

Diet And Health

Diet And Health



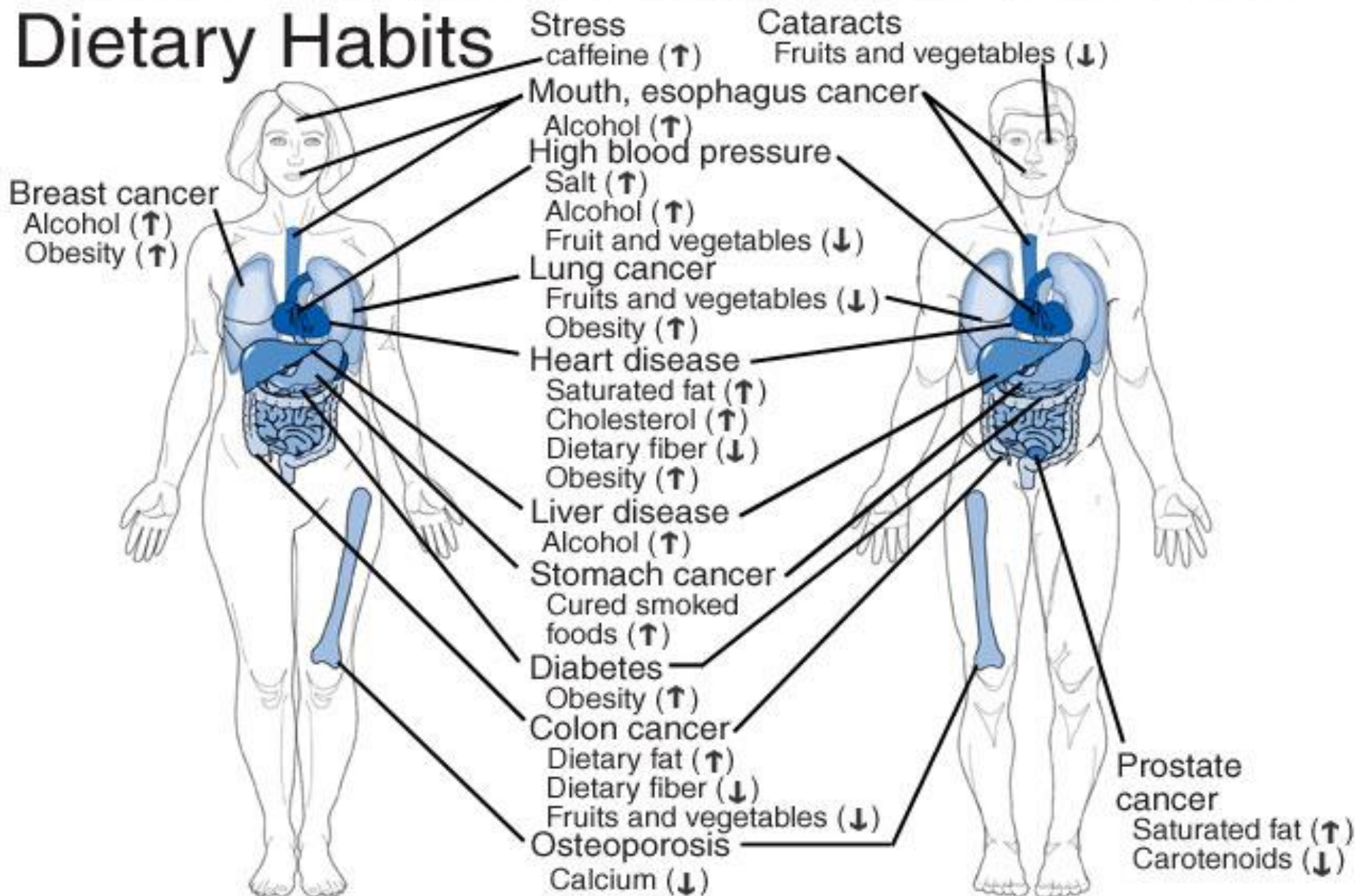
- Diet and Health
- Diet has always played an important role
- Early nutrition research focussed on diseases of the day:
e.g. night blindness, beriberi, scurvy, rickets
- More recently..... **CHRONIC DISEASES** “disease of over-consumption”
- Heart disease, cancers, stroke, diabetes mellitus
- Cause of death in almost 2 of 3 deaths

- **The food that we choose to eat from youth to old age is a major contributor to CHRONIC DISEASE.**
- **Heart disease (32%)**
- **Cancers (23%)**
- **Stroke (7%)**
- **Quality of Life**
- **Diabetes mellitus Arthritis**
- **High Blood Pressure**
- **Osteoporosis**

Statistics

- Every second person in the U.S. is chronically ill
 - cancer, heart disease, diabetes, glaucoma, etc.
- By 2020, the number of people living with chronic conditions is expected to rise to 157 million and direct medical costs are expected to double to more than \$1 trillion
 - 80 percent of the nation's health care spending

Health Problems Associated with Poor Dietary Habits

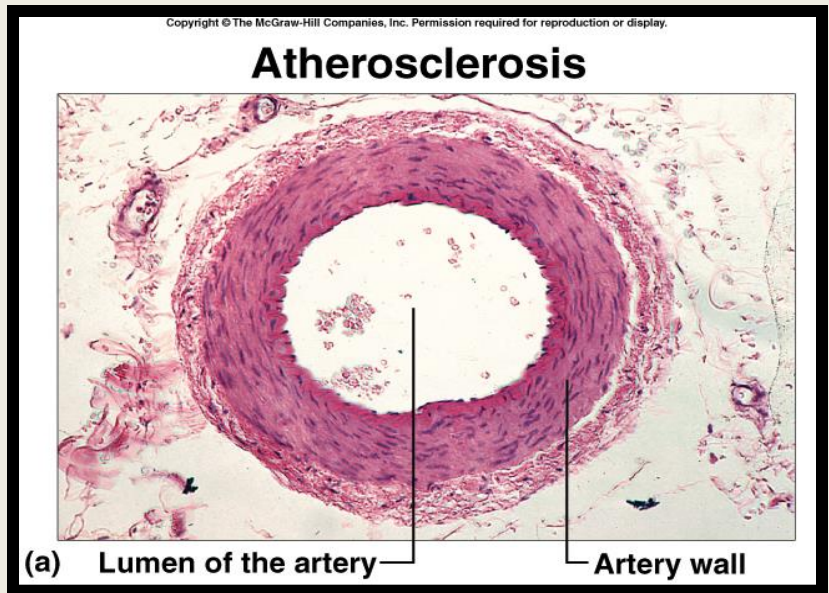


Nutrition and Disease

- 6 out of 10 leading causes of death are Chronic Diseases
- Chronic Diseases cause over 80% of all deaths
- Prevention is the best approach to lessening one's chances of these diseases
- Physical Activity and Diet are 2 of the leading lifestyle factors in the prevention

Leading Causes of Death and Diseases Related to Improper Diet and/or Lack of Physical Activity

- Heart Disease
- Cancer
- Stroke
- Hypertension
- Diabetes
- Arthritis
- Osteoporosis
- Obesity



Overall Health: Risk of Disease

- Cancer
- Heart disease
- Diabetes
- Stroke

- Osteoporosis
- Cataracts
- Birth defects
- Premature death

SOME DISEASES LINKED WITH DIET

- CANCER
- HEART DISEASE
- HIGH BLOOD PRESSURE
- OBESITY
- DIVERTICULITIS

Nutrition and Infectious Diseases

- **The Immune System**

- Organs of the immune system fight antigens

- Spleen
- Lymph nodes
- Thymus

- Phagocytes

- Engulf and digest invaders; a process is called phagocytosis
- Secrete special proteins called cytokins that activate a metabolic and immune response

Nutrition and Infectious Diseases

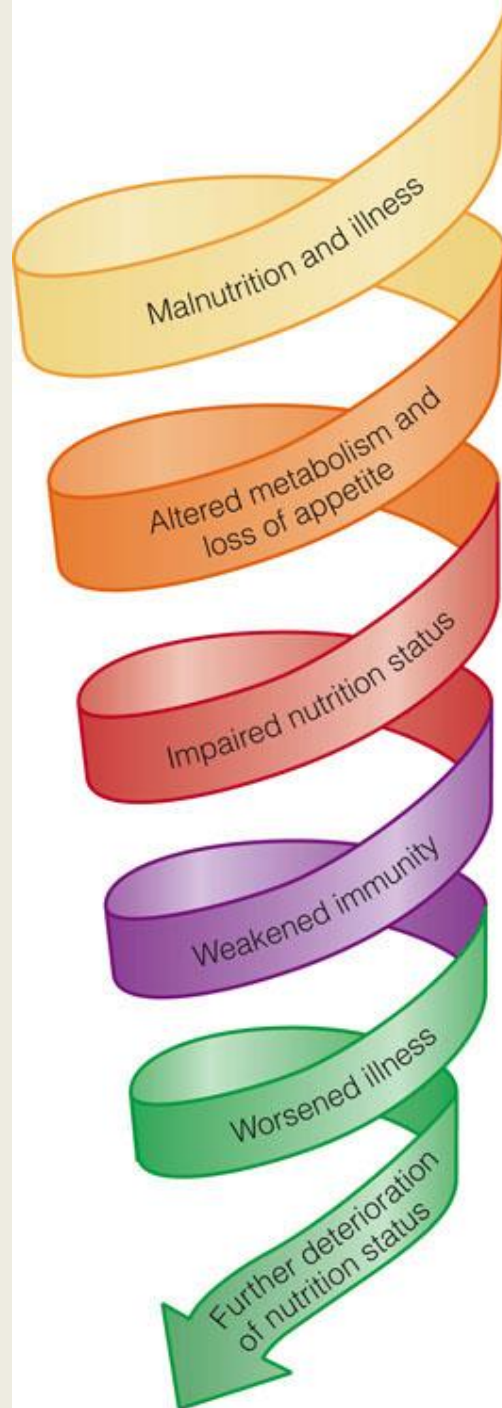
- The Immune System
 - Lymphocytes: B-cells
 - Produce antibodies that react selectively, part of a class of proteins called immunoglobulins
 - Retain memory to react faster with the same foreign organism
 - Resistance to infection
 - Lymphocytes: T-cells
 - Release powerful chemicals to destroy foreign particles
 - Highly specific, attacking only one antigen
 - Defend against fungi, viruses, parasites, some bacteria, and cancer cells
 - Participate in the rejection of transplanted tissue

Nutrition and Infectious Diseases

- **Nutrition and Immunity**
 - Malnutrition compromises immunity.
 - Immunity and infectious disease increase nutrient needs and lower food intake.
 - The synergistic downward cycle of disease and malnutrition must be broken for recovery to occur.
 - Opportunistic infections develop when the immune system is suppressed.

Nutrition and Immunity

- Protein
- Fatty acids
- Vitamins A, E, B₆, C
- Folate
- Iron
- Zinc
- Selenium

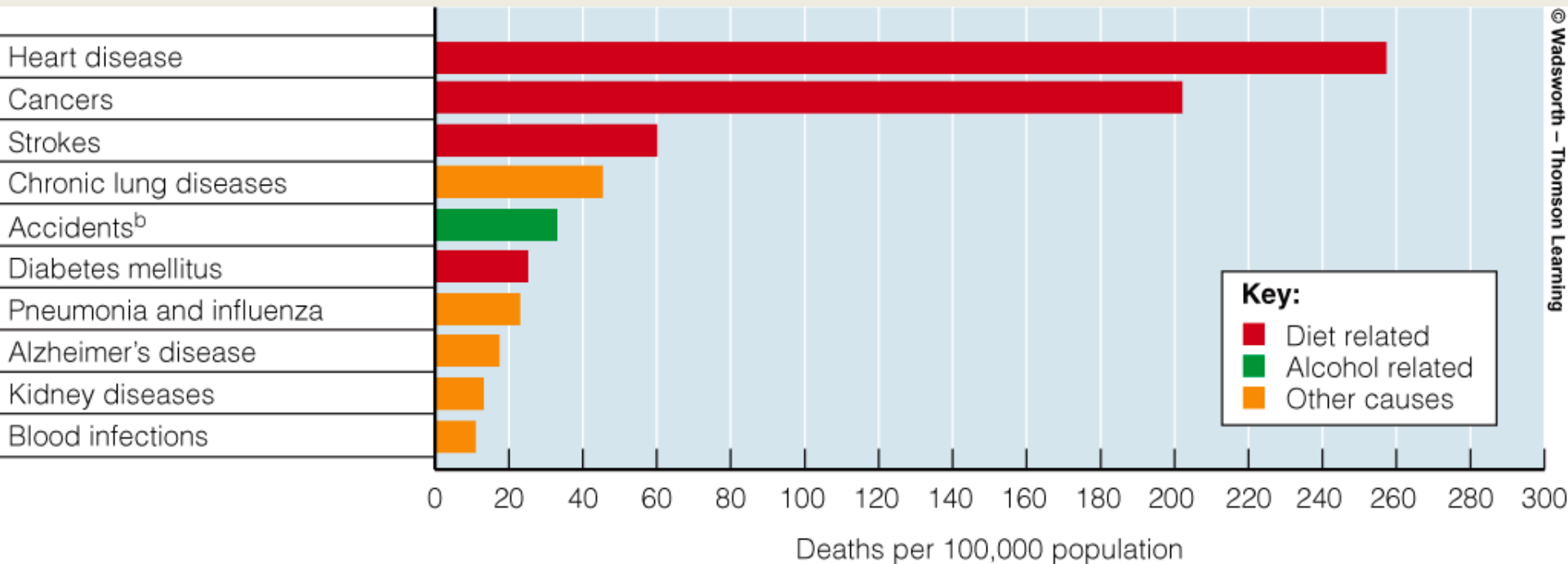


Nutrition and Infectious Diseases

- HIV and AIDS
 - HIV (human immunodeficiency virus) is the infection that attacks the immune system and disables the body's defenses.
 - AIDS (acquired immune deficiency syndrome) is the infectious disease that destroys health and life.
 - Epidemic
 - Early detection and early intervention are critical.

Nutrition And Chronic Disease

- Leading causes of death in the U.S.



^aRates are age adjusted to allow relative comparisons of mortality among groups and over time.

^bMotor vehicle and other accidents are the leading cause of death among people aged 15-24, followed by homicide, suicide, cancer, and heart disease. Alcohol contributes to about half of all accident fatalities.

SOURCE: Data from National Center for Health Statistics, 2002.

© 2005 Thomson - Wadsworth

Nutrition and Chronic Diseases

- Four of the top ten causes of death are related to diet.
- There are also genetic and lifestyle risk factors that are important and related to chronic disease.
- Many of the nutritional factors in the treatment of chronic disease are interrelated.

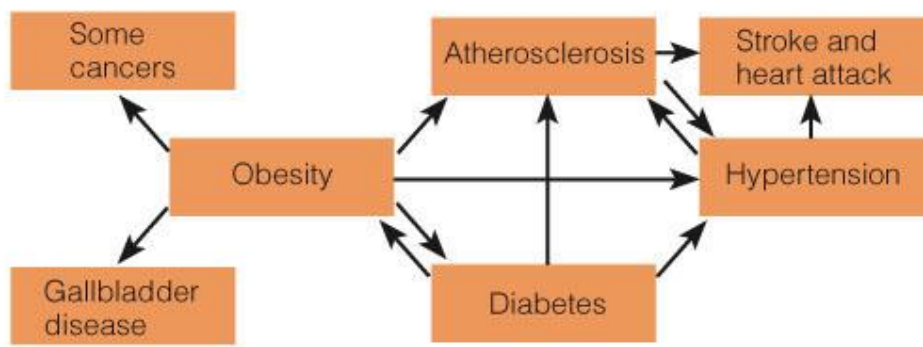
Diet Risk Factors

Other Risk Factors



Chronic Diseases

Chronic Disease	Diet high in fat, saturated fat, and/or trans fat	Excessive alcohol intake	Low complex carbohydrate/fiber intake	Low vitamin and/or mineral intake	High sugar intake	High intake of salty or pickled foods	Genetics	Age	Sedentary lifestyle	Smoking and tobacco use	Stress	Environmental contaminants
Cancers	✓	✓	✓	✓			✓	✓	✓	✓		✓
Hypertension	✓	✓		✓			✓	✓	✓	✓	✓	✓
Diabetes (type 2)	✓			✓			✓		✓			
Osteoporosis		✓		✓			✓	✓	✓	✓		
Atherosclerosis	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓
Obesity	✓	✓	✓		✓		✓		✓			
Stroke	✓	✓	✓				✓	✓	✓	✓	✓	✓
Diverticulosis	✓		✓	✓				✓	✓			
Dental and oral disease				✓	✓		✓		✓			



This chart shows that the same risk factor can affect many chronic diseases. Notice, for example, how many diseases have been linked to a sedentary lifestyle. The chart also shows that a particular disease, such as atherosclerosis, may have several risk factors.

This flow chart shows that many of these conditions are themselves risk factors for other chronic diseases. For example, a person with diabetes is likely to develop atherosclerosis and hypertension. These two conditions, in turn, worsen each other and may cause a stroke or heart attack. Notice how all of these chronic diseases are linked to obesity.

Nutrition and Chronic Disease

- Deficiency diseases (rickets and pellagra) are rare in the general population in the U.S.
- They can be found in special groups: severely ill, neglected children, house-bound aged
- Currently more common are diseases of dietary excess or imbalance
- 3 important risk factors used to determine nutritional status are shown ([Devlin fig 28.16](#))
- A person on the periphery would have very low risk of any nutritional deficiency, whereas people in the green, orange, purple or center areas would be much more likely to experience some symptoms of nutritional deficiencies

Many of the leading causes of death are affected by diet or alcohol ([figure 27.15](#))

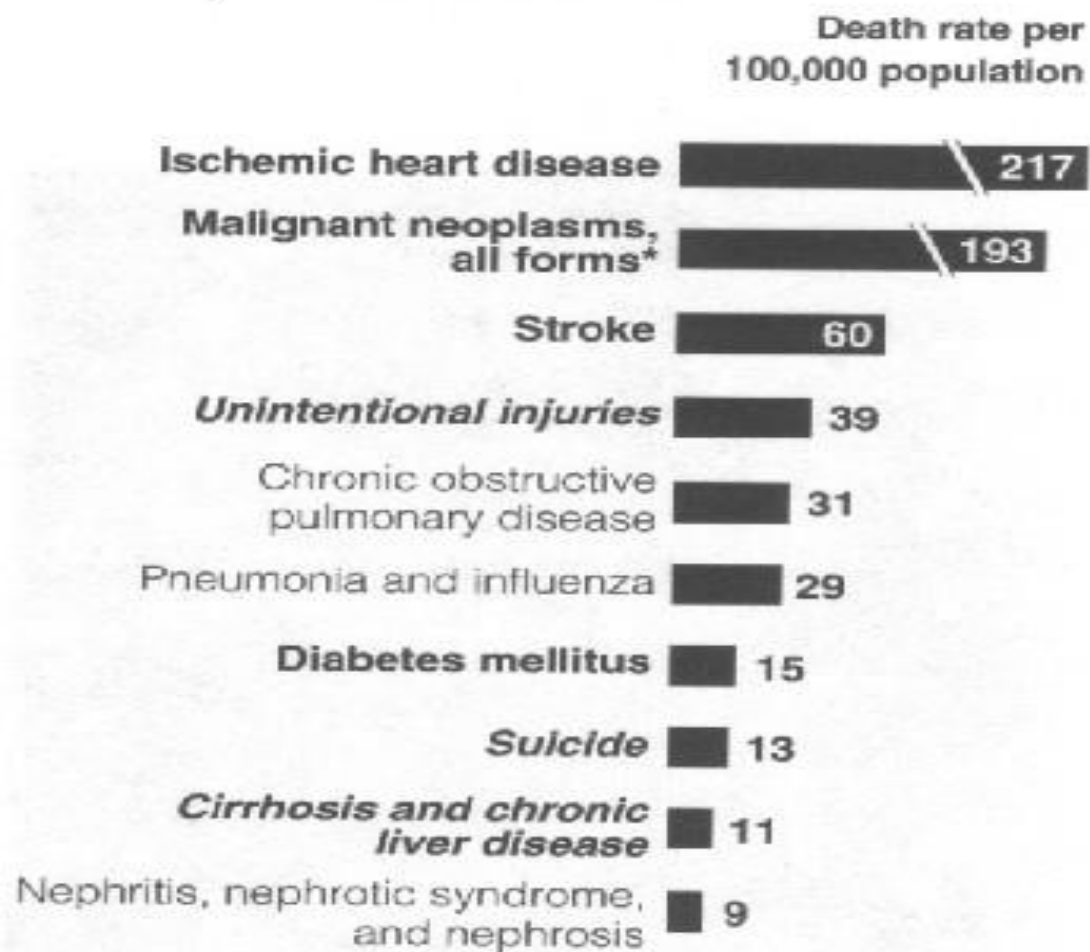


Figure 27.15

Influence of nutrition on some common causes of death. Bold type indicates cause of death in which diet plays a part. Bold italic type indicates cause of death in which excessive alcohol consumption plays a part. (*Diet plays a role in only some forms of cancer.)

Heart Disease and Stroke

- Diseases of the heart and blood vessels= Cardiovascular disease (CVD)
 - Results in heart disease and strokes
- Most common form of CVD is coronary heart disease (CHD)
 - Involves atherosclerosis (accumulation of lipids and other materials in the arteries) and hypertension
- Blood pressure and atherosclerosis

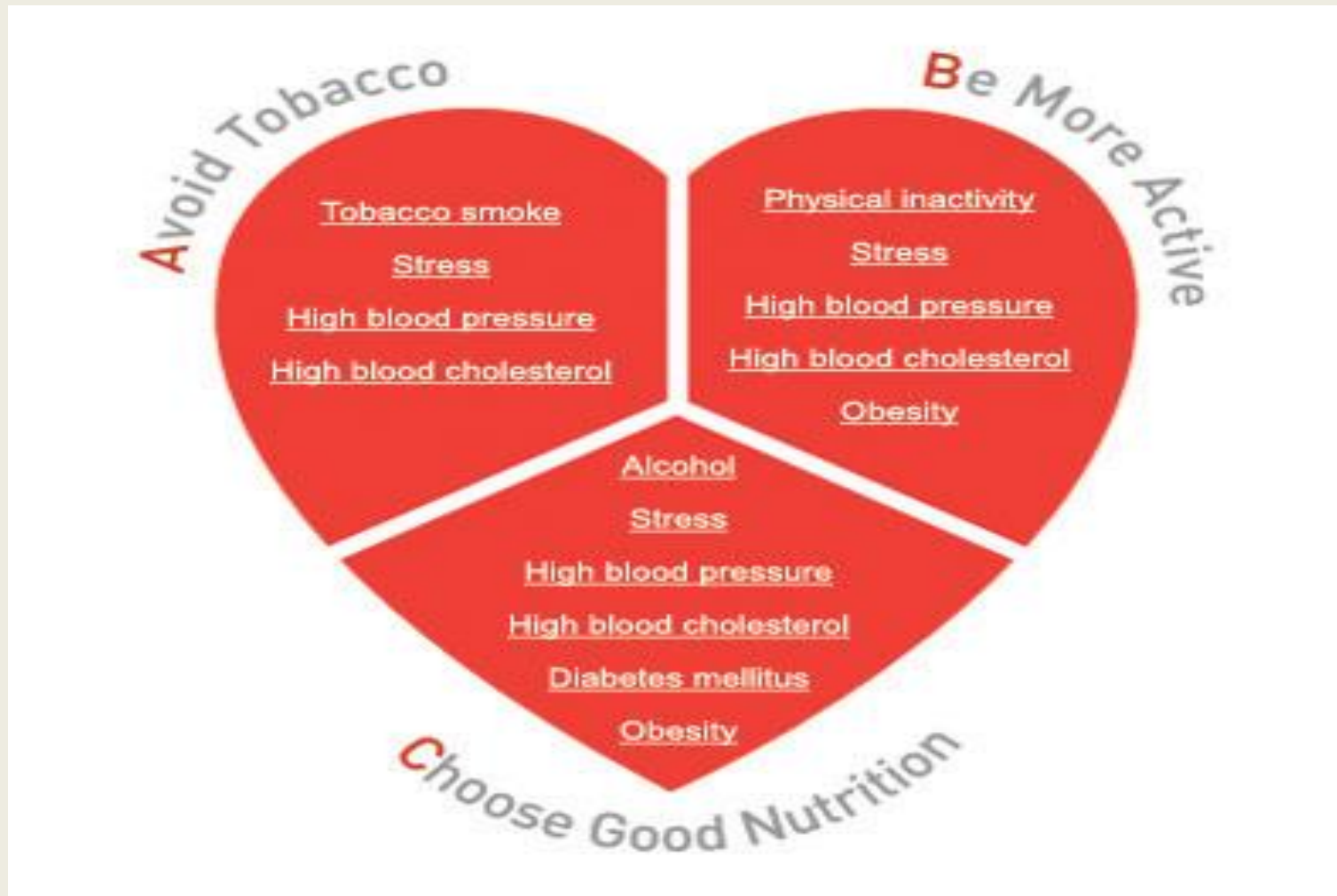
How Atherosclerosis Develops

- Plaques
- The result: heart attacks and strokes
 - Angina
 - Heart attack
 - Stroke

Risk factors for CHD

- High LDL cholesterol
- Low HDL cholesterol
- Hypertension
- Diabetes
- Male, 45 yrs or older
- Female, 55 yrs or older or w/ premature menopause
- Smoking
- Family history of heart attacks or sudden death of male <55 yrs or female <65 yrs

ABCs of Preventing Heart Disease, Stroke and Heart Attack



Cardiovascular Disease

- Atherosclerotic plaques can raise blood pressure, cause abnormal blood clotting, and cause heart attacks and strokes.
- There are many recommendations for prevention and treatment including dietary interventions, quitting smoking and engaging in regular physical activity.
- The most common form of CVD is coronary heart disease (CHD), which develops due to atherosclerosis in the coronary arteries.

Cardiovascular Disease

- How Atherosclerosis Develops
 - Atheromatous plaque builds on artery walls and leads to inflammation.
 - Causes of Atherosclerosis
 - Cells lining the blood vessels incur damage.
 - Inflammatory response using macrophages that become the cells of plaque
 - Blood clots form and minerals harden the plaque.
 - Fibrous connective tissue
 - C-reactive protein (CRP) is a sign of inflammation of the artery walls.

Cardiovascular Disease

- How Atherosclerosis Develops
 - Plaques
 - Fibrous coating can be torn away with a surge in blood pressure
 - Blood Clots
 - Platelets cover the damaged area and form a clot.
 - Thrombosis is a blood clot that sticks to an artery and grows large enough to restrict or close off a blood vessel.
 - Embolism is when a blood clot breaks free, travels, and lodges in a small artery and shuts off blood flow to tissues.
 - Platelets are under the control of eicosanoids, made from omega-3 and omega-6 fatty acids.

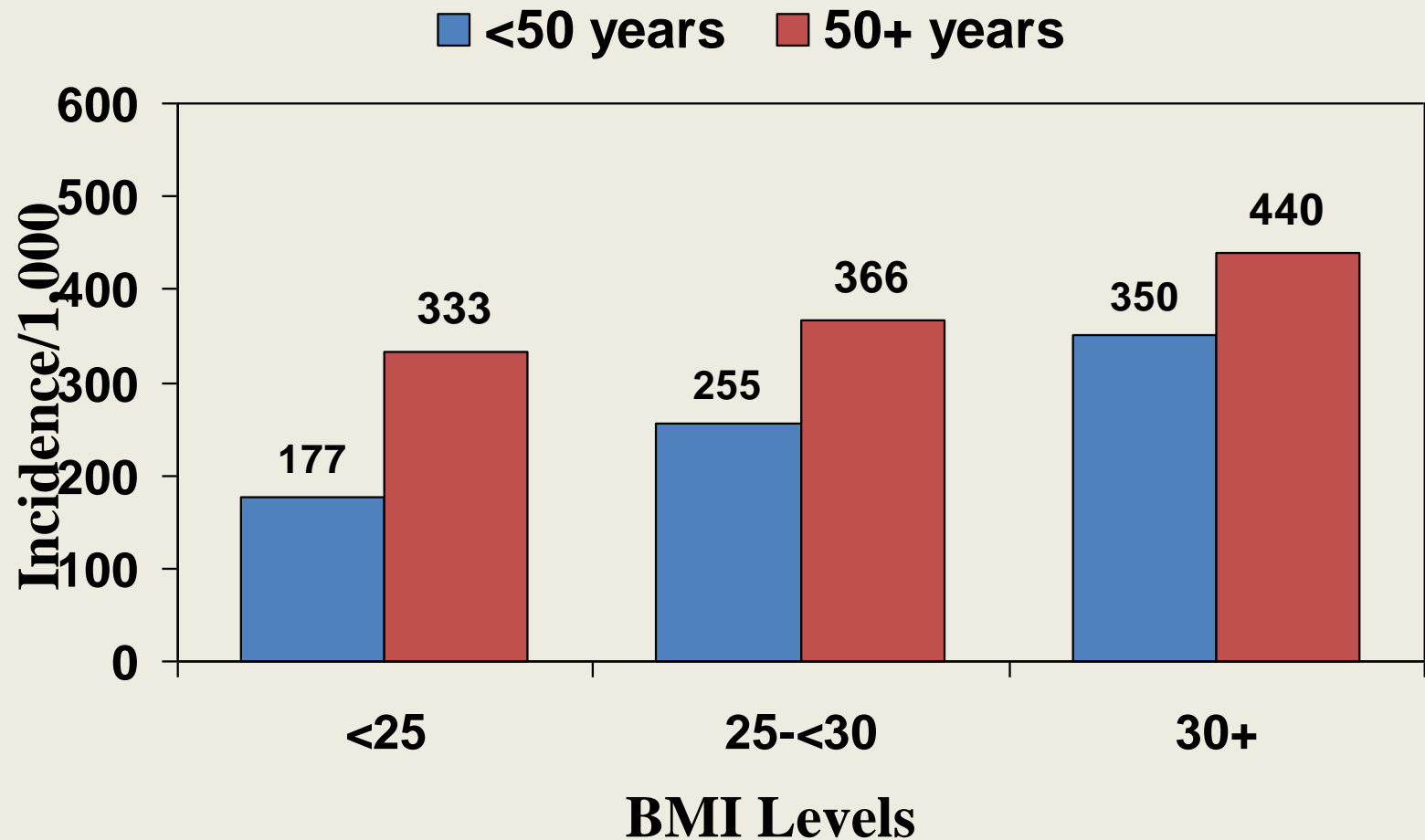
Cardiovascular Disease

- How Atherosclerosis Develops
 - Blood Pressure and Atherosclerosis
 - Arteries are narrowed due to plaque, clots, or both.
 - The heart must generate more pressure to deliver blood to the tissues.
 - Higher blood pressure results in further damages.
 - The Result: Heart Attacks and Strokes
 - Angina – pain or pressure feeling around the area of the heart
 - Heart attack – restricted blood flow to the heart
 - Transient ischemic attack or stroke – restricted blood flow to the brain

Cardiovascular Disease

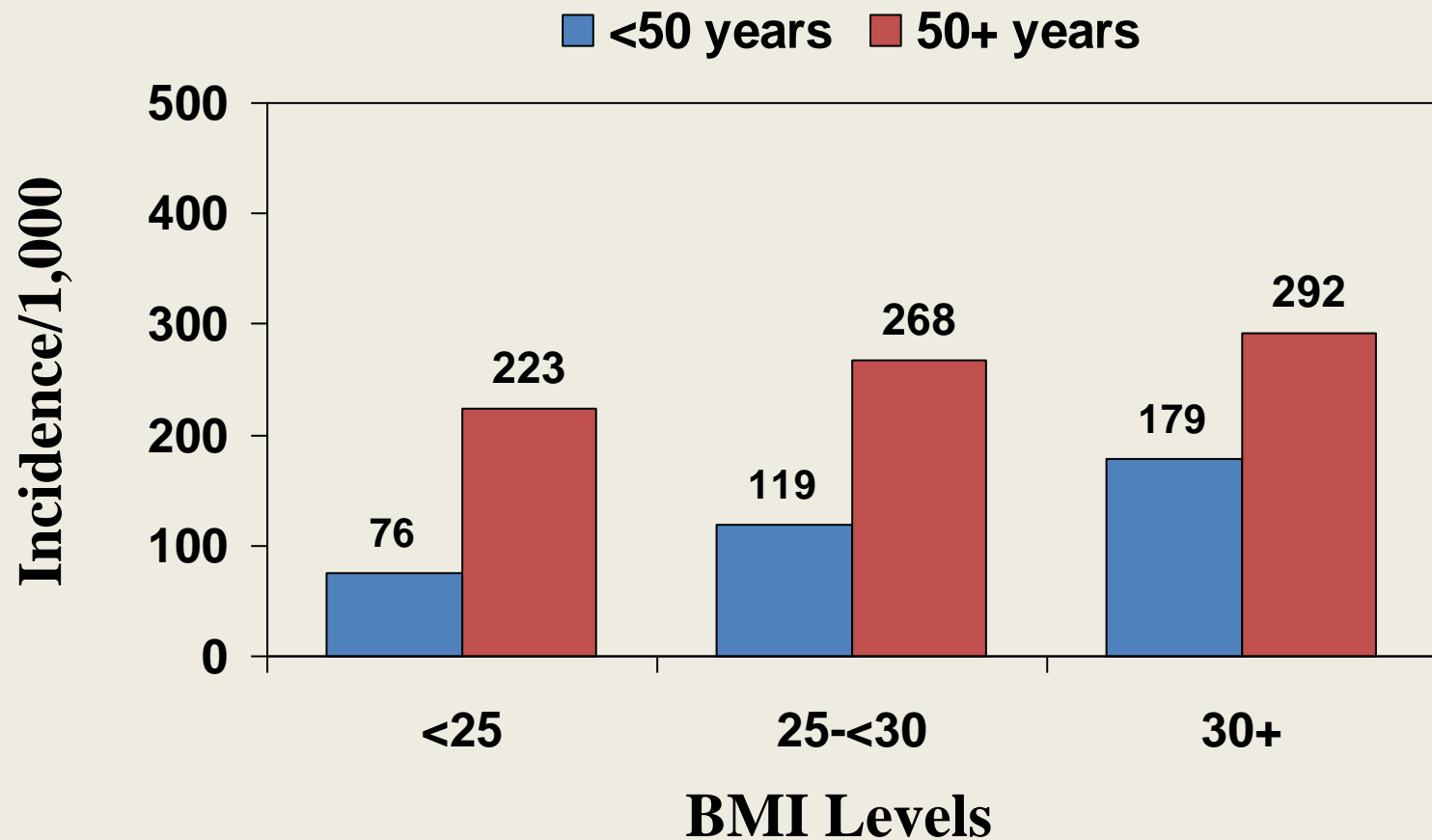
- Risk Factors for Coronary Heart Disease
 - Diet and physical activity are modifiable risk factors.
 - Age, Gender, and Family History
 - Cannot change these factors
 - Men higher risk than women
 - Men older than 45 years of age
 - Women older than 55 years of age
 - Immediate family history of premature heart disease

26 -Year Incidence of Coronary Heart Disease in Men



Adapted from Hubert HB et al. *Circulation* 1983;67:968-977.
Metropolitan Relative Weight of 110 is a BMI of approximately 25.
usworth

26 -Year Incidence of Coronary Heart Disease in Women



Adapted from Hubert HB et al. *Circulation* 1983;67:968-977
Metropolitan Relative Weight of 110 is a BMI of approximately 25

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - High LDL and Low HDL Cholesterol
 - LDL
 - Excess LDL (low-density lipoproteins) become available for oxidation, high risk
 - Risk factors for LDL cholesterol
 - » Desirable: <100 mg/dL
 - » Above optimum level: 100-129 mg/dL
 - » Borderline: 130-159 mg/dL
 - » High: 160-189 mg/dL
 - » Very High: >190 mg/dL

Cardiovascular Disease

- High LDL and Low HDL Cholesterol
 - HDL
 - HDL (high-density lipoproteins) represent cholesterol being carried back to the liver, reduced risk
 - Risk factors for HDL cholesterol
 - Desirable: ≥ 60 mg/dL
 - Borderline: 59-40 mg/dL
 - High: < 40 mg/dL

Cardiovascular Disease

- High LDL and Low HDL Cholesterol
 - Total cholesterol
 - Desirable levels at < 200 mg/dL
 - Borderline levels at 200-239 mg/dL
 - High levels at ≥ 240 mg/dL

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - High Blood Pressure (Hypertension)
 - Injures artery walls and accelerates plaque formation which in turn increases blood pressure
 - Blood pressure (systolic and/or diastolic pressure)
 - Desirable: $<120/<80$
 - Borderline: $120-139/80-89$ (prehypertension)
 - High: $\geq 140/\geq 90$ – stage one hypertension
 - Stage two hypertension: $\geq 160/\geq 100$

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - Diabetes
 - Risk similar to people with established CHD
 - CHD risk equivalents

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - Obesity and Physical Inactivity
 - Obesity, especially abdominal obesity, and physical inactivity increase risk
 - Body mass index
 - Desirable: 18.5-24.9
 - Borderline: 25-29.9
 - High: ≥ 30
 - Weight loss and regular physical activity are protective.

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - Cigarette Smoking
 - Powerful increased risk
 - Increases blood pressure and the workload of the heart
 - Atherogenic Diet
 - A diet high in saturated fats, trans fats, and cholesterol and low in fruits and vegetables elevates LDL cholesterol.
 - Antioxidants and omega-3 fatty acids lower the risk of CHD.

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - Other Risk Factors
 - Emerging risk factors and predictions
 - Elevated triglycerides are a marker for other risk factors and being studied in relation to CHD
 - Desirable levels of fasting triglycerides: <150 mg/dL
 - Borderline levels of fasting triglycerides: 150-199 mg/dL
 - High levels of fasting triglycerides: 200-499 mg/dL
 - Very high levels of fasting triglycerides: ≥ 500 mg/dL
 - Diabetes and overweight

Cardiovascular Disease

- Risk Factors for Coronary Heart Disease
 - Metabolic Syndrome
 - Also called Syndrome X or insulin resistance syndrome
 - Insulin resistance is a risk factor

Cardiovascular Disease

- Metabolic Syndrome
 - Any three of the following factors
 - Abdominal obesity
 - Men: Waist circumference >40 inches
 - Women: waist circumference >35 inches
 - Triglycerides: ≥ 150 mg/dL
 - HDL: <40 mg/dL in men, <50 mg/dL in women
 - Blood pressure: $\geq 130/85$ mm Hg
 - Fasting glucose: ≥ 100 mg/dL

Recommendations for Reducing Cardiovascular Disease Risk

- Blood lipid screening
- Control weight
- Regular aerobic exercise
- Reduce fat, especially saturated fat
- Increase fiber, Vit C and Vit E, Moderate alcohol use
- Drug treatment

Cardiovascular Disease

- Recommendations for Reducing Coronary Heart Disease Risk
 - Cholesterol Screening – at least two times at least one week apart
 - Lifestyle Changes
 - Balance energy intake with energy needs.
 - Include lean meats, vegetables, and low-fat milk products.
 - Limit foods with high concentrations of saturated fatty acids (< 7% of total kcalories) and *trans*-fatty acids (< 1% of total kcalories).
 - Limit foods with a high content of cholesterol (< 300 mg/day).
 - Choose foods high in soluble fiber: vegetables, fruits, and whole grains.

Cardiovascular Disease

- Lifestyle Changes
 - High-potassium, low-sodium foods
 - Limit sodium to 2,300 mg/day.
 - Limit intake of added sugar.
 - Consume fatty fish at least twice a week for omega-3 fatty acids.
 - Consume foods with plant sterols or stanols added.
 - Use soy products in place of animal foods that are high in saturated fat and cholesterol.
 - Limit alcohol consumption to 1 drink/day for women or 2 drinks/day for men.
 - Exercise at least 30 minutes most days of the week to expend 2,000 kcalories weekly.
 - Reduce exposure to tobacco smoke.

Hypertension (HTN)

- Higher than normal blood pressure (BP)
- Normal BP at rest: 120/70 mm Hg
- Hypertension: >140/90 mm Hg
- Affects 1 out of every 4 Americans
- If untreated can lead to stroke, heart attack, congestive heart failure, kidney disease and blood vessel damage



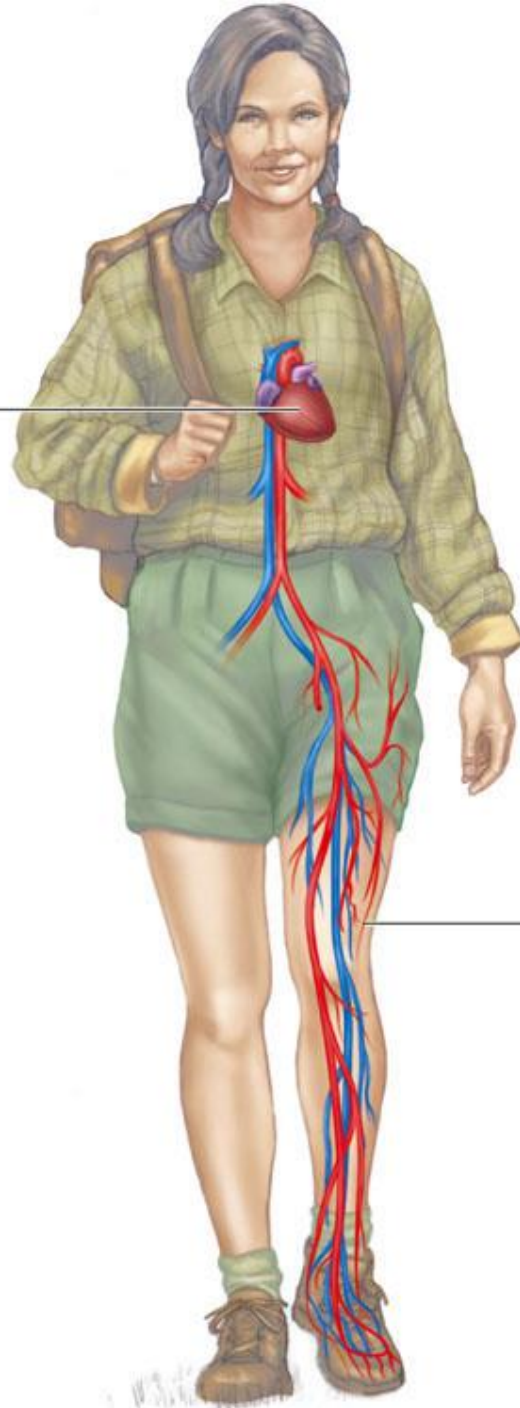
Hypertension

- Hypertension with accompanying atherosclerosis can cause heart attacks and strokes.
- Weight control is the most effective dietary strategy for treating hypertension.

Hypertension

- How Hypertension Develops
 - Blood flow to the kidneys is reduced so the kidneys expand blood volume and constrict peripheral blood vessels, resulting in peripheral resistance and thus raising blood pressure.
 - Cardiac output increases, increasing the work of the heart.

Cardiac output is the volume of blood pumped by the heart within a specified period of time.



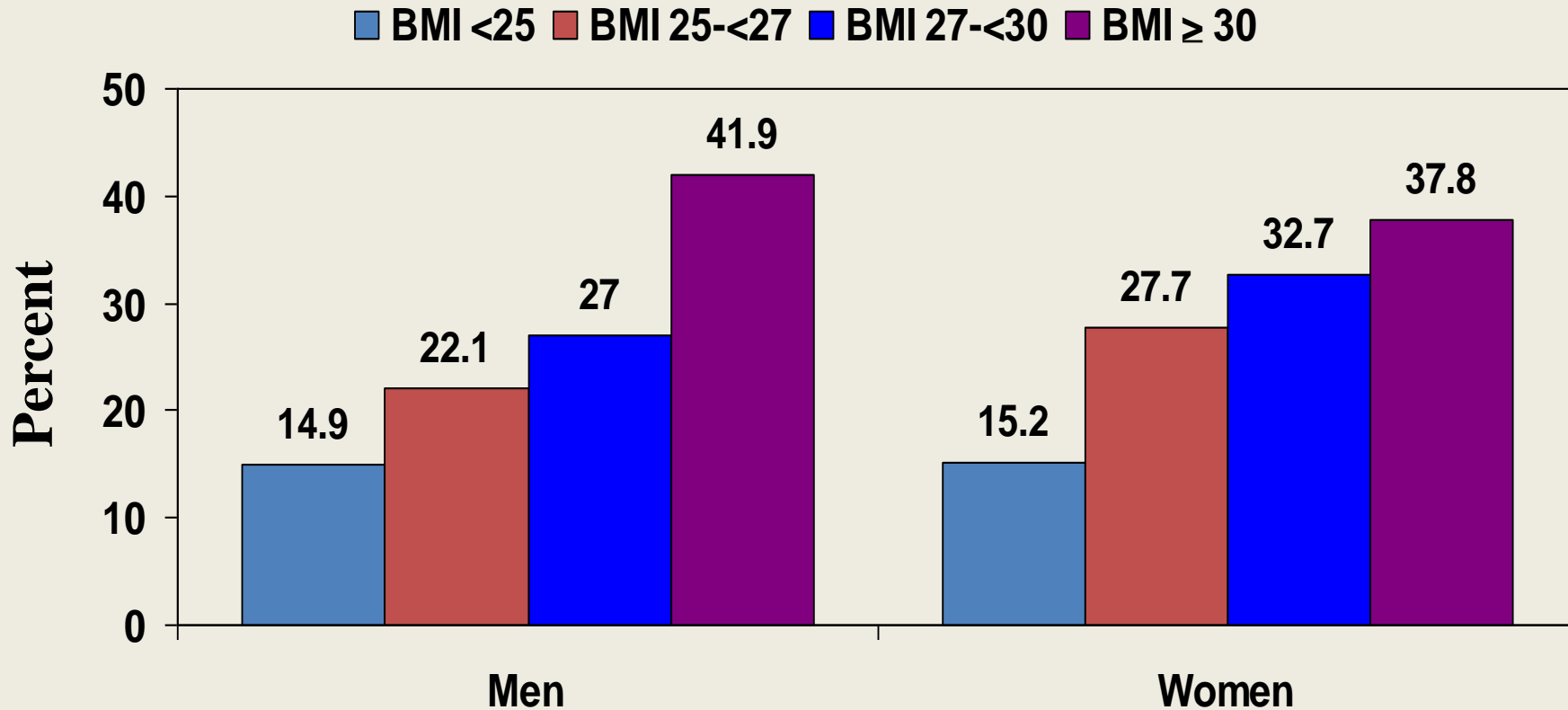
Peripheral resistance refers to the resistance to pumped blood by the small arterial branches (arterioles) that carry blood to tissues.

Risk factors for Hypertension

- **Age** risk increases with age
- **Genetics Heredity or Family History**
- **Obesity** 60% of those with hypertension are obese
- **Race** prevalent in African-American

- **Smoking**
- **Alcohol** may raise blood pressure and is associated with strokes.
- **Salt sensitivity**
- **Stress**

NHANES III Prevalence of Hypertension* According to BMI



*Defined as mean systolic blood pressure ≥ 140 mm Hg, mean diastolic ≥ 90 mm Hg, or currently taking antihypertensive medication.

Brown C et al. Body Mass Index and the Prevalence of Hypertension and Dyslipidemia. *Obes Res*. 2000;8:605-619.
© 2008 Thomson - Wadsworth

Hypertension

- **The DASH Diet**
 - Grains: 6-8 ounces
 - Vegetables: 2-2 ½ cups
 - Fruits: 2-2 ½ cups
 - Milk (low-fat or fat-free): 2-3 cups
 - Meat (lean): 6 ounces or less
 - Nuts, seeds, legumes: 4-5 ounces per week
 - 2000 kcalories

Hypertension

- Treatment of Hypertension
 - Drug Therapy
 - Diuretics and antihypertensive agents
 - Watch potassium

Reduce salt intake to control hypertension

- When you're choosing packaged foods, look at the sodium content on the Nutrition Facts label.
- Use the percent Daily Value (% DV) to help limit your sodium intake.
- 5% DV or less is low and 20% DV or more is high. You don't want to exceed a total of 100% DV for sodium in a day.

Reduce salt intake to control hypertension

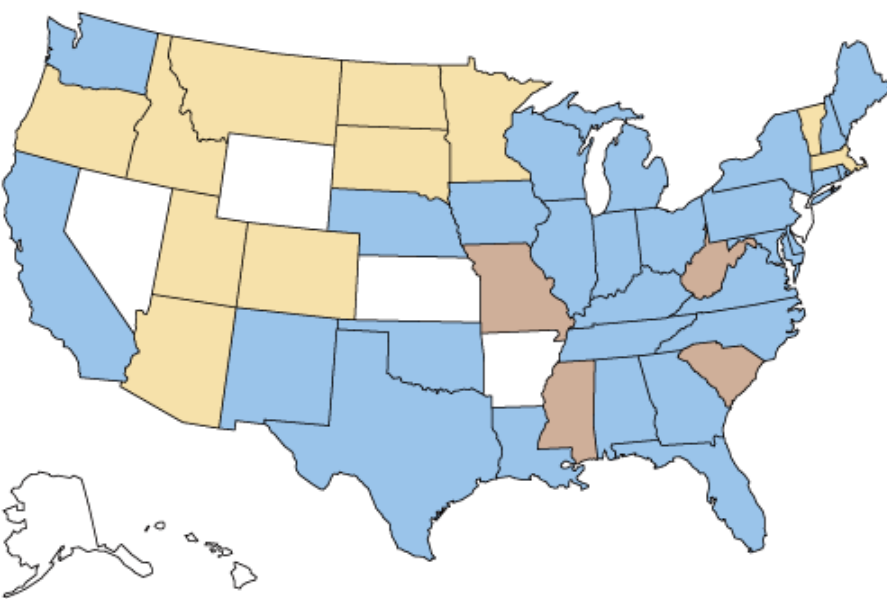
- When you're preparing food at home, use herbs and spices to add flavor to your foods so you don't depend too heavily on salt. (Be careful of Mrs. Dash for people with kidney problems because it contains potassium)
- Don't salt foods before or during cooking—and limit salt use at the table.
- When you're eating out, ask that your meal be prepared without added salt or ask the server to identify foods on the menu that are made without added salt.
- Limit processed foods in your diet!!

Diabetes Mellitus

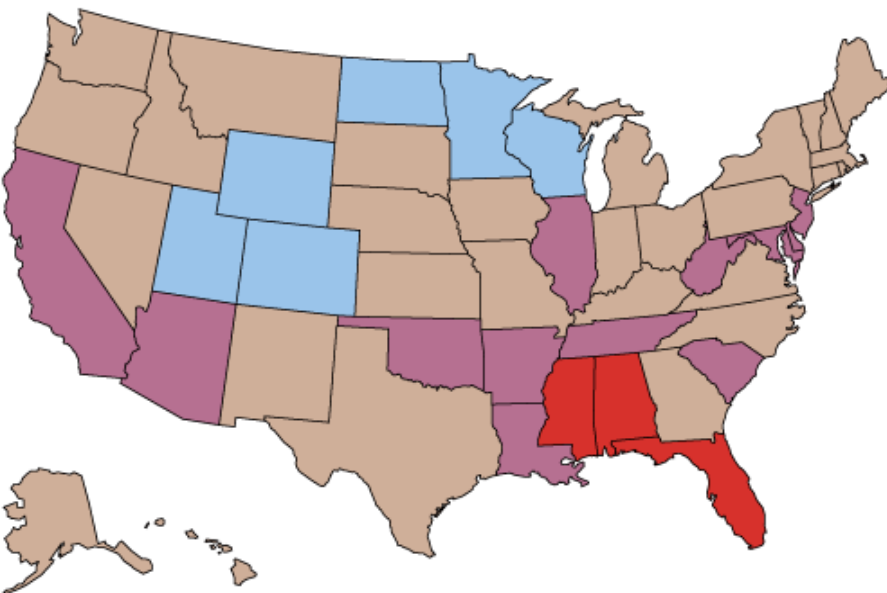
- Diabetes is characterized by high blood glucose (hyperglycemia) and either insufficient insulin, ineffective insulin, or both.
- Diabetes treatment involves the coordination of diet and/or drugs and physical activity to control blood glucose fluctuations and control or lose weight.

Diabetes In The U.S.

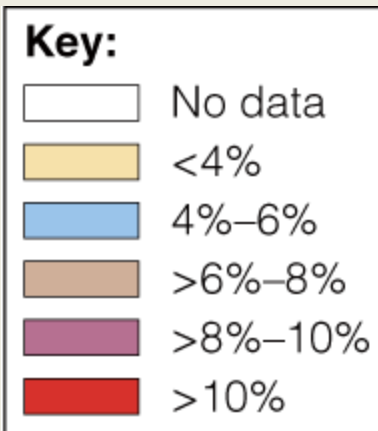
- Prevalence among adults

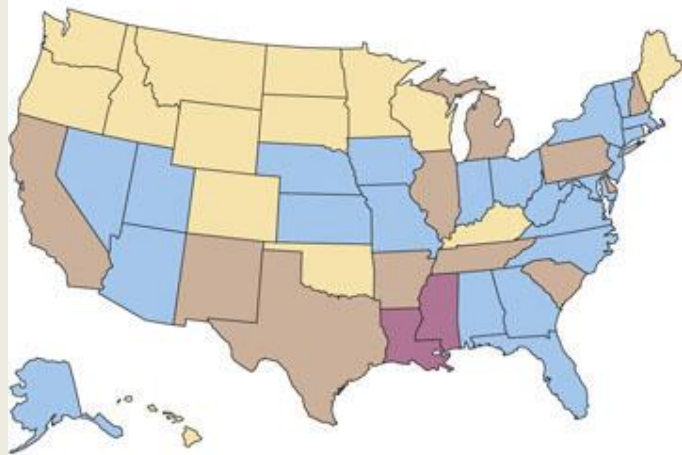
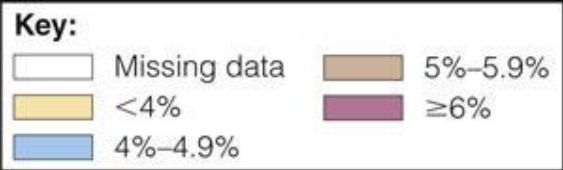


1990

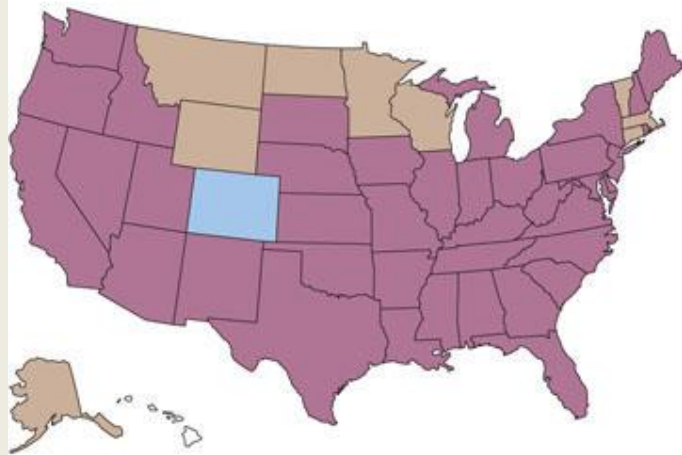


2001





1994: 14 states had a prevalence of diabetes of less than 4% and only two states had a prevalence of 6% or greater.

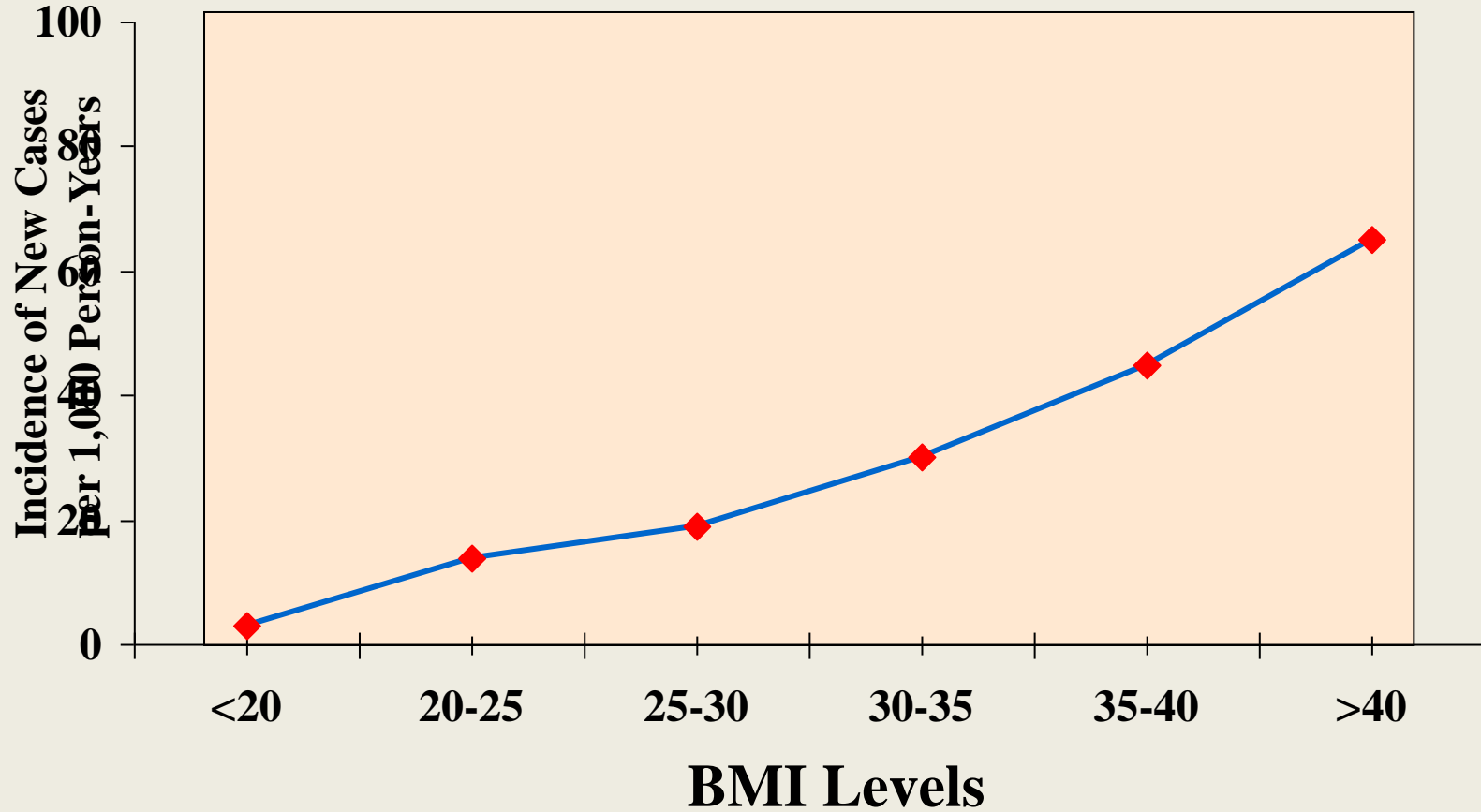


2004: No state had a prevalence of diabetes of less than 4%, and 39 states had a prevalence of 6% or greater.

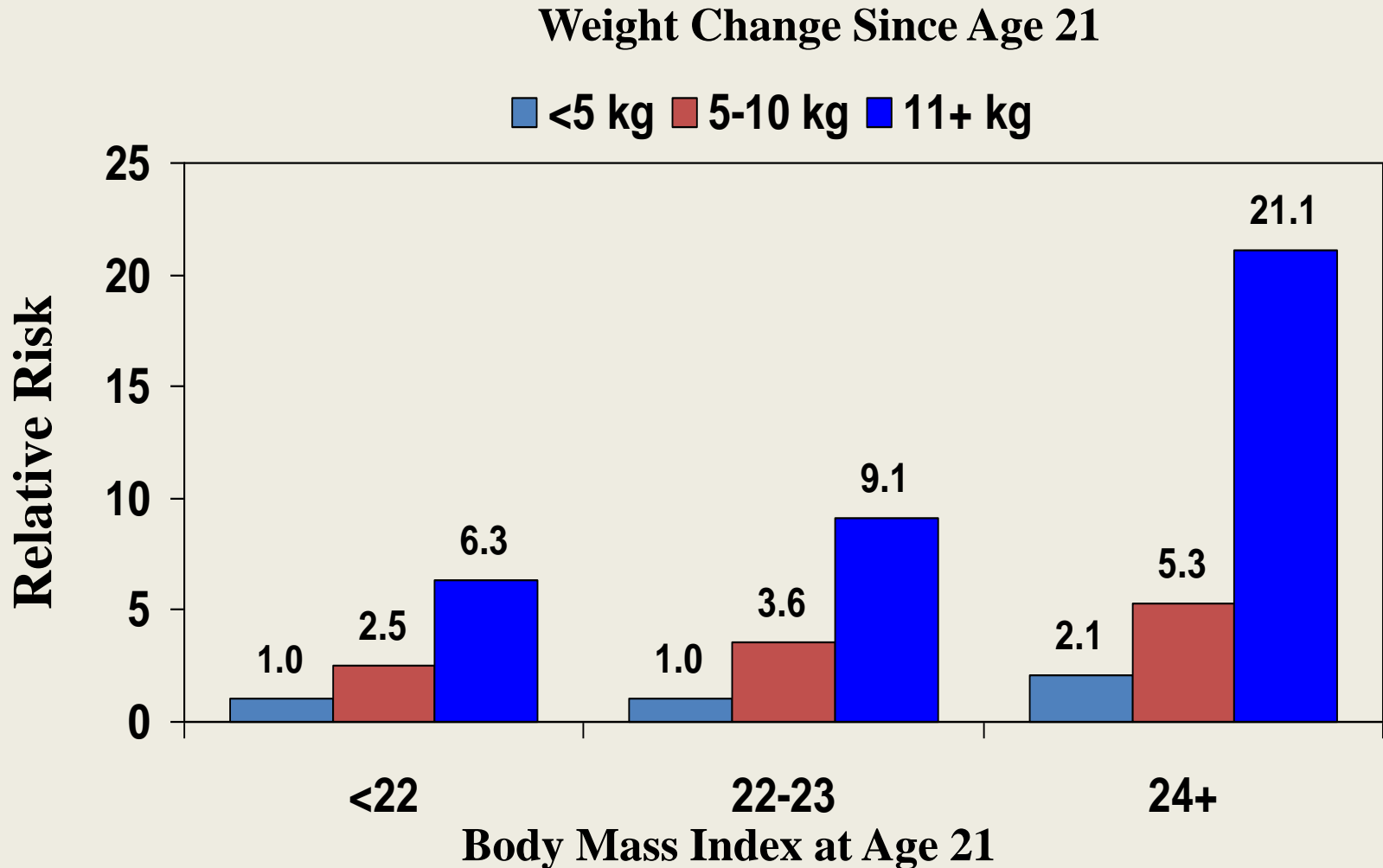
Risk factors for impaired glucose tolerance

- Obesity (in 85% of cases)
- Age
- Family history
- Gestational diabetes

Obesity and Diabetes Risk



Weight Gain and Diabetes Risk



Diabetes

Metabolic disorder in which the body does not produce or use insulin properly.

- Type 1: Body does not produce insulin,
- Need insulin injections
- Makes up 5-10% of those with diabetes
- Commonly appears in childhood or young adults
- Usually underweight or normal weight

Diabetes

- Type 2: Produce insulin but body cannot use it properly
- Meal plan and physical activity can control blood sugar
- Some may need oral medication and/or insulin injections
- Makes up 90-95% of those with diabetes
- Usually appears in middle age but now seen in children
- Usually overweight

How Diabetes Develops

- Type 1 diabetes
 - Autoimmune disorder
- Type 2 diabetes
- Impaired glucose tolerance

How Diabetes Develops

TABLE 18-8

Features of Type 1 and Type 2 Diabetes Compared

	Type 1 Diabetes	Type 2 Diabetes
Other names	Insulin-dependent diabetes ^a mellitus (IDDM)	Noninsulin-dependent diabetes ^a mellitus (NIDDM)
Average age of onset	<20 (mean age, 12)	10–19; >40
Associated conditions	Viral infection, heredity	Obesity, heredity, aging
Insulin required?	Yes	Sometimes
Cell response to insulin	Normal	Resistant
Symptoms	Relatively severe	Relatively moderate
Prevalence in diabetic population	5 to 10%	90 to 95%

^aThe terms *insulin-dependent diabetes (IDDM)* and *noninsulin-dependent diabetes (NIDDM)* have been eliminated from use by the Expert Committee on the Diagnosis and Classification of Diabetes Mellitus. The committee states that these terms have been confusing and often result in classifying patients based on treatment rather than the cause of the disorder.

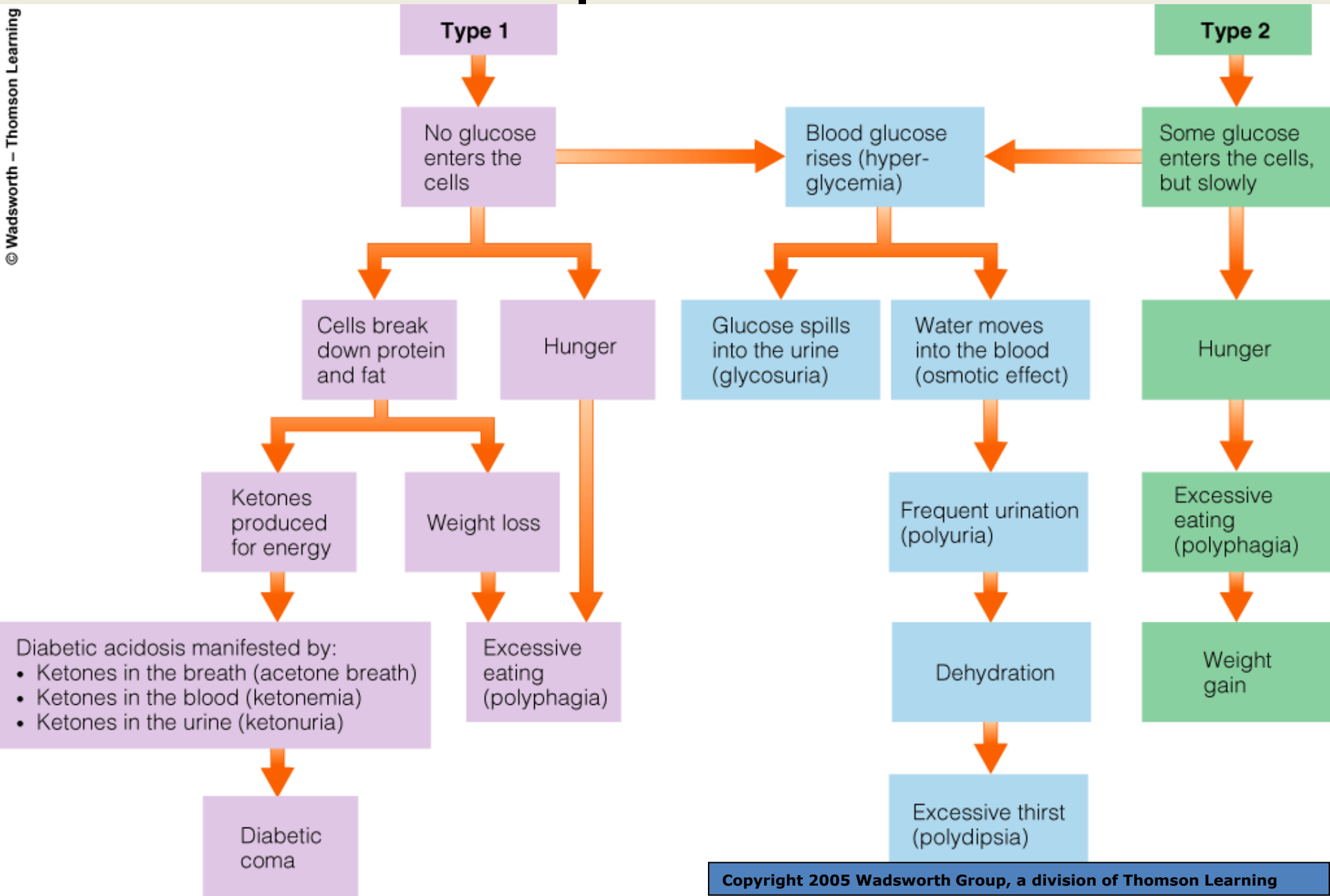
Diabetes Mellitus

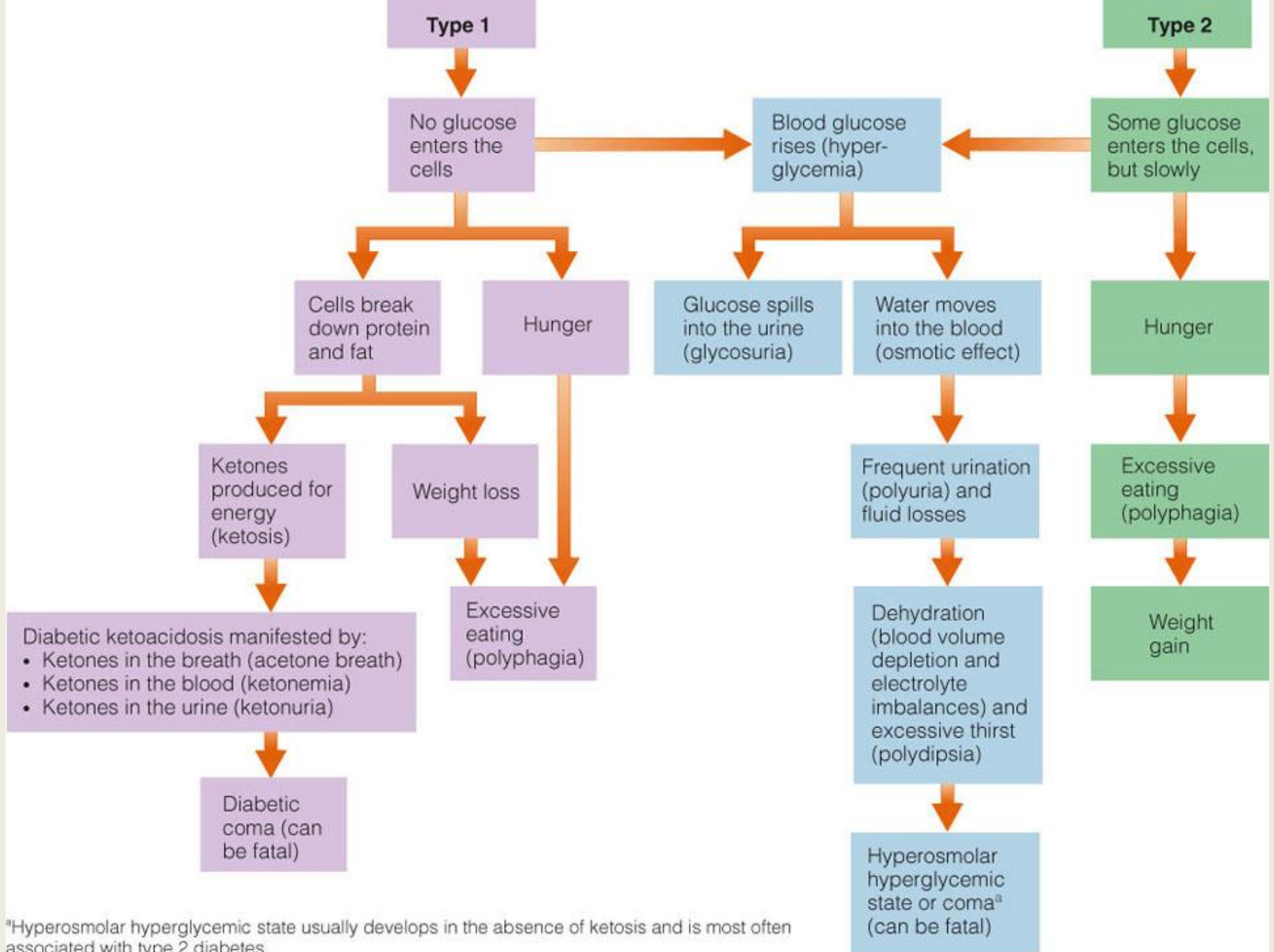
- How Diabetes Develops
 - Impaired glucose tolerance or prediabetes
 - Type 1 Diabetes
 - 5-10% prevalence in diabetic population
 - **Autoimmune disorder**
 - Usually diagnosed in childhood or adolescence
 - Relatively severe symptoms
 - Associated with viral infection and heredity
 - Insulin is required

Diabetes Mellitus

- How Diabetes Develops
 - Type 2 Diabetes
 - 90-95% prevalence in diabetic population
 - Occurring in children and adults
 - Relatively moderate symptoms
 - Cells are resistant to insulin
 - Associated with obesity, heredity, and aging
 - Sometimes insulin is required

Complications





Complications Of Diabetes

- Diseases of the large blood vessels
- Diseases of the small blood vessels
- Diseases of the nerves

Diabetes Mellitus

- Complications of Diabetes
 - Diseases of the Large Blood Vessels
 - Atherosclerosis tends to develop early and is more severe.
 - Long-term, intensive intervention targeting multiple factors can reduce risk.
 - Diseases of the Small Blood Vessels
 - Microangiopathies
 - Affect kidney function and retinal degeneration

Diabetes Mellitus

- Complications of Diabetes
 - Diseases of the Nerves
 - Hands and feet
 - Careful of injuries and infections
 - Gangrene may develop and amputation may be required.

Diabetes Mellitus

- Recommendations for Diabetes
 - Total Carbohydrate Intake
 - Consistent intake helps to regulate blood sugar.
 - Too little carbohydrate consumption can lead to hypoglycemia.
 - Carbohydrate Sources
 - Glycemic effect of a food needs to be considered.
 - Avoid foods and beverages with added sugar.

Diabetes Mellitus

- Recommendations for Diabetes
 - Dietary Fat
 - Saturated fat: <7% of total kcalories
 - Cholesterol: <200 mg/day
 - Protein
 - No need to modify intake as long as there is normal kidney function
 - 15-20% of total kcalories
 - Alcohol Use in Diabetes
 - Alcohol should be used in moderation.
 - One drink/day for women two drinks/day for men

Diabetes Mellitus

- Recommendations for Diabetes
 - Recommendations for Type 1 Diabetes
 - Adjust insulin doses
 - Optimal nutrition status
 - Control blood glucose with consistent carbohydrate intake at meals and snacks.
 - Achieve desirable blood lipids.
 - Control blood pressure.
 - Prevent and treat complications.
 - Physical activity
 - Be careful of hypoglycemia.
 - Monitor blood glucose.

Diabetes Mellitus

- Recommendations for Diabetes
 - Recommendations for Type 2 Diabetes
 - Moderate weight loss is helpful (10-20 pounds).
 - Regular, long-term physical activity

Recommendations For Diabetes

- Recommendations for type diabetes
- Recommendations for type diabetes



Recommendations for preventing diabetes

- Lose weight (5-7% decrease)
- If pregnant, gain appropriate weight without excess
- Increase physical activity (30 mins, 5x/wk)
- Replace simple sugars with complex carbohydrates
- Reduce saturated fat intake
- Control hypertension, if present

Cancers

- Uncontrolled growth of abnormal cells which disrupts the normal functioning of the body's cells or organs
- 2nd leading cause of death in the US

Cancer

- **Classifications of cancers**
 - Adenomas – glandular tissues
 - Carcinomas – epithelial tissues
 - Gliomas – glial cells of the central nervous system
 - Leukemias – white blood cells
 - Lymphomas – lymph system
 - Melanomas – pigmented skin cells
 - Sarcomas – muscle, bone or connective tissues

Cancer Sites	Associated with:	Probable Protective Effect from:
Bladder cancer	Cigarette smoking and alcohol; weak association with coffee and chlorinated drinking water	Fruits and vegetables (especially fruits); adequate fluid intake
Breast cancer	High intakes of food energy, alcohol intake; low vitamin A intake; obesity, sedentary lifestyle, probably not associated with dietary fat	Monounsaturated fats; physical activity
Cervical cancer	Folate deficiency; viral infection; possibly, cigarette smoking	Adequate folate intake; possibly, fruits and vegetables
Colorectal cancer	High intakes of fat (particularly saturated fat), red meat, alcohol, and supplemental iron; low intakes of fiber, folate, vitamin D, and vegetables; inactivity; cigarette smoking	Vegetables, especially cruciferous (cabbage-type) vegetables; calcium, vitamin D, and dairy intake; possibly, whole wheat, wheat bran; high levels of physical activity
Kidney cancer	Possibly, high intakes of red meat (especially fried, sautéed, charred, burned, or cooked well-done); cigarette smoking; obesity	Fruit and vegetables, especially orange-colored and dark green ones
Mouth, throat, and esophagus cancers	Heavy use of alcohol, tobacco, and especially combined use; heavy use of preserved foods (such as pickles); low intakes of vitamins and minerals; obesity (esophageal)	Fruits and vegetables
Liver cancer	Infection with hepatitis virus; high intakes of alcohol; iron overload; toxins of a mold (aflatoxin) or other toxicity	Vegetables, especially yellow and green ones
Lung cancer	Smoking; low vitamin A; supplements of beta-carotene (in smokers)	Fruits and vegetables
Ovarian cancer	Possibly, high lactose intake from milk products; inversely correlated with oral contraceptive use	Vegetables, especially green leafy ones
Pancreatic and lung cancer	Possibly, high intakes of red meat (pancreatic cancer); correlated with cigarette smoking and air pollution	Fruits and vegetables, especially green and yellow ones
Prostate cancer	High intakes of fats, especially saturated fats from red meats and possibly milk products	Possibly, cooked tomatoes, soybeans, soy products, and flaxseed; adequate selenium intake
Stomach cancer	High intakes of smoke- or salt-preserved foods (such as dried, salted fish); cigarette smoking; possibly, refined flour or starch; infection with ulcer-causing bacteria	Fresh fruits and vegetables, especially tomatoes

SOURCES: National Cancer Policy Board, Institute of Medicine, S. J. Curry, T. Byers, and M. Hewitt, eds., *Fulfilling the Potential of Cancer Prevention and Early Detection* (Washington, D.C.: National Academies Press, 2003), pp. 66–86; S. E. McCann and coauthors, Risk of human ovarian cancer is related to dietary intake of selected nutrients, phytochemicals and food groups, *Journal of Nutrition* 133 (2003): 1937–1942; S. A. Smith-Warner and coauthors, Intake of fruits and vegetables and risk

of breast cancer, *Journal of the American Medical Association* 285 (2001): 769–776; R. L. Nelson, Iron and colorectal risk: Human studies, *Nutrition Reviews* 59 (2001): 140–148; M. C. Jansen and coauthors, Dietary fiber and plant foods in relation to colorectal cancer mortality: The Seven Countries Study, *International Journal of Cancer* 81 (1999): 174–179; B. S. Reddy, Role of dietary fiber in colon cancer: An overview, *American Journal of Medicine* 106 (1999): S16–S19.

How common is cancer?

- Half of all men and one-third of all women in the US will develop cancer during their lifetimes.
- One third of all cancer deaths are related to diet and activity factors.

Risk factors for cancer

- Genetics
- Environment
 - Smoking, water/air pollution, sun exposure
- Diet
 - Carcinogenic: cancer initiators
 - Nitrosamines and alcohol
 - Accelerate development of the tumor: cancer promoters
 - Excess fat in the diet

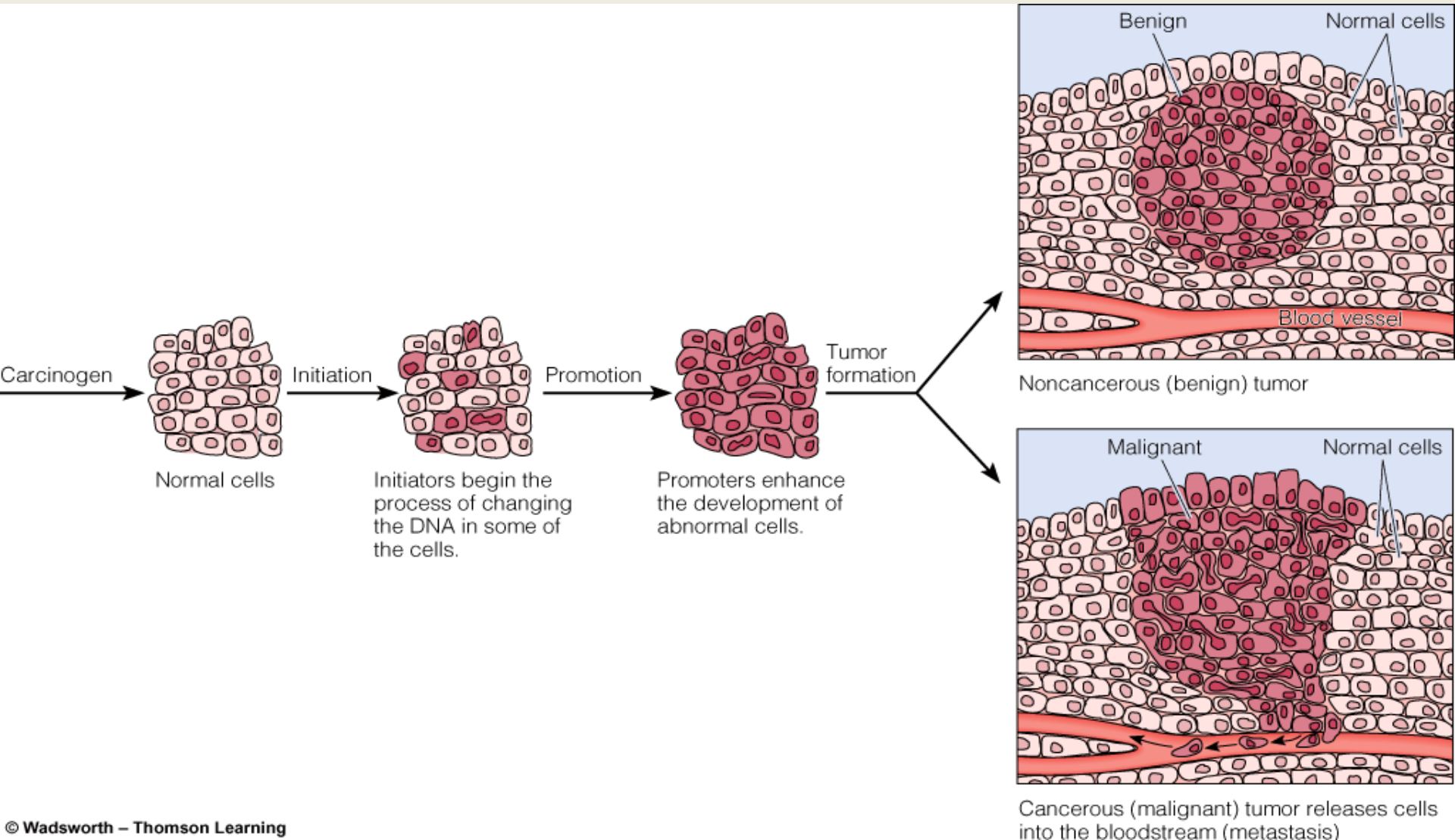
Cancer

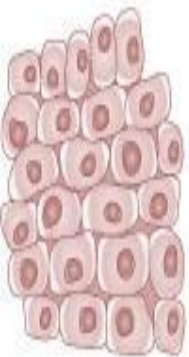
- Cancer is the growth of malignant tissue.
- Dietary factors that initiate cancer development include alcohol and heavily smoked foods.
- Dietary factors that promote cancer once it has started include saturated fat and *trans* fat. Dietary factors that serve as antipromoters—that is, protect against the development of cancer—include fiber, antioxidant nutrients, and phytochemicals.
- Eating a variety of healthful foods and adapting a physically active lifestyle is the best advice to lower cancer risk.

Cancer

- How Cancer Develops
 - Carcinogenesis is the development of cancer from mutated cells and can result in the formation of an abnormal mass, or tumor.
 - Tumors can metastasize, or spread to other areas of the body.
 - Carcinogens are substance an individual is exposed to that can lead to cancer.

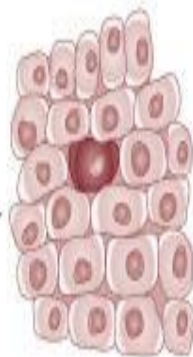
How Cancer Develops





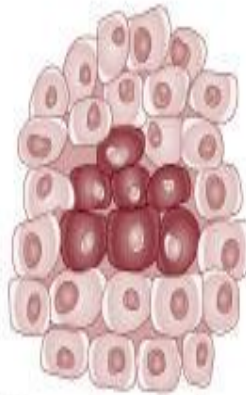
Normal cells

Initiation



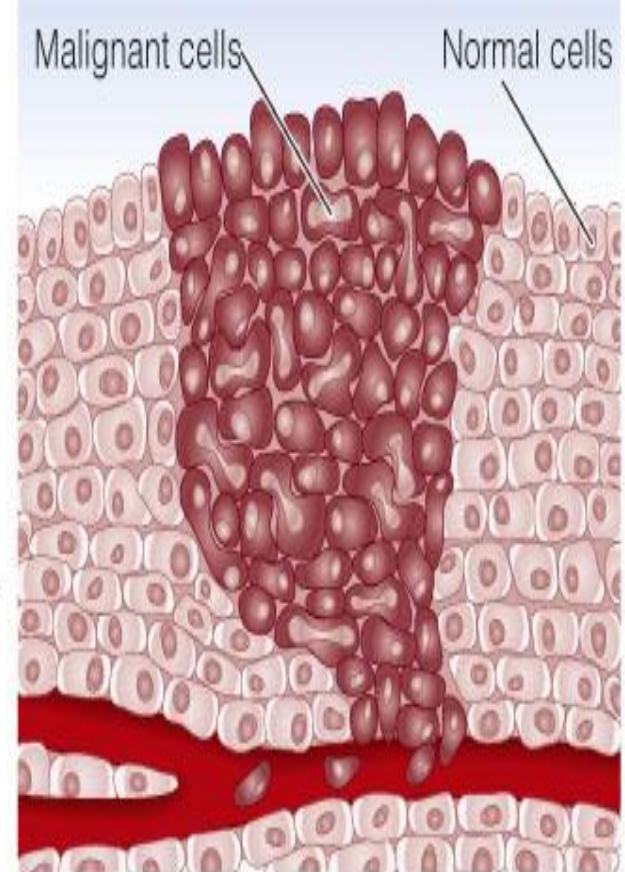
Mutagens alter the DNA in a cell and induce abnormal cell division.

Promotion



Promoters enhance the development of abnormal cells, resulting in formation of a tumor.

Further tumor development



The cancerous tumor releases cells into the bloodstream or lymphatic system (metastasis).

Normal cells



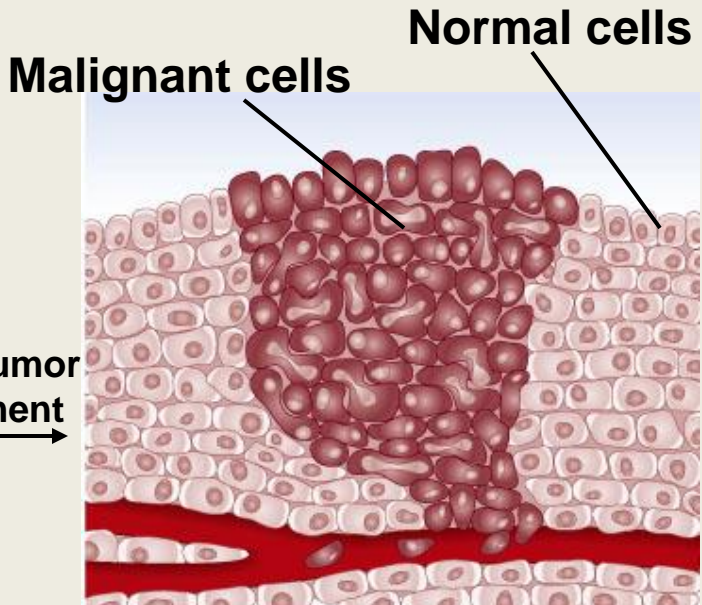
Initiation



Promotion



Further tumor development

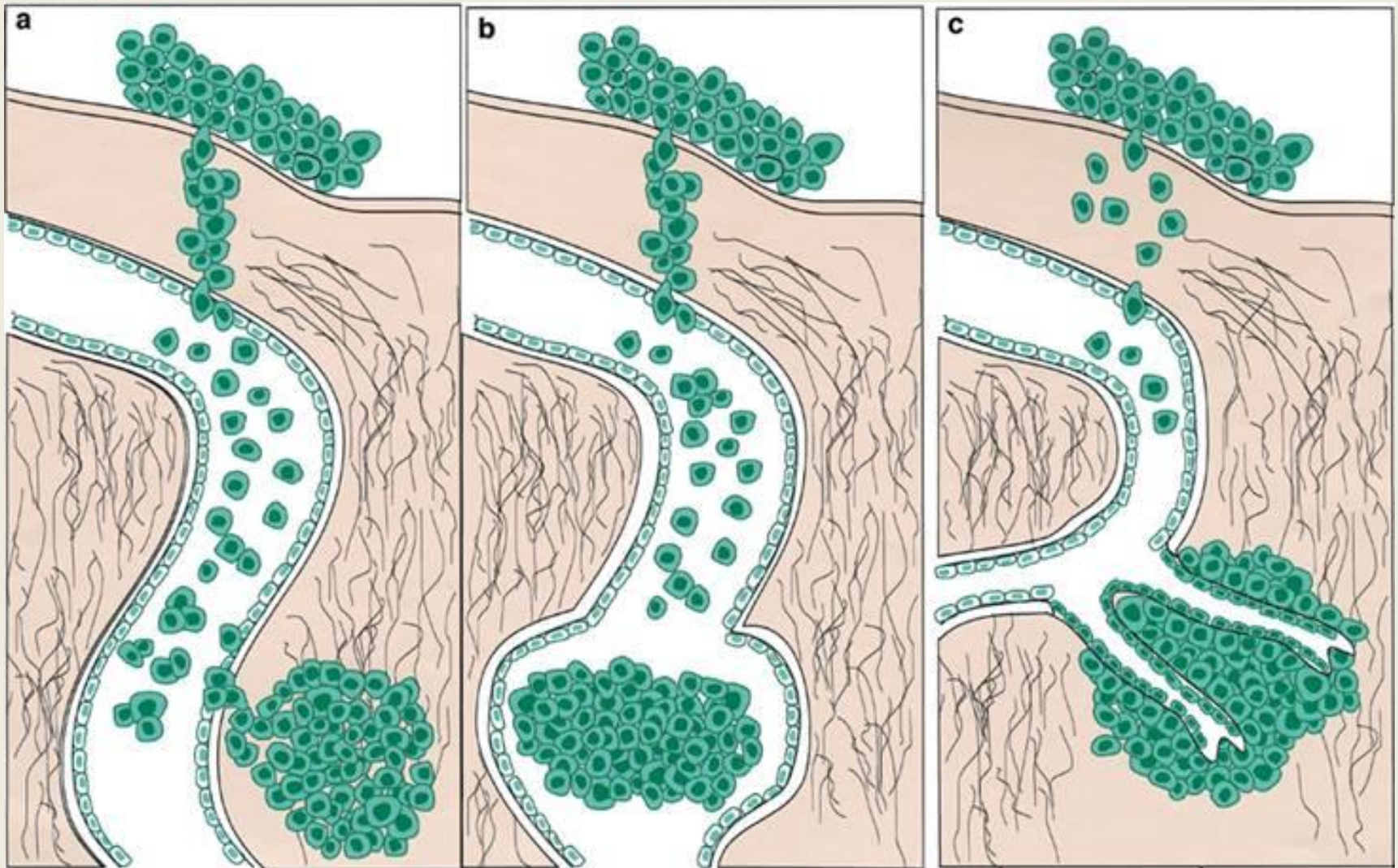


Mutagens alter the DNA in a cell and induce abnormal cell division.

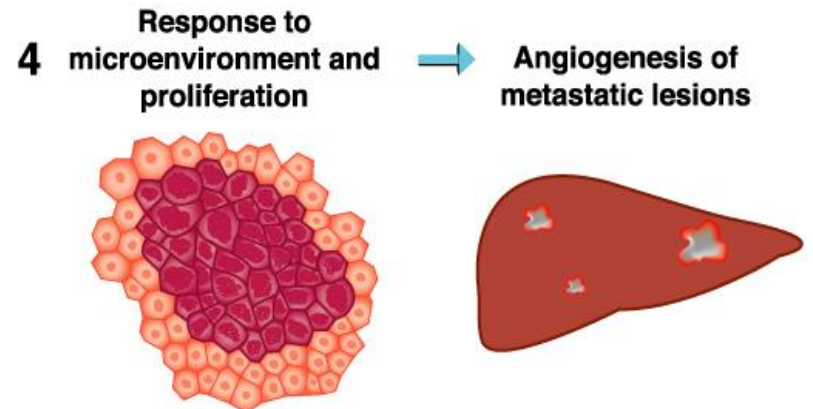
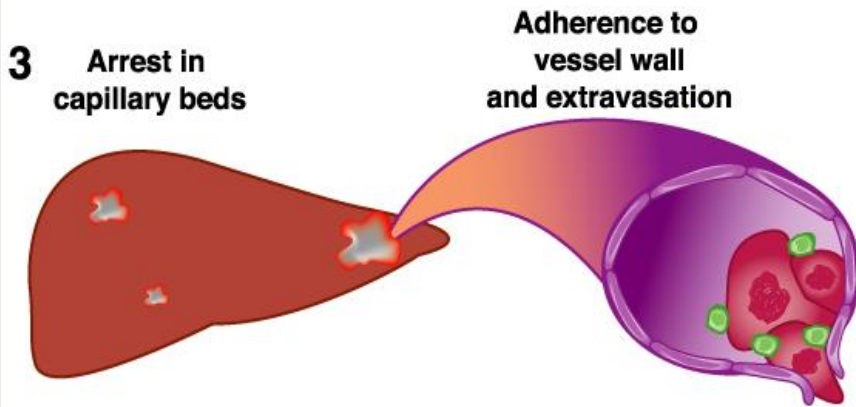
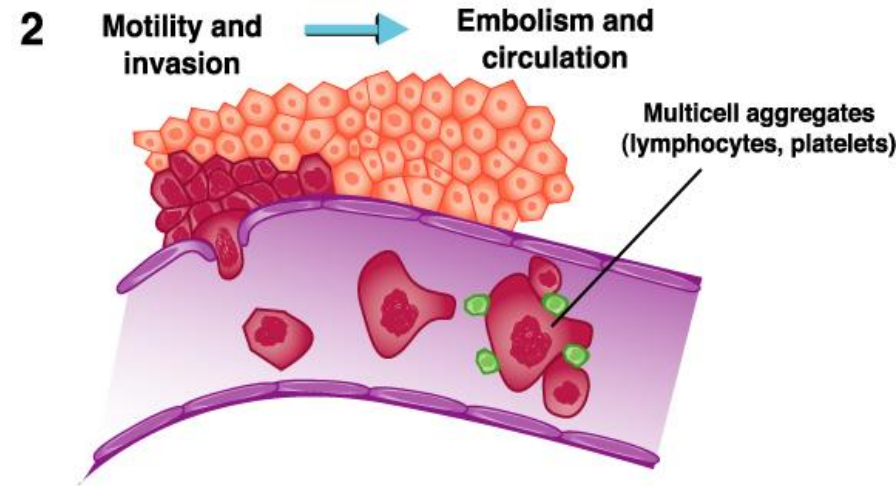
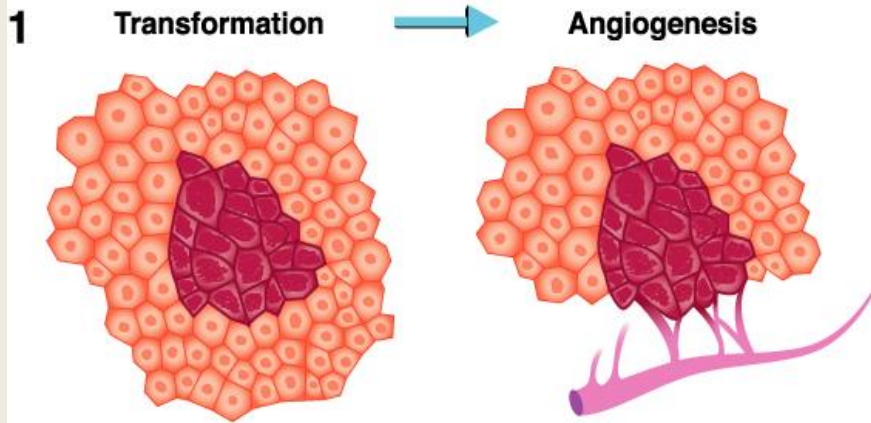
Promoters enhance the development of abnormal cells, resulting in formation of a tumor.

The cancerous tumor releases cells into the bloodstream or lymphatic system (metastasis).

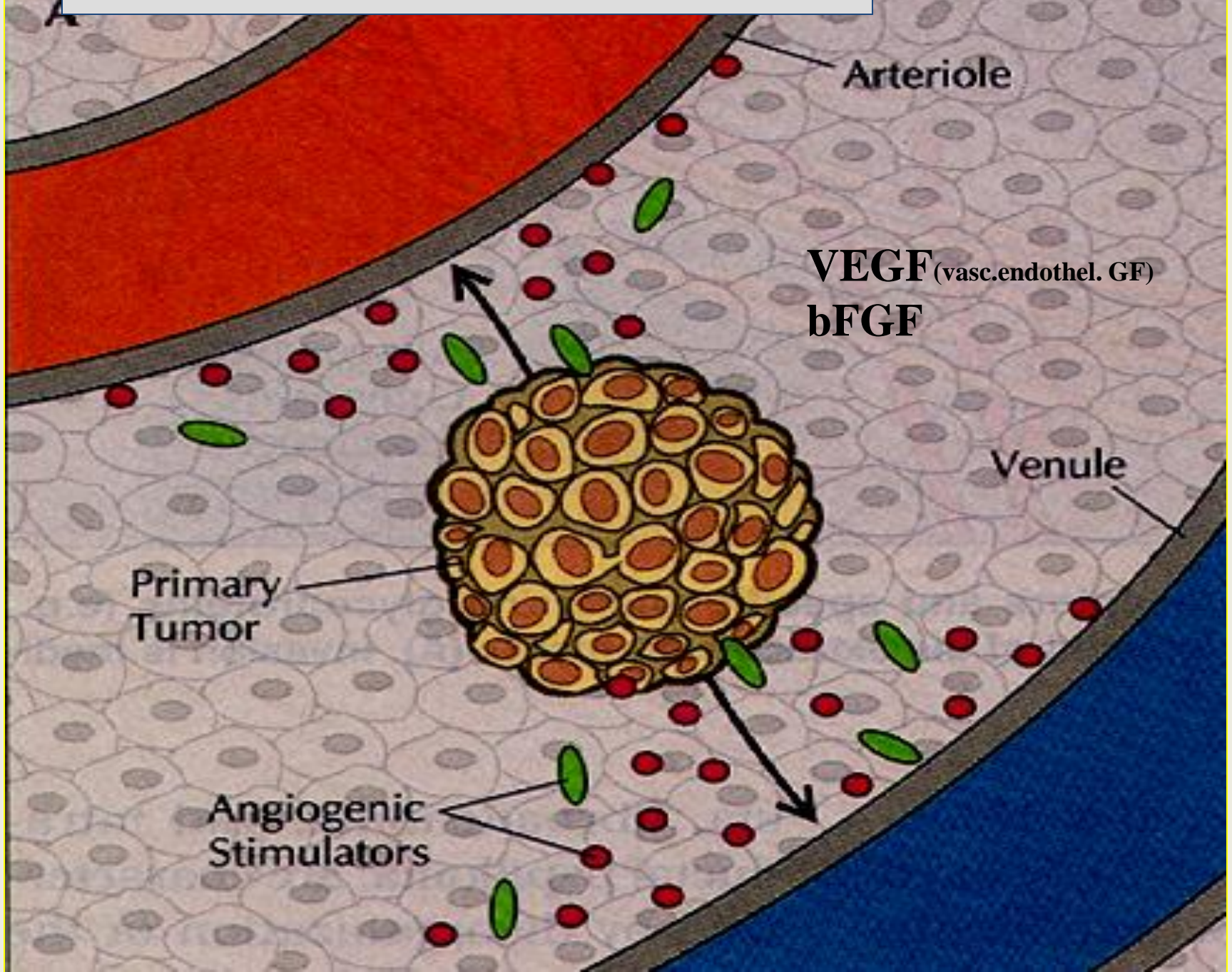
Cancer entering the blood stream and being carried elsewhere
(cancer metastasis)



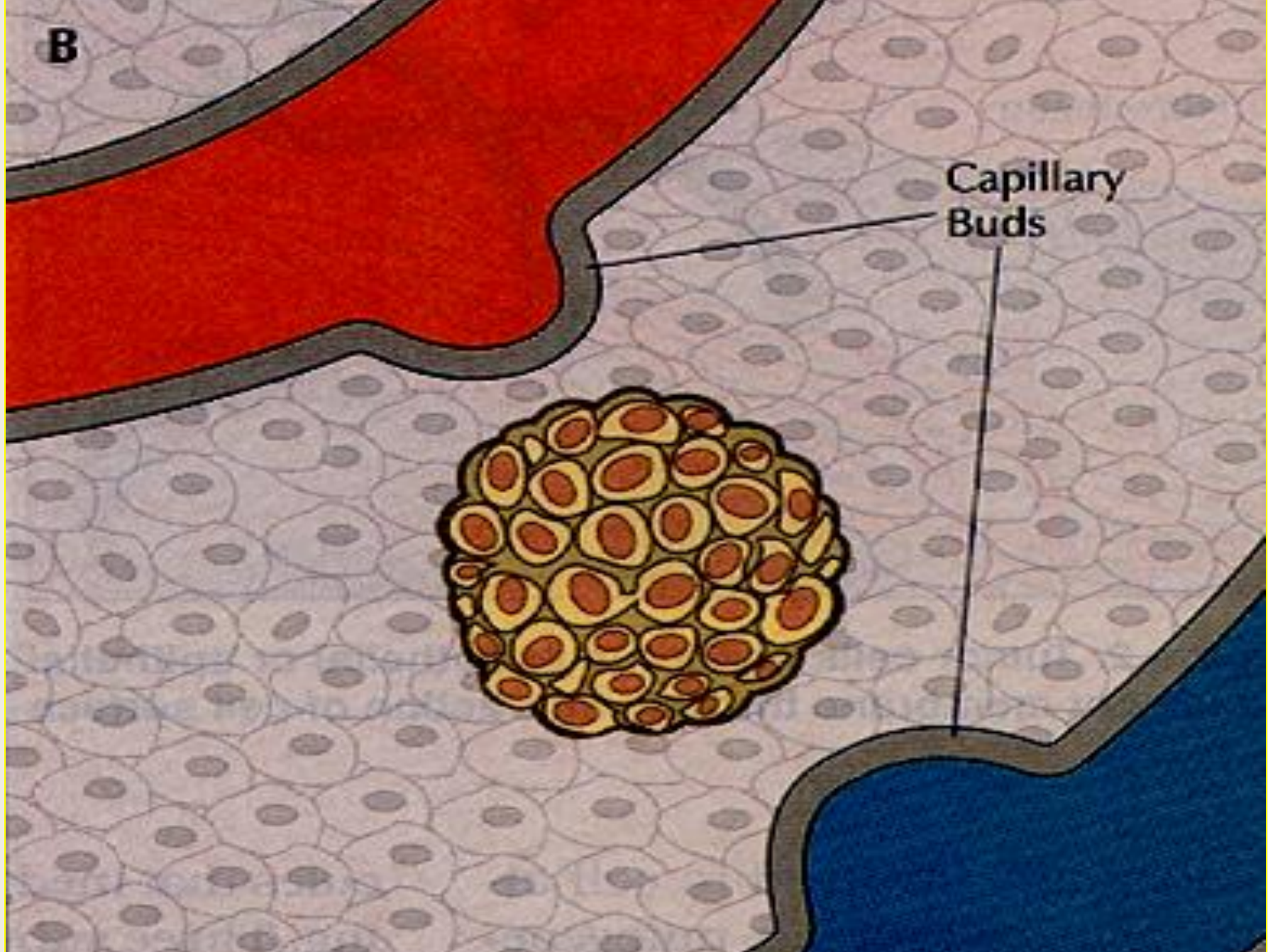
Role of Angiogenesis(blood vessel formation) in Primary and Metastatic Tumors



TUMOR FOMENTS ANGIOGENESIS



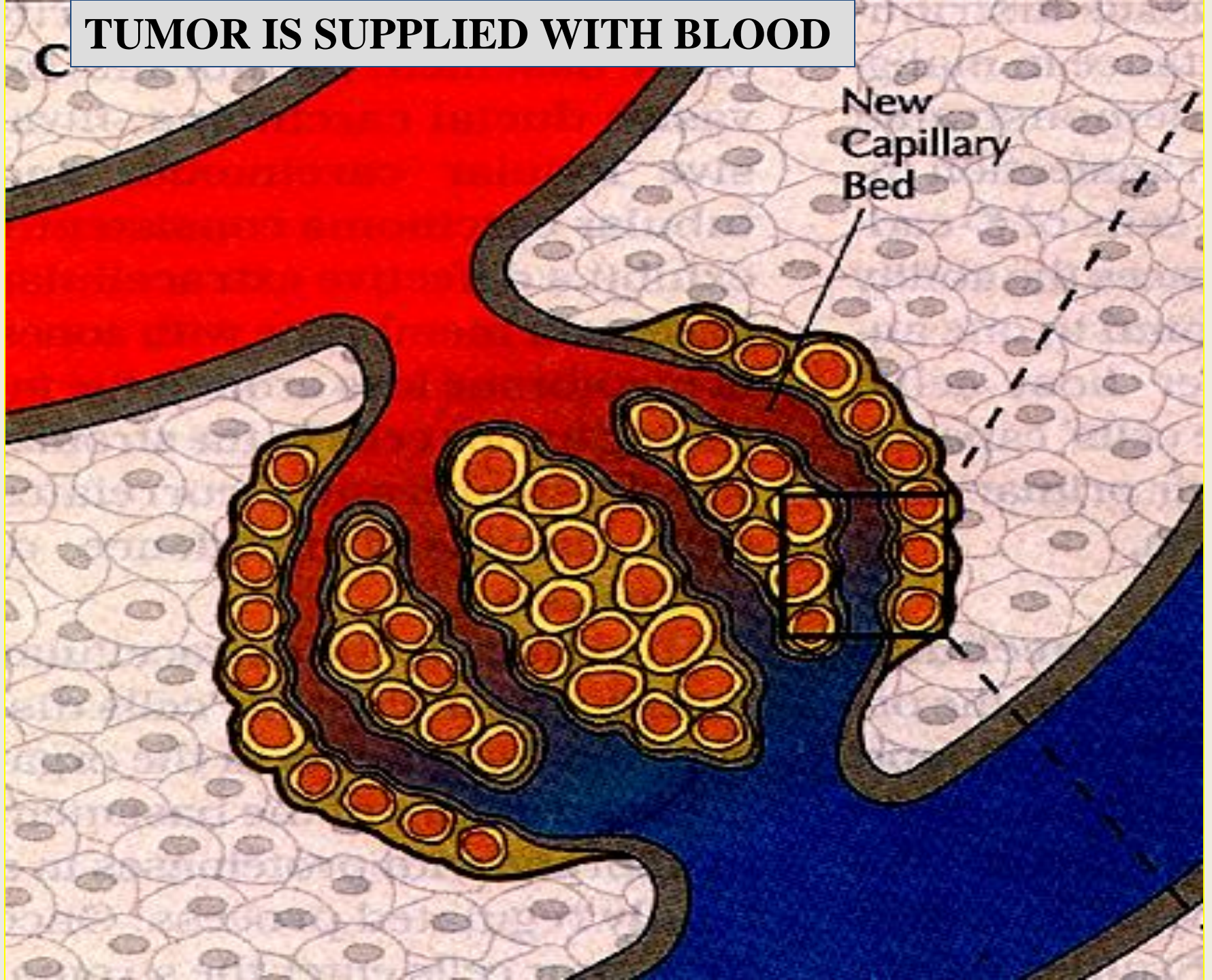
B



Capillary
Buds

CAPILLARY BUDS GROW INTO TUMOR

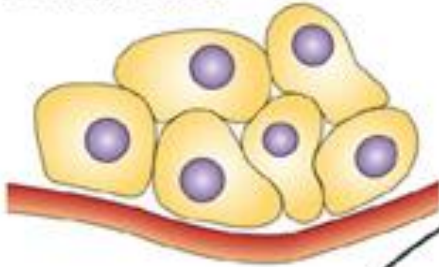
TUMOR IS SUPPLIED WITH BLOOD



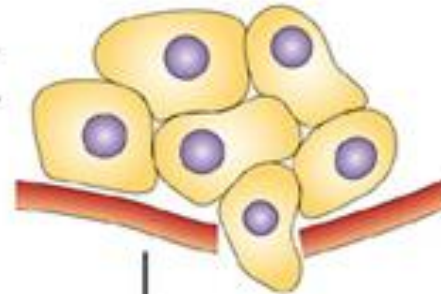
5 major steps in metastasis

- 1. Invasion and infiltration of surrounding normal host tissue with penetration of small lymphatic or vascular channels;**
- 2. Release of neoplastic cells, either as single cells or small clumps, into the circulation;**
- 3. Survival in the circulation;**
- 4. Arrest in the capillary beds of distant organs;**
- 5. Penetration of the lymphatic or blood vessel walls followed by growth of the disseminated tumor cells**

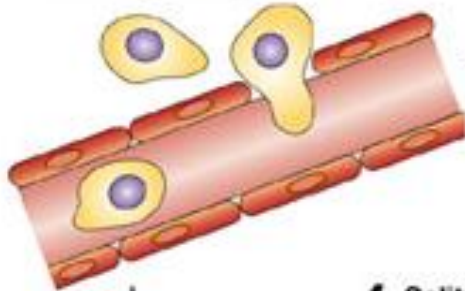
a *In situ* cancer



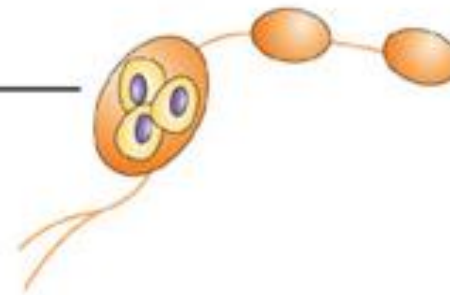
b Invasion of the tumour border



d Intravasation of the circulatory system
Survival, transport



c Lymphatic spread



e Arrest
Extravasation

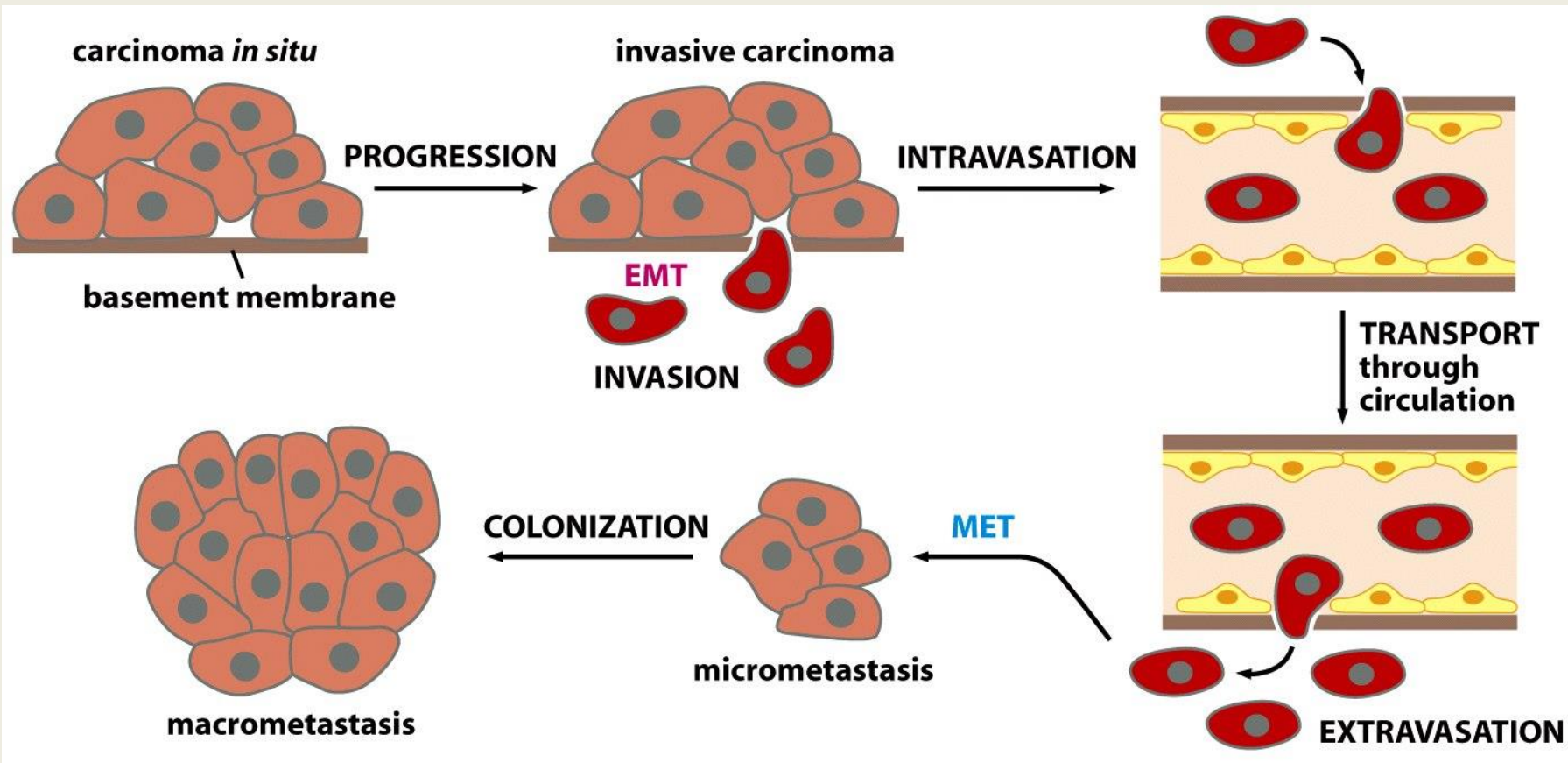


f Solitary dormant cells
Occult micrometastases

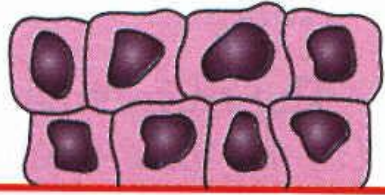


g Progressive colonization
Angiogenesis

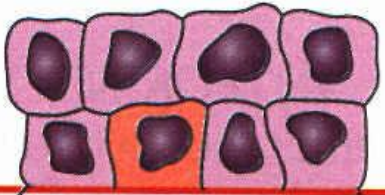




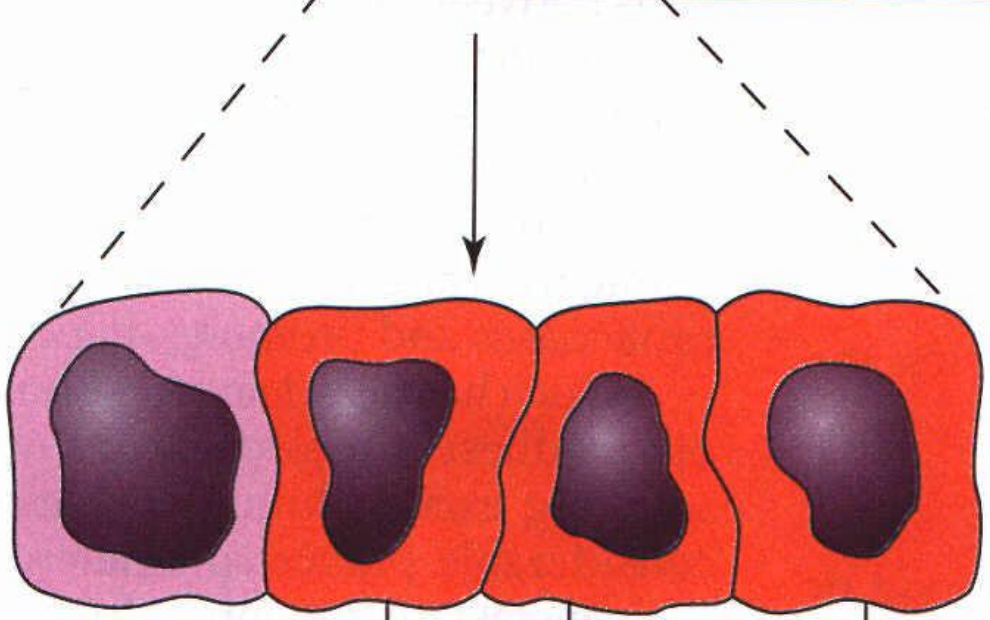
Basement
membrane



Carcinoma in situ



A cancer cell becomes capable of invasion (expresses surface adhesion molecules)



Tumor cell adhesion molecules bind to underlying extracellular matrix



Cancer

- How Cancer Develops
 - Environmental Factors
 - Exposure to radiation and sun, water and air pollution, and smoking are known to cause cancer.
 - Physical activity may protect against certain types of cancer.
 - Obesity increases risk for cancer.

Cancer

- How Cancer Develops
 - Dietary Factors – Cancer Initiators
 - Additives and pesticides
 - Minimize carcinogens when cooking – use foil on grill, do not burn foods, and marinate meat beforehand
 - Alcohol and smoking
 - High red meat intake and colon cancer
 - Acrylamide is produced when starches are cooked at high temperatures – french fries and potato chips

Cancer

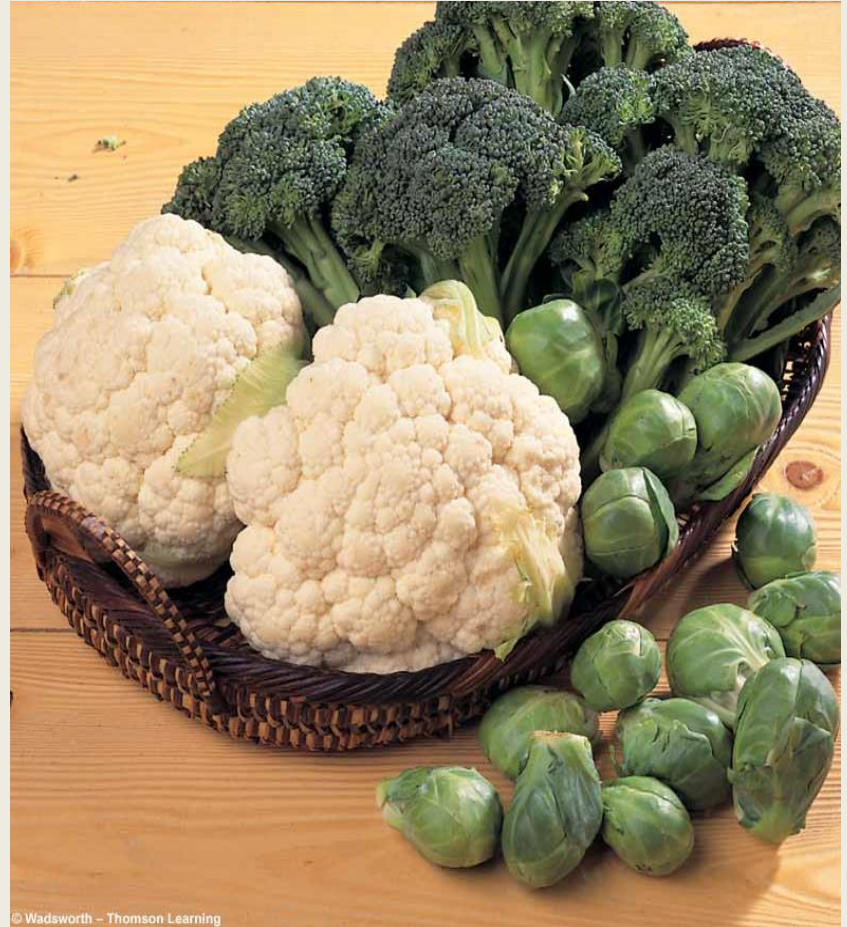
- How Cancer Develops
 - Dietary Factors – Cancer Promoters
 - High-fat diets correlate with high cancer rates but inconclusive
 - High-kcalorie diets correlate with high cancer rates
 - High-saturated fat and high-trans fat diets correlate with high cancer rates
 - Omega-3 may protect

Cancer

- How Cancer Develops
 - Dietary Factors – Antipromoters
 - Fruits and vegetables and low incidence of cancer
 - Fiber-rich diets might protect against colon cancer
 - Phytochemicals found in cruciferous vegetables activate enzymes that destroy carcinogens.
 - Antioxidant nutrients are effective – vitamin C, vitamin E, and beta-carotene

Risk factors for cancer

- **Diet**
 - **Antipromoters**
 - Fruits and vegetables with fiber, antioxidants (beta-carotene, vitamins C and E), phytochemicals may lower the incidence of cancer



© Wadsworth - Thomson Learning

Diet and cancer

- Diet influences risk of certain forms of cancer:
- Esophagus
- Stomach
- Large intestine
- Breast
- Lung
- prostate
- also influenced by environmental and genetic factors
- high intake of saturated fats → ↑'sed risk to certain cancers – colon, prostate, breast
- correlation between relative risk for colon cancer and consumption of animal fat in women (fig 27.19)

- consuming foods rich in carotenes → ↓'sed risk for cancers – lung, stomach, esophagus, oral cavity
- high fiber diets → lower risk of colon cancer and diverticulitis.

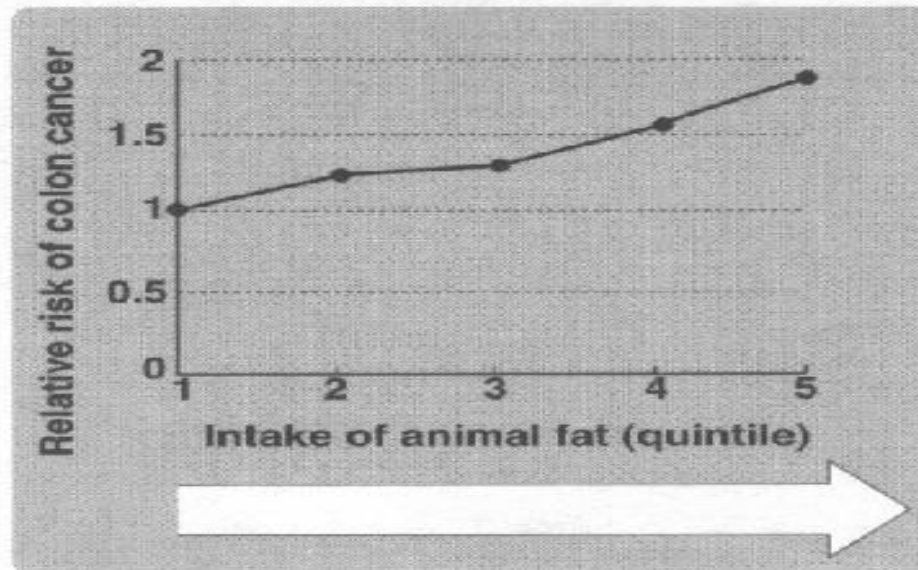


Figure 27.19

Relative risk of colon cancer according to the intake of animal fat. First quintile (1 on graph) indicates the relative risk of 20% of the population (88,751 women) who consumed the least animal fat. Individuals in the fifth quintile (5 on graph) consumed the most animal fat.

Recommendations for reducing cancer risk

- Healthy body weight
- Eat a variety of healthy foods.
- Five or more cups of fruits and vegetables
- Limit red meats.
- Limit consumption of alcoholic beverages.
- Adopt a physically active lifestyle.

Recommendations for Reducing Cancer Risk

- Control weight and prevent obesity
- Decrease total fat intake to 30% or less of total calories
- Increase dietary fiber intake to 25-38g/day for adults 50 years and younger; 21-30 g/day for adults over 50
- Eat at least 5 servings of fruits and vegetables daily
- Limit or avoid salt-cured, salt-pickled, and smoked foods
- Limit grilling?
- If you drink alcohol, drink in moderation.

CANCER AND DIET: PHYTOCHEMICALS

- FOUND ONLY IN PLANTS
- IMMUNE FUNCTION
- HORMONE BALANCE
- DETOXIFICATION

CANCER AND DIET N.R.C.RECOMMENDATIONS

- EAT LESS FAT (30% OR LESS OF TOTAL CALORIES)
- EAT FRUITS, VEGITABLES, AND WHOLE-GRAIN CEREAL FOODS EVERY DAY (ESPECIALLY THOSE HIGH IN VITAMINS A AND C)
- AVOID HIGH DOSE SUPPLIMENTS OF VITAMINS OR OTHER NUTRIENTS
- ALCOHOL ONLY IN MODERATION

TABLE 18-11 Dietary Guidelines and Recommendations for Chronic Diseases Compared

Dietary Guidelines	Heart disease	Hypertension	Diabetes	Cancer
Maintain a healthy body weight.	✓	✓	✓	✓
Engage in regular physical activity.	✓	✓	✓	✓
Keep total fat 20–35%.	✓			
Limit saturated and <i>trans</i> fats.	✓			
Select fiber-rich fruits, vegetables, and whole grains.	✓	✓	✓	✓
Use little sugar.	✓		✓	
Use little salt.	✓	✓		
Drink alcohol in moderation.	✓	✓	✓	✓

© 2007 Thomson Higher Education

Recommendations for Chronic Diseases

- Recommendations for the Population
 - Make dietary changes to forestall or prevent disease is the preventive or population approach
- Recommendations for Individuals
 - Urge dietary changes for people who need them is the medical or individual approach
- Recommendations for Each Individual
 - Genomics may allow for individual nutritional recommendations.