overweight?**
  - 1. No
  - 2. Yes
- **Are you using birth control pills?**
  - 1. No
  - 2. Yes
  - 3. Multiple pregnancies

#### Prostate Cancer
- **Age**
  - 1. ≤64
  - 2. ≥65
- **Family history**
  - 1. No
  - 2. Yes

(continued)
Figure 11.10  Cancer questionnaire: Assessing your risks (continued).

- **Are you African American?**
  1. No
  2. Yes

- **Diet**
  1. Low in saturated fat
  2. High in saturated fat

- **Are you physically active?**
  1. Yes
  2. No

- **Family history**
  1. No
  2. Yes

- **Kidney and Bladder Cancer**
  - Smoking history
    1. Nonsmoker
    2. Ex-smoker
    3. Cigarette smoker
  - Were you diagnosed with congenital (inborn) abnormalities of the kidneys or bladder?
    1. No
    2. Yes
  - Have you been exposed to aniline dyes, naphthalenes, or benzidines?
    1. No
    2. Yes
  - Do you have a history of schistosomiasis (a parasitic bladder infection)?
    1. No
    2. Yes
  - Do you use alcohol or tobacco in any form?
    1. No
    2. Yes

- **Oral Cancer**
  - Tobacco use
    1. Nonuser
    2. Ex-user
    3. Pipe, cigar, or smokeless tobacco
    4. Cigarettes
  - Alcohol use
    1. Do not drink alcohol
    2. Less than 1 drink per day (women) or 2 drinks per day (men)
    3. More than 1 drink per day (women) or 2 drinks per day (men)

- **Pancreatic Cancer**
  - Age
    1. ≤55
    2. ≥56
  - Tobacco use
    1. No
    2. Yes
  - Sugar intake
    1. Low
    2. Moderate
    3. Excessive
  - Are you obese?
    1. No
    2. Yes
  - Do you now have or have you had chronic pancreatitis, cirrhosis, or diabetes?
    1. No
    2. Yes
  - Are you physically active?
    1. Yes
    2. No
  - Are you African American?
    1. No
    2. Yes
  - Family history
    1. No
    2. Yes

- **Testicular Cancer**
  - Did you have an undescended testicle?
    1. No
    2. Yes
  - Did you have abnormal testicular development?
    1. No
    2. Yes
  - Do you have a family history of testicular cancer?
    1. No
    2. Yes
  - Are you Caucasian?
    1. No
    2. Yes

- **Liver Cancer**
  - Do you have a family history of cirrhosis of the liver?
    1. No
    2. Yes
  - Have you been exposed to vinyl chloride (industrial gas used in plastics manufacturing)?
    1. No
    2. Yes
  - Have you been exposed to aflatoxin (natural food contaminant)
    1. No
    2. Yes
2. Complexion. Risk factors vary for different types of skin. Individuals with light complexions, natural blonde or red hair, and those who burn easily are at greater risk.

3. Personal and family history of melanoma and moles. Of particular note are large or unusual moles or a large number of moles.

4. Work environment. Work in mines, around coal tar, radioactive materials, or arsenic (used in some insecticides) can cause cancer of the skin.

5. Radiation. Individuals who have undergone radiation treatment run a much higher risk of skin cancer in the treated area.

Risks for skin cancer are difficult to state. For instance, a person with a dark complexion can work longer in the sun and be less likely to develop cancer than a light-skinned person. Furthermore, a person wearing a long-sleeved shirt and a wide-brimmed hat who spends hours working in the sun has less risk than a person wearing a swimsuit who sunbathes for only a short time. The risk increases greatly with age, and family history also plays a role.

If any of the previous risk factors apply to you, you need to protect your skin from the sun or any other toxic material. Changes in moles, warts, or skin sores are important and should be evaluated by your doctor (see Figure 11.11).

Skin Self-Exam
One of the easiest and quickest self-exams is a brief survey to detect possible skin cancers (see Figure 11.12). A simple skin self-exam can reduce deaths from melanoma

Figure 11.10 Cancer questionnaire: Assessing your risks (continued).

Leukemia
- Family history
  1. No
  2. Yes

- Do you suffer from Down syndrome or other genetic abnormalities?
  1. No
  2. Yes

- Have you had excessive exposure to ionizing radiation?
  1. No
  2. Yes

- Are you exposed to environmental chemicals?
  1. No
  2. Yes

Lymphomas
- Are you physically active?
  1. Yes
  2. No

- Do you have a family history of lymphomas?
  1. No
  2. Yes

- Are you exposed to
  1. Herbicides
  2. Organic solvents

- Have you had an organ transplant?
  1. No
  2. Yes

- Have you been diagnosed with any of the following?
  1. Epstein-Barr virus
  2. HIV
  3. Human T-cell leukemia/lymphoma virus-I (HTLV-1) virus

Figure 11.11 Warning signs of melanoma: ABCDE rule.

A. Asymmetry: One-half of a mole or lesion doesn’t look like the other half.
B. Border: A mole has an irregular, scalloped, or not clearly defined border.
C. Color: The color varies or is not uniform from one area of a mole or lesion to another, whether the color is tan, brown, black, white, red, or blue.
D. Diameter: The lesion is larger than 6 millimeters (1/4 inch) or larger than a pencil eraser.
E. Elevation: Does it raise off the skin?

Critical Thinking
What significance does a “healthy tan” have in your social life? • Are you a “sun worshiper,” or are you concerned about skin damage, premature aging, and potential skin cancer in your future?

If any of the previous risk factors apply to you, you need to protect your skin from the sun or any other toxic material. Changes in moles, warts, or skin sores are important and should be evaluated by your doctor (see Figure 11.11).

Adapted from FDA Consumer, May 1991.
I. Risk Assessment

Read the section “Assessing Your Risks” (page 377) and complete the Cancer Questionnaire: Assessing Your Risks in Figure 11.10 (pages 380–382). Rate yourself on a scale from 1 to 3 (1 = low risk, 2 = moderate risk, 3 = high risk) according to the risk factors provided for each site and write the scores and risk categories in the blanks provided below.

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>Total Points</th>
<th>Risk Category</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Men</td>
<td>Women</td>
</tr>
<tr>
<td>Lung</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colon/Rectum</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breast</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endometrial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prostate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Testicular</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pancreatic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidney and Bladder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Esophageal and Stomach</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ovarian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thyroid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liver</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leukemia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymphomas</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Cancer Risk Profile (continued)

Name: ___________________________ Date: __________________
Course: ___________________________ Section: ________________ Gender: ________ Age: ________

II. Stage of Change for Cancer Prevention

Using Figure 2.5 (page 61) and Table 2.3 (page 60), identify your current stage of change for participation in a cancer-prevention program:

III. Personal Interpretation

In the space provided below, discuss your results for the various cancer sites. State your feelings about cancer and comment on any experiences that you may have had with cancer patients.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

IV. Cancer Prevention: Behavior Modification

Discuss lifestyle habits that you should eliminate and habits that you need to adopt to reduce your own risk for cancer. Also indicate how you can best implement and adhere to these changes.

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________

____________________________________________________________________________________
Cancer Prevention

Excessive sun exposure, cigarette smoking, and excessive body weight are major risk factors for cancer.

- Make a drawing of yourself. Include a full frontal view, a full back view, and close-up views of your head (both sides), the soles of your feet, the tops of your feet, and the backs of your hands.
- After you get out of the bath or shower, examine yourself closely in a full-length mirror. On your sketch, make note of any moles, warts, or other skin marks you find anywhere on your body. Pay particular attention to areas that are exposed to the sun constantly, such as your face, the tops of your ears, and your hands.
- Briefly describe each mark on your sketch—its size, color, texture, and so on.
- Repeat the exam about once a month. Watch for changes in the size, texture, or color of moles, warts, or other skin marks. If you notice any difference, contact your physician. You also should contact a doctor if you have a sore that does not heal.

Breast Cancer

Risk Factors

1. Age. The risk for breast cancer increases significantly after 50 years of age.
2. Race. Breast cancer occurs slightly more frequently in white women than African American women. The latter, however, are more likely to die from the disease.
3. Family history. The risk for breast cancer is higher in women with a family history of it. The risk is even higher if more than one family member has developed breast cancer, and is further enhanced by the closeness of the relationship (e.g., a mother or sister with breast cancer indicates a higher risk than a cousin with breast cancer).
4. Personal history. A previous history of breast or ovarian cancer indicates a higher risk.

5. Maternity. The risk is higher in women who have never had children and in women who bear children after 30 years of age. Women are encouraged to breast feed their babies at least up to six months as such also reduces the risk for breast cancer.

6. Physical inactivity. Physically inactive women are at higher risk. Regular aerobic exercise has consistently been associated with a lower risk of breast cancer. Some research even indicates that the risk of dying from breast cancer decreases by more than 50 percent in women with high aerobic fitness as compared to less fit women.

7. Hormone replacement therapy (HRT). Long-term use of a combination of progesterone and estrogen increases the risk. The risk seems to apply to current and recent users.

8. Alcohol. Even one alcoholic drink per day slightly enhances breast cancer risk in women. Two or more drinks per day clearly enhance the risk.

9. Obesity. Adipose tissue increases estrogen levels. Higher estrogen levels, particularly following menopause, increase the risk.

About 5 to 10 percent of breast cancers may be related to gene mutations; the most common are BRCA1 and BRCA2. These are tumor suppressor genes located on chromosomes 17 and 13. Women with such mutation have up to 80 percent greater risk of developing breast cancer.

Women with low to moderate risk should practice monthly BSE (see Figure 11.13) and have their breasts ex-
examined by a doctor as a part of a cancer-related checkup. Periodic mammograms should be included as recommended. Women at high risk should practice monthly BSE and have their breasts examined regularly by a doctor. See your doctor for the recommended examinations (including mammograms and physical exam of breasts).

Clinical breast exams by a physician are recommended every 3 years for women between ages 20 and 40 and every year for women over age 40. The American Cancer Society also recommends an annual mammogram for women over age 40. The 2009 guidelines by the U.S. Preventive Service Task Force, although heatedly debated by many health care practitioners, recommended that women get a mammogram every 2 years starting at age 50. According to Dr. Otis Brawley, Chief Medical Officer of the American Cancer Society, “This is one screening test I recommend unequivocally, and would recommend to any woman 40 and over.” Frequency of mammograms is currently an area of debate among health care practitioners, and personal risk factors should be considered to determine when to start and how often they should be done.

Other possible risk factors for breast cancer that are not listed in the questionnaire are high breast-tissue density (a mammographic measure of the amount of glandular breast tissue relative to fatty breast tissue), a long menstrual history (onset of menstruation prior to age 13 and ending later in life), postmenopausal hormone therapy, recent use of oral contraceptives or postmenopausal estrogens, high saturated fat intake, high refined carbohydrate intake, chronic cystic disease, and ionizing radiation. To decrease the risk, increase fiber, folic acid, monounsaturated fat, and vegetable consumption, and increase daily physical activity.

Men should not feel immune to breast cancer. Although not common in men, approximately 2,000 men in the United States are diagnosed with breast cancer and 400 die from it each year.

**Cervical Cancer (Women)**

**Risk Factors**

1. **Human papilloma virus (HPV).** The most significant risk factor is infection with the HPV, a group of more than 100 related viruses, some of which can cause cervical cancer. The virus is frequently transmitted through vaginal, anal, or oral sex; or simply by skin-to-skin contact with a body area infected with HPV. Most infected women do not develop cervical cancer but other factors (see below) must be present for the cancer to develop.
2. **Smoking.** The risk doubles in women who smoke. Tobacco by-products are found in cervical mucus of women who smoke.
3. **Infections.** Both human immunodeficiency virus (HIV) and chlamydia (bacterial infection—see Chapter 14) infections increase the risk of cervical cancer.
4. **Diet.** Low consumption of fruits and vegetables has been linked to higher cervical cancer risk.
5. **Overweight.** Women who are overweight are at higher risk.
6. **Birth control pills.** Long-term use of birth control pills increases the risk. The risk decreases once their use is stopped.
7. **Pregnancies.** Multiple pregnancies (three or more) increase the risk. Pregnancy prior to age 17 also increases the risk.
8. **Family history.** Cervical cancer may run in families because women in these families are less able to fight off the HPV.

Early detection through a Pap test during a pelvic exam should be performed annually in women who are or have been sexually active or who have reached the age of 18. Following three normal tests during three consecutive years, the Pap test may be done less frequently, at the discretion of the physician.

**Endometrial Cancer (Women)**

**Risk Factors**

1. **Estrogen use.** Cancer of the endometrium is associated with high cumulative exposure to estrogen. Obesity and hormone replacement therapy increase estrogen exposure. You should consult your physician before starting or stopping any estrogen therapy.
2. **Age.** Endometrial cancer is seen in older age groups.
3. **Race.** White women have a higher occurrence but African American women have a higher incidence of death.
4. **Pregnancy.** The fewer children the woman has delivered, the greater is the risk for endometrial cancer.
5. **Excessive weight.** Women who are significantly overweight or obese are at greater risk.
6. **Diabetes.** Cancer of the endometrium is associated with diabetes.
7. **Total number of menstrual cycles (periods).** The greater the number of lifetime menstrual cycles (periods), the greater the risk.
8. **Hypertension.** Cancer of the endometrium is associated with high blood pressure.
9. **Physical inactivity.** The risk for endometrial cancer is higher among physically inactive women.

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**Key Terms**

**Mammogram** Low-dose x-rays of the breasts used as a screening technique for the early detection of breast tumors.
Prostate Cancer (Men)

The prostate gland is actually a cluster of smaller glands that encircle the top section of the urethra (urinary channel) at the point where it leaves the bladder. Although the function of the prostate is not entirely clear, the muscles of these small glands help squeeze prostatic secretions into the urethra.

Risk Factors

1. Age. The highest incidence of prostate cancer is found in men over age 65 (more than 70 percent of cases).
2. Family history.
3. Race. African American men have the highest rate in the world.
4. Diet. A diet high in red meat or high-fat dairy products may increase risk.
5. Physical inactivity. The risk may be greater in physically inactive men.

Prostate cancer is difficult to detect and control because the causes are not known. Death rates can be lowered through early detection and awareness of the warning signals. Detection is done by a digital rectal exam of the gland and a prostate-specific antigen (PSA) blood test once a year after the age of 50. Possible warning signals include difficulties in urination (especially at night), painful urination, blood in the urine, and constant pain in the lower back or hip area.

Factors that may decrease the risk include increasing the consumption of tomato-rich foods and fatty fish in the diet two or three times per week, avoiding a high-fat (especially animal fat) diet, increasing daily consumption of produce and grains, and maintaining recommended vitamin D intake (obtained through supplements, in multivitamins, in fortified milk, and manufactured by the body when exposed to sunlight).

Testicular Cancer (Men)

Testicular cancer accounts for only 1 percent of all male cancers, but it is the most common type of cancer seen in men between ages 15 and 34. The incidence is higher in Caucasians than in African Americans. If diagnosed early, this type of cancer is highly curable.

Risk Factors

1. Undescended testicle.
2. Abnormal testicle development.
3. Family history of testicular cancer.
4. Race. White American men have the highest rate (five times greater than African Americans and three times greater than Asian American and Native American men).

The incidence of testicular cancer is quite high in males born with an undescended testicle. Therefore, this condition should be corrected before puberty. The risk, however, remains high and the individual should be vigilant about the condition.

Some of the warning signals associated with testicular cancer are a small lump on the testicle, slight enlargement (usually painless) and change in consistency of the testis, sudden buildup of blood or fluid in the scrotum, pain in the groin and lower abdomen or discomfort accompanied by a sensation of dragging and heaviness, breast enlargement or tenderness, and enlarged lymph glands.

Early diagnosis of testicular cancer is essential, because this type of cancer spreads rapidly to other parts of the body. Because in most cases no early symptoms or pain is associated with testicular cancer, most people do not see a physician for months after discovering a lump or a slightly enlarged testis. Unfortunately, this delay allows almost 90 percent of testicular cancer to metastasize (spread) before a diagnosis is made. TSE once a month following a warm bath or shower (when the scrotum is relaxed). Gently roll each testicle between your thumb and the first three fingers until you have felt the entire surface. Pay particular attention to any lumps, change in size or texture, pain, or a dragging or heavy sensation since your last self-exam. Do not confuse the epididymis at the rear of the testicle for an abnormality.

Bring any changes to the attention of your physician. A change does not necessarily indicate a malignancy, but only a physician is able to determine that.
Pancreatic Cancer

The pancreas is a thin gland that lies behind the stomach. This gland releases insulin and pancreatic juice. Insulin regulates blood sugar, and pancreatic juice contains enzymes that aid in digesting food.

Possible Risk Factors

1. The risk increases with age. Almost 90 percent of cases are seen in people older than 55.
2. Cigarette smoking, cigar smoking, and smokeless tobacco use significantly increase the risk.
3. Excessive sugar intake, which may increase the risk of developing pancreatic cancer by 70 percent.
4. Obesity.
5. Physical inactivity.
6. Chronic pancreatitis.
7. Cirrhosis.
8. Diabetes.
10. African American race.

Detection of pancreatic cancer is difficult because (a) no symptoms are apparent in the early stages and (b) advanced disease symptoms are similar to those of other diseases. Only a biopsy can provide a definite diagnosis, but because pancreatic cancer is primarily a “silent” disease, the need for a biopsy is apparent only when the disease is already in an advanced stage.

Warning signals that may be related to pancreatic cancer include pain in the abdomen or lower back; jaundice; loss of weight and appetite; nausea; weakness; weariness, and loss of energy; agitation depression; dizziness; chills; muscle spasms; double vision; and coma.

Kidney and Bladder Cancer

The kidneys are the organs that filter the urine, and the bladder stores and empties the urine. Most of these two types of cancer are caused by environmental factors. Bladder cancer occurs most frequently between the ages of 50 and 70. Of all bladder cancers, 80 percent are seen in men, and the incidence among Caucasian males is twice that among African American males.

Possible Risk Factors

1. Heavy cigarette smoking, responsible for almost half of all deaths from bladder cancer in men and one-third of deaths from bladder cancer in women.
2. Congenital abnormalities of either organ, detectable by a physician.
3. Exposure to certain chemical compounds, such as aniline dyes, naphthalenes, or benzidines, cadmium, some herbicides, and asbestos.
4. History of schistosomiasis, a parasitic bladder infection.
5. Frequent urinary-tract infections, particularly after age 50.
6. The rate is higher in men.

Avoiding cigarette smoking and occupational exposure to cancer-causing chemicals is important to decrease the risk. Bloody urine, especially in repeated occurrences, is always a warning sign and requires immediate evaluation. Bladder cancer is diagnosed through urine analysis and examination of the bladder with a cystoscope (a small tube that is inserted into the tract through the urethra).

Oral Cancer

Oral cancer affects the mouth, lips, tongue, salivary glands, pharynx, larynx, and floor of the mouth. Most of these cancers seem to be related to cigarette smoking and excessive consumption of alcohol.

Risk Factors

1. Heavy use of tobacco (cigarette, cigar, pipe, or smokeless).
2. Excessive alcohol consumption.

Regular examinations and good dental hygiene help in prevention and early detection of oral cancer. Warning signals include a sore that doesn’t heal or a white patch in the mouth, a lump, problems with chewing and swallowing, or a constant feeling of having “something” in the throat. A person with any of these conditions should be evaluated by a physician or a dentist. A tissue biopsy normally is conducted to diagnose the presence of cancer.

Esophageal and Stomach Cancer

The incidence of gastric cancer in the United States has dropped significantly the last few decades. Cancer experts attribute this drastic decrease to changes in dietary habits and refrigeration. This type of cancer is more common in men, and the incidence is higher in African American males than in Caucasian males.

Risk Factors

1. A diet low in fresh fruits and vegetables.
2. High consumption of salt-cured, smoked, and nitrate-cured foods.
3. Imbalance in stomach acid, heartburn, or gastroesophageal reflex disease (GERD).
4. History of pernicious anemia.
5. Chronic gastritis or gastric polyps.
7. Tobacco and alcohol use.
8. Family history of these types of cancer.

Prevention is accomplished primarily by increasing dietary intake of complex carbohydrates and fiber and decreasing the intake of salt-cured, smoked, and nitrate-
cured foods. In addition, regular guaiac testing for occult blood (hemoccult test) is recommended. Warning signals for this type of cancer include indigestion for 2 weeks or longer, blood in the stools, vomiting, and rapid weight loss.

Ovarian Cancer (Women)
The ovaries are part of the female reproductive system that produces and releases the egg and the hormone estrogen. Ovarian cancer develops more frequently after menopause.

Risk Factors
1. Higher risk with age.
2. History of ovarian problems.
3. Estrogen postmenopausal hormone therapy.
4. Extensive history of menstrual irregularities.
5. Family history of breast or ovarian cancer.
7. Nulliparity (no pregnancies).

In most cases, ovarian cancer has no signs or symptoms. Therefore, regular pelvic examinations to detect signs of enlargement or other abnormalities are highly recommended. Some warning signals may be bloating, an enlarged abdomen, lower abdominal/pelvic pressure or pain, abnormal vaginal bleeding, unexplained digestive disturbances, trouble eating or feeling full quickly, “normal”-size (premenopause-size) ovaries after menopause, and frequent or urgent urination without infection. The previous symptoms may happen sporadically, but if they are a change from “normal,” occur more often, or worsen, consult your doctor. Mutations to the BRCA1 and BRCA2 genes are also a risk factor.

Thyroid Cancer
The thyroid gland, located in the lower portion of the front of the neck, helps regulate growth and metabolism. Thyroid cancer occurs almost three times as often in women as in men. The incidence also is higher in Caucasians than African Americans.

Risk Factors
1. Age.
2. Radiation therapy of the head and neck region received in childhood or adolescence or exposure to high levels of radiation.
3. Family history of thyroid cancer.

Regular inspection for thyroid tumors is done by palpating the gland and surrounding areas during a physical examination. Thyroid cancer is slow-growing; therefore, it is highly treatable. Nevertheless, any unusual lumps in front of the neck should be reported promptly to a physician. Although thyroid cancer does not have many warning signals (besides a lump), these may include difficulty swallowing, choking, labored breathing, and persistent hoarseness.

Liver Cancer
The incidence of liver cancer in the United States is low. Men are more prone than women, and the disease is more common after age 60.

Risk Factors
1. History of cirrhosis of the liver.
2. History of hepatitis B or hepatitis C virus.
3. Exposure to vinyl chloride (industrial gas used in plastics manufacturing) and aflatoxin (a natural food contaminant).
4. Excessive alcohol consumption.
5. Race/ethnicity. Asian Americans and Pacific Islanders have the highest rate.

Prevention consists primarily of avoiding the risk factors and being aware of warning signals. Possible signs and symptoms are a lump or pain in the upper right abdomen (which may radiate into the back and shoulder), fever, nausea, rapidly deteriorating health, jaundice, and tenderness of the liver.

Leukemia
Leukemia is a type of cancer that interferes with blood-forming tissues (bone marrow, lymph nodes, and spleen) by producing too many immature white blood cells. People who have leukemia cannot fight infection very well. The causes of leukemia are mostly unknown, although suspected risk factors have been identified.

Possible Risk Factors
1. Inherited susceptibility, but not transmitted directly from parent to child.
2. Greater incidence in individuals with Down syndrome (mongolism) and a few other genetic abnormalities.
3. Excessive exposure to ionizing radiation.
4. Environmental exposure to chemicals such as benzene, found in gasoline and cigarette smoke.

Detection is not easy because early symptoms can be associated with other serious ailments. When leukemia is suspected, the diagnosis is made through blood tests and a bone marrow biopsy.

Early warning signals include fatigue, pallor, weight loss, easy bruising, nosebleeds, loss of appetite, repeated infections, hemorrhages, night sweats, bone and joint pain, and fever. At a more advanced stage, fatigue increases, hemorrhages become more severe, pain and
high fever continue, the gums swell, and various skin disorders occur.

**Lymphoma**

Lymphomas are cancers of the lymphatic system. The lymphatic system consists of lymph nodes found throughout the body and a network of vessels that link these nodes. The lymphatic system participates in the body’s immune reaction to foreign cells, substances, and infectious agents.

**Possible Risk Factors**

As with leukemia, the causes of lymphomas are unknown. Age is a strong risk factor. Because of the weakened immune system, the majority of cases are seen in people over 60. Individuals who have received organ transplants are at higher risk. Some researchers suspect that a form of herpes virus (called Epstein-Barr virus) is active in the initial stages of lymphosarcomas. Risk of non-Hodgkin’s lymphoma is higher in people who carry the human immunodeficiency virus (HIV) and human T-cell leukemia/lymphoma virus I (HTLV-I). A family history increases the risk as well.

Other researchers suggest that certain external factors may alter the immune system, making it more susceptible to the development and multiplication of cancer cells. Exposure to radiation, herbicides, organic solvents, and other chemicals may also increase risk, as may poor diet and insufficient physical inactivity.

Prevention of lymphoma is limited because little is known about its causes. Enlargement of a lymph node or a cluster of lymph nodes is the first sign of lymphoma. Other signs and symptoms are an enlarged spleen or liver, weakness, fever, back or abdominal pain, nausea/vomiting, unexplained weight loss, unexplained itching and sweating, and fever at night that lasts for a long time.

**Critical Thinking**

You have learned about many of the risk factors for major cancer sites. How will this information affect your health choices in the future? Will it be valuable to you, or will you quickly forget all you have learned and remain in a contemplation stage at the end of this course?

**What Can You Do?**

If you are at high risk for any form of cancer, you are advised to discuss this with your physician. An ounce of prevention is worth a pound of cure. Although cardio-

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**Behavior Modification Planning**

**Lifestyle Factors That Decrease Cancer Risk**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>Controls body weight, may influence hormone levels, strengthens the immune system.</td>
</tr>
<tr>
<td>Fiber</td>
<td>Contains anti-cancer substances, increases stool movement, blunts insulin secretion.</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>Contain phytonutrients and vitamins that thwart cancer.</td>
</tr>
<tr>
<td>Recommended weight</td>
<td>Helps control hormones that promote cancer.</td>
</tr>
<tr>
<td>Healthy grilling</td>
<td>Prevents formation of heterocyclic amines (HCAs) and polycyclic aromatic hydrocarbons (PAHs), both carcinogenic substances.</td>
</tr>
<tr>
<td>Tea</td>
<td>Contains polyphenols that neutralize free radicals, including epigallocatechin gallate (EGCG), which protects cells and the DNA from damage believed to cause cancer.</td>
</tr>
<tr>
<td>Spices</td>
<td>Provide phytonutrients and strengthen the immune system.</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Disrupts abnormal cell growth.</td>
</tr>
<tr>
<td>Monounsaturated fat</td>
<td>May contribute to cancer cell destruction.</td>
</tr>
</tbody>
</table>

**Try It** In your Online Journal or class notebook, note ways you can incorporate all of these factors into your everyday lifestyle.

vascular disease is the number one killer in the United States, cancer is the number one fear. Of all cancers, 60 to 80 percent are preventable, and about 50 percent are curable. Most cancers are lifestyle related, so being aware of the risk factors and following basic recommendations for preventing cancer will greatly decrease your risk for developing it.
Assess Your Behavior

1. Are you physically active on most days of the week?
2. Does your diet include ample amounts of colorful fruits and vegetables and of fiber, and is it low in red and processed meats?
3. Are you aware of your family history of cancer?
4. Do you practice monthly breast self-examination (women) or testicular self-examination (men)?
5. Do you respect the sun’s rays? Do you use sunscreen lotion or wear protective clothing when you are in the sun for extended periods of time? Do you perform regular skin self-examinations?
6. Are you familiar with the seven warning signals of cancer?

Assess Your Knowledge

Evaluate how well you understand the concepts presented in this chapter using the chapter-specific quizzing available in the online materials at www.cengagebrain.com.

1. Cancer can be defined as
   a. a process whereby some cells invade and destroy the immune system
   b. uncontrolled growth and spread of abnormal cells.
   c. the spread of benign tumors throughout the body.
   d. interference of normal body functions through blood-flow disruption caused by angiogenesis.
   e. All are correct choices.

2. Cancer treatment becomes more difficult when
   a. cancer cells metastasize.
   b. angiogenesis is disrupted.
   c. a tumor is encapsulated.
   d. cells are deficient in telomerase.
   e. cell division has stopped.

3. The leading cause of deaths from cancer in women is
   a. lung cancer.
   b. breast cancer.
   c. ovarian cancer.
   d. skin cancer.
   e. endometrial cancer.

4. Cancer
   a. is primarily a preventable disease.
   b. is often related to tobacco use.
   c. has been linked to dietary habits.
   d. risk increases with obesity.
   e. All are correct choices.

5. About 60 percent of cancers are related to
   a. genetics.
   b. environmental pollutants.
   c. viruses and other biological agents.
   d. ultraviolet radiation.
   e. diet, obesity, and tobacco use.

6. A cancer-prevention diet should include
   a. ample amounts of fruits and vegetables.
   b. cruciferous vegetables.
   c. phytonutrients.
   d. soy products.
   e. all of the above.

7. The biggest carcinogenic exposure in the workplace is to
   a. asbestos fibers.
   b. cigarette smoke.
   c. biological agents.
   d. nitrosamines.
   e. pesticides.

8. Which of the following is not a warning signal for cancer?
   a. Change in bowel or bladder habits
   b. Nagging cough or hoarseness
   c. A sore that does not heal
   d. Indigestion or difficulty in swallowing
   e. All of the above are warning signals for cancer.

9. The risk for breast cancer is higher in
   a. women under age 50.
   b. women with more than one family member with a history of breast cancer.
   c. minority groups than white women.
   d. women who had children prior to age 30.
   e. all of the above groups.

10. The risk for prostate cancer can be decreased by
    a. consuming selenium-rich foods.
    b. adding fatty fish to the diet.
    c. avoiding a high-fat diet.
    d. including tomato-rich foods in the diet.
    e. all of the above.

Correct answers can be found at the back of the book.
Chapter 11:

Notes

5. See note 1.
12. See note 1.

**Suggested Readings**


Chapter 11
1. b  2. a  3. a  4. e  5. e  6. e  7. b  8. e  9. b  10. e

This page contains answers for this chapter only
Check Yourself
Tips for a Healthy Cancer-Fighting Diet

Increase intake of phytonutrients, fiber, cruciferous vegetables, and more antioxidants by

- Eating a predominantly vegetarian diet
- Eating more fruits and vegetables every day (six to eight servings per day maximize anticancer benefits)
- Increasing the consumption of broccoli, cauliflower, kale, turnips, cabbage, kohlrabi, Brussels sprouts, hot chili peppers, red and green peppers, carrots, sweet potatoes, winter squash, spinach, garlic, onions, strawberries, tomatoes, pineapple, and citrus fruits in your regular diet
- Eating vegetables raw or quickly cooked by steaming or stir-frying
- Substituting tea and fruit and vegetable juices for coffee and soda
- Eating whole-grain breads
- Including calcium in the diet (or from a supplement)
- Including soy products in the diet
**Do you have these healthy lifestyle factors working in your favor?**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity</td>
<td>Controls body weight, may influence hormone levels, strengthens the immune system.</td>
</tr>
<tr>
<td>Fiber</td>
<td>Contains anti-cancer substances, increases stool movement, blunts insulin secretion.</td>
</tr>
<tr>
<td>Fruits and vegetables</td>
<td>Contain phytoneutrients and vitamins that thwart cancer.</td>
</tr>
<tr>
<td>Recommended weight</td>
<td>Helps control hormones that promote cancer.</td>
</tr>
<tr>
<td>Healthy grilling</td>
<td>Prevents formation of carcinogenic substances.</td>
</tr>
<tr>
<td>Tea</td>
<td>Contains polyphenols that neutralize free radicals.</td>
</tr>
<tr>
<td>Spices</td>
<td>Provide phytoneutrients and strengthen the immune system.</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>Disrupts abnormal cell growth.</td>
</tr>
<tr>
<td>Monounsaturated fat</td>
<td>May contribute to cancer cell destruction.</td>
</tr>
</tbody>
</table>

II. Limit saturated and trans fats by:
   - Limiting red meat intake to two 3-ounce servings of lean meat per week
   - Consuming low-fat or nonfat dairy products only
   - Using primarily omega-3 fats found in cold water fish at least twice per week as well as poultry, nuts, and legumes as the main protein sources in the diet

III. Balancing caloric input with caloric output to maintain recommended body weight