Chapter 14
Lecture Outline

See separate PowerPoint slides for all figures and tables pre-inserted into PowerPoint without notes.

14.1 The Digestive Tract

• The digestive system contributes to homeostasis using four steps.
  – Ingesting food
  – Digesting food into nutrients that cells can use
  – Absorbing nutrients
  – Eliminating indigestible remains

14.1 The Digestive Tract

• Organs of the human digestive tract

Figure 14.1
14.1 The Digestive Tract

• Digestion involves two processes.
  – Mechanical digestion
    • Begins with the chewing of food in the mouth
    • Continues with the churning and mixing of food in the stomach
  – Chemical digestion
    • Enzymes break down macromolecules into smaller molecules that can be absorbed

The Mouth

• The mouth, which ingests food, is bounded externally by the lips and cheeks.
  – The tongue
    • Comprised of skeletal muscles to change shape of the tongue
    • Taste buds are sensory receptors that allow people to enjoy eating by taste and texture

The Mouth

• The roof of the mouth separates the nasal cavity from the mouth.
  – Prevents ingested food from entering the nasal cavity
  – Divided into two parts
    • Hard palate (anterior)
      – Contains several bones
    • Soft palate (posterior)
      – Made of muscle
      – Uvula: finger-shaped projection at back of the mouth
      – Tonsils: Help protect the body from infections
The Mouth

• Salivary glands produce saliva.
  – Three different glands are located in the mouth.
    • One pair lies on either side of the face
    • One pair lies beneath the tongue
    • One pair lies beneath the floor of the mouth
  – Saliva keeps the mouth moist.
  – Saliva contains the enzyme salivary amylase.
    • Begins process of digesting starch

The Teeth

• Teeth are used to chew food into pieces suitable for swallowing.
• Adults have 32 teeth.
• Each tooth has two main divisions.
  – A crown
  – A root

The Teeth

• 20 baby teeth
• 32 adult teeth
• Tooth divided into
  – Crown
    • Enamel
    • Dentin
    • Pulp
  – Root
    • Dentin
    • Pulp
  – Gingiva (gums)

Figure 14.2b
The Teeth

- Bacteria that adhere to teeth metabolize sugar and release acids, which erode enamel.
- **Dental caries** (cavities) result from eroded enamel, a slow process.
  - Once the dentin layer is reached, the damage spreads more rapidly
- **Gingivitis** is inflammation of the gums.
- **Periodontitis** is inflammation of the periodontal membrane, characterized by bone loss.

The Pharynx

- **Pharynx**
  - Passageway that receives air from the nasal cavities and food from the mouth
  - Swallowing
    - Reflex action – performed automatically
    - Soft palate closes off the nasopharynx
    - Trachea moves up causing the epiglottis to cover the glottis
    - As a result, food can enter esophagus only
The Esophagus

- **Esophagus**
  - The esophagus is a muscular tube that extends from the pharynx to stomach.
    - Usually collapsed except during swallowing
  - **Peristalsis**, rhythmic muscular contractions, pushes food along the digestive tract.
  - The sphincter muscle closes the esophagus from the stomach
    - Relaxation of the sphincter allows food to enter the stomach
    - If contents of the stomach escape into the esophagus, this causes **heartburn**

The Wall of the Digestive Tract

- Four layers of the Digestive Tract
  1. **Mucosa**
     - Epithelium supported by connective tissue
     - Smooth muscle lines lumen (central cavity)
     - Glandular epithelial cells secrete enzymes
     - Goblet cells secrete mucus
  2. **Submucosa**
     - Loose connective tissue that contains blood vessels
     - Peye’s patches - lymph nodules
       - Help protect us from disease
The Wall of the Digestive Tract

- Four layers of the Digestive Tract

3. **Muscularis**
   - Two layers of smooth muscle
     - Circular, inner layer encircles tube
     - Longitudinal, outer layer runs perpendicular

4. **Serosa**
   - Very thin outermost layer of squamous epithelium
   - Secretes serous fluid to moisten surface
     - Organs slide against one another
The Stomach

- **Stomach**
  - Thick-walled, J-shaped organ
  - Continuous with esophagus and duodenum of small intestine
  - Receives food from the esophagus
  - Starts digestion of proteins
  - Moves food into the small intestine
  - Expands to hold about four liters when full.
    - Rugae or folds allows for expansion

The Stomach

- The columnar epithelium lines the stomach.
  - Contains gastric pits which lead into gastric glands
  - Gastric glands produce gastric juice
    - Pepsinogen (becomes pepsin)
    - Hydrochloric acid (HCl)
    - Mucus

Figure 14.5
The Stomach

- The stomach acts both mechanically and chemically on food.
- The wall has three layers of muscles.
  - Circular, longitudinal, and oblique
  - Churns the food, mixing it with gastric juices
- Most food is not absorbed by the stomach.
  - Alcohol and other liquids are absorbed in the stomach
- The stomach normally empties in two to six hours.
  - Chyme — food leaving stomach
  - Enters small intestine through pyloric sphincter

The Small Intestine

- Small Intestine
  - Approximately six meters long
  - Smaller in diameter compared to the large intestine
- Duodenum
  - The first 25 centimeters of the small intestine
  - Receives bile from the liver
    - Bile emulsifies fat
  - Receives pancreatic juice from the pancreas
    - Many enzymes for digestion of nutrients
    - Bicarbonate to neutralize acidic pH of chyme

14.1 The Digestive Tract

- The Small Intestine
  - Jejunum
    - Middle section
  - Ileum
    - Remainder leading to large intestine
    - Contains Peyer's patches — immune response to intestinal pathogens
The Small Intestine

- The small intestine has large surface area.
  - **Villi** – fingerlike projections
    - Blood capillaries for nutrient absorption
      - Carries sugars and amino acids
  - **Lacteals** (lymph/blood capillaries)
    - Part of lymphatic system
    - Carries digested fats
  - **Microvilli** – microscopic extensions on surface of epithelial cells of villi
Regulation of Digestive Secretions

- Digestive secretions are regulated by the nervous system and by hormones.
  - **Hormone** – substance produced by a group of cells that affects a different group of cells (target cells)
    - Hormone released into the blood for transport
    - Ex: **Gastrin** released by stomach after protein rich meal
      - Stomach churns, gastric gland activity increased
    - Ex: **GIP** (gastric inhibitory peptide) produced by duodenal wall
      - Inhibits gastric gland secretion

Regulation of Digestive Secretions

- Two other hormones that regulate digestion
  - Secretin - produced by duodenal wall
    - Release stimulated by entrance of HCl in chyme
  - CCK (cholecystokinin) - produced by duodenal wall
    - Release stimulated by proteins and fat in chyme
  - Together, secretin and CCK act on three organs.
    - Pancreas to increase pancreatic juice output
    - Liver to increase bile output
    - Gallbladder to contract to release bile
Secretin and CCK together stimulate actions of three organs.
- Pancreas
- Liver
- Gallbladder

The Large Intestine

- Large Intestine
  - Includes cecum, colon, rectum and anal canal
  - Larger in diameter, but shorter length compared to the small intestine

- Functions:
  - Absorbs water, salts, and some vitamins
  - Stores indigestible materials until eliminated as feces

The Large Intestine

- Cecum
  - Lies below junction with small intestine
  - Small pouch (6 cm long) that forms first part of the large intestine
  - Human cecum has projection called appendix or veriform appendix
    - Like tonsils, may play a role in fighting infection
    - Subject to inflammation, appendicitis
    - If inflamed it should be removed before rupturing
• Cecum
  – Lies below junction with small intestine
  – Human cecum has vermiform appendix
    • Role in fighting infection

The Large Intestine

• Colon
  – Ascending, transverse, descending, and sigmoid

• Rectum
  – Last 20 cm of large intestine
  – Opens to anus

• Anus
  – Where defecation (expulsion of feces) occurs
  – Reflex triggered as feces are forced into rectum

• Defecation occurs after the stretching of the rectal wall initiates nerve impulse to the spinal cord
  • As a result, rectal muscles contract and anal sphincters relax
The Large Intestine

- Feces are typically ¾ water and ¼ solids
  - Bacteria, plant fiber and indigestible materials are in the solid portion.
  - Bacterial breakdown of indigestible materials account for the odor also for the presence of gas.
  - Metabolism of bilirubin and oxidized iron account for the brown color.

14.2 Accessory Organs of Digestion

- Accessory organs of digestion
  - Pancreas
  - Liver
  - Gallbladder
  - Three salivary gland types

Figure 14.10a
14.2 Accessory Organs of Digestion

- **Pancreas**
  - Endocrine function
    - Insulin and glucagon
    - Blood glucose regulation
  - Exocrine function – pancreatic juice
    - Sodium bicarbonate: neutralizes the stomach acid
    - Pancreatic amylase: digests starch
    - Trypsin: digests protein
    - Lipase: digests fat

- **Liver**
  - Largest gland in the body
  - Lobules are structural and functional units
  - Three structures located between lobules
    - A bile duct takes bile away.
    - A branch of the hepatic artery brings O₂ rich blood.
    - A branch of the hepatic portal vein transports nutrients from intestines.
    - Each lobule has a central vein that enters a hepatic vein.

Figure 14.10b
The Liver

- Acts as gatekeeper for the blood
  - Detoxifies and removes poisonous substances
  - Removes and stores iron and vitamins A, D, E, K, and B12
  - Makes plasma proteins
  - Regulates cholesterol
  - Regulates blood glucose – stores as glycogen
  - Produces bile
    - Bilirubin – hemoglobin breakdown product
    - Bile salts – emulsify fat

Figure 14.10: Hepatic Portal System

Figure 14.11: Hepatic Portal System

4. Blood enters general circulation by way of the hepatic veins, which empty into the inferior vena cava.
3. Liver monitors blood content.
2. Nutrient molecules travel in hepatic portal vein to liver.
1. Small intestine absorbs products of digestion.
The Gallbladder

- **Gallbladder**
  - The liver produces 400-800 ml of bile each day.
  - The gallbladder stores excess bile.
  - Water is reabsorbed so that bile is thickened.
  - Bile is secreted through the common bile duct into the duodenum.

14.3 Digestive Enzymes

- Proteins that speed up specific chemical reactions
  - Break down biomolecules of major food components
    - Carbohydrates
    - Proteins
    - Nucleic acids
    - Fats

- Starch digestion begins in the mouth.
  - **Salivary Amylase**
    - Catalyzes starch + H₂O $\rightarrow$ maltose
    - Maltose is broken down in the small intestine to glucose for absorption.

- Protein digestion begins in the stomach.
  - **Pepsin**
    - Pepsinogen is activated to pepsin by low pH.
    - Catalyzes protein + H₂O $\rightarrow$ peptides
    - Peptides will be broken down in the small intestine into amino acids for absorption.
14.3 Digestive Enzymes

- Pancreatic juice has a basic pH to neutralize acidic stomach chyme.
  - Slightly basic small intestine optimum for pancreatic enzymes
    - **Pancreatic Amylase**
      - Digests starch
    - **Trypsin**
      - Produced by pancreas as trypsinogen and converted to trypsin
      - Digests proteins

- Lipase, a third pancreatic enzyme, digests fats
  - Fats are first emulsified by bile salts.
  - Catalyzes the reaction:
    - Fats + H₂O → Glycerol + 3 fatty acids
  - Glycerol and fatty acids are absorbed into villi.
  - They are rejoined and packaged as lipoproteins, which are absorbed into lacteals.

- Small intestine villi cells produce enzymes.
  - **Peptidases**
    - Catalyze Peptides + H₂O → Amino Acids
      - Occur in small intestine
      - Absorbed into villi
  - **Maltase**
    - Catalyzes Maltose + H₂O → Glucose + Glucose
    - Each disaccharide that is digested in the small intestine has its own enzyme.
    - Lack of any one of these enzymes can cause illness.
      - Lactose intolerance = no lactase
14.3 Digestive Enzymes

- Enzymes function best at an optimum temperature and pH.
  - Optimum conditions help to maintain the proper shape to fit substrate.
  - An experiment can support the hypothesis that digestion of egg white (protein) requires the correct enzyme (pepsin) and acidic conditions.
14.4 Human Nutrition

- **Nutrition** is the intake of nutrients.
  - A **nutrient** is a component of food utilized by the body as it performs physiological function.
  - Six major classes - carbohydrates, fats, proteins, vitamins, minerals, and water
  - All body functions depend on proper nutrition.
  - Overconsumption can also cause health problems.

14.4 Human Nutrition

- **Diet** is made up of the food choices that fulfill nutrient needs.
- In 2011, the USDA replaced its 20-year old food pyramid with the MyPlate symbol.
- This replaced numerical recommendations for amounts of different types of foods with a simpler image of a plate symbolizing a well-balanced diet.
Obesity

• Today, obesity is defined as having a body mass index (BMI) of 30 or greater.
• Your BMI can be determined based on your height and a standard graph.
• It does not account for certain factors.
  – Fitness
  – Gender
  – Bone structure

Obesity

• Likely caused by a combination of behavioral, genetic, metabolic, and social factors
• Related factors contributing to obesity
  – Sedentary lifestyle
  – Processed foods
  – Higher number of fat cells in obese individuals
  – Reduced levels of leptin which regulates appetite

Obesity

• Obesity is associated with certain illnesses.
  – Type 2 diabetes
  – Hypertension
  – Cardiovascular disease
  – Respiratory dysfunction
  – Osteoarthritis
• Treatment depends on the degree of obesity.
Major Classes of Nutrients - Carbohydrates

- Carbohydrates are present in food as complex polysaccharides like starch and fiber and simple sugars like glucose.
  - Glucose is the most readily available energy source.
  - Excess glucose is stored by liver and muscles as glycogen in quantities of up to 600g.
  - Additional glucose is converted into fat and stored in adipose tissue.
    - Between meals the liver keeps blood glucose constant by breakdown of glycogen.
    - Glucose is maintained at 50 – 80 mg/100ml blood.

Carbohydrates

- Many Americans do not eat the right types of carbohydrates.
- The typical American diet obtains one-sixth of daily calories from simple sugars.
  - Foods like candy and cookies, foods with high fructose corn syrup, starch in white bread have a high glycemic index.
  - They cause blood glucose levels to rise rapidly.
  - This in turn causes an overload of insulin.
  - A chronically high insulin level may have harmful effects.

Carbohydrates

- Studies have shown that reducing intake of foods with high-glycemic-index carbohydrates can reduce weight gain.
- After adjusting for lifestyle factors such as physical activity, alcohol use, and smoking, dietary factors that had the greatest effect on body weight over time were identified.
- The biggest cause of weight gain was potatoes.
Carbohydrates

- Complex carbohydrates are recommended.
  - Slowly digested to sugars
  - Also contain fiber
    - Insoluble fiber: undigestible plant material
      - Acts as laxative
      - May protect against colon cancer
    - Soluble fiber
      - Combines with bile acids and cholesterol to prevent their absorption
  - Fiber derived from peas, beans, nuts, fruits, vegetables
    - Too much fiber can be detrimental as it prevents absorption of iron, zinc, or calcium

<table>
<thead>
<tr>
<th>Food</th>
<th>Weight Change (lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato chips</td>
<td>1.69</td>
</tr>
<tr>
<td>Potatoes</td>
<td>1.28</td>
</tr>
<tr>
<td>Sugar-sweetened beverages</td>
<td>1.00</td>
</tr>
<tr>
<td>Unprocessed red meat</td>
<td>0.95</td>
</tr>
<tr>
<td>Processed meats</td>
<td>0.93</td>
</tr>
<tr>
<td>Vegetables</td>
<td>-0.22</td>
</tr>
<tr>
<td>Whole grains</td>
<td>-0.37</td>
</tr>
<tr>
<td>Fruits</td>
<td>-0.49</td>
</tr>
<tr>
<td>Nuts</td>
<td>-0.57</td>
</tr>
<tr>
<td>Yogurt</td>
<td>-0.82</td>
</tr>
</tbody>
</table>
Proteins

- Dietary proteins are digested to amino acids which cells use to synthesize a variety of proteins.
- Foods rich in proteins include red meat, fish, poultry, dairy products, and legumes.
- Amino acids are usually not used as an energy source.
- Most amino acids are used to make structural proteins (muscle, hair, skin, nails).
- Others are used to synthesize proteins such as hemoglobin, plasma proteins, enzymes, and hormones.

**Proteins**

- Adequate protein formation requires twenty amino acids.
- **Essential amino acids** include eight required from the diet because the body cannot produce them sufficiently.
- Complete protein sources such as milk, meat, eggs provide all twenty amino acids.
- Other dietary protein sources may contain insufficient amounts of at least one essential amino acid.
- Vegetarians are advised to combine plants from two or more incomplete protein groups.

Proteins

- Amino acids are not stored in cells, so a regular supply is required.
- Two servings per day are sufficient.
- The body is harmed if the amount of protein in the diet is limited.
- Excess protein requires deamination of amino acids which leads to urea formation.
- Water is lost as kidneys excrete urea.
**Lipids**

- Lipids include fats, oils, and cholesterol
  - **Saturated fats**
    - Solid at room temperature
    - Usually of animal origin
      - Exceptions: palm oil, coconut oil
    - Associated with cardiovascular disease

- **Unsaturated fats**
  - Oils have two kinds of *unsaturated fatty acids*.
    - **Monounsaturated**
    - **Polyunsaturated**
      - Polyunsaturated oils contain *essential fatty acids* that can be obtained only through the diet
        - Linoleic acid
        - Linolenic acid
      - Corn and safflower oils are high in polyunsaturated fatty acids

- Olive and canola oil have a larger percentage of monounsaturated fatty acids compared to other cooking oils.
- Omega-3 fatty acids are especially protective against heart disease.
  - Found in cold-water fish, flax seed oil
Lipids

• Saturated fats – trans fats
  – Trans fatty acids are the worst type of saturated fat.
    • Formed by hydrogenation of unsaturated fatty acids to produce a solid fat in certain foods
    • Found largely in commercial food products such as cookies and crackers
    • May reduce ability to clear cholesterol from bloodstream

Lipids

• Fats That Cause Disease
  – Plaques form in and block arteries
    • Contain cholesterol and saturated fats
  – Cholesterol
    • Carried in blood by low density lipoprotein (LDL) and high density lipoprotein (HDL)
    • LDL (“bad” cholesterol) - transports cholesterol from the liver to cells
    • HDL- (“good” cholesterol) - transports cholesterol to the liver to make bile salts

<table>
<thead>
<tr>
<th></th>
<th>% saturated fat</th>
<th>% polyunsaturated fat</th>
<th>% monounsaturated fat</th>
<th>% cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canola oil</td>
<td>8</td>
<td>62</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Safflower oil</td>
<td>8</td>
<td>12</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>Olive oil</td>
<td>14</td>
<td>77</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Beef fat</td>
<td>51</td>
<td>44</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Butter</td>
<td>62</td>
<td>33</td>
<td>33</td>
<td></td>
</tr>
<tr>
<td>Coconut oil</td>
<td>82</td>
<td>11</td>
<td>7</td>
<td></td>
</tr>
</tbody>
</table>

Percentages
Vitamins

• **Vitamins**
  - Organic compounds the body needs for metabolic purposes but is unable to produce
    - Many are coenzymes – enzyme helpers
    - Deficiencies produce specific symptoms
    - Not all vitamins are coenzymes, for example vitamin A is a precursor for a visual pigment
  - Thirteen vitamins in total
    - Fat soluble – vitamins A, D, E, K
    - Water soluble – remaining nine

Vitamins

• **Antioxidants** defend against free radicals
  - Cellular metabolism generates free radicals
    - Most common are superoxide (O$_2^-$) and hydroxide (OH$^-$)
    - Cause cell damage leading to disorders and even cancer
  - Vitamins C, E, and A believed to defend the body
  - Especially abundant in fruits and vegetables
Vitamins

• Vitamin D (calcitrol)
  – Skin cells contain a precursor cholesterol molecule that is converted to vitamin D after UV exposure
  – Further modification occurs in kidneys and liver.
    • Becomes calcitrol
    • Promotes calcium absorption from intestines
  – Deficiency causes rickets in children.

Illnesses Due to Vitamin Deficiency

- Rickets due to vitamin D deficiency
- Pellagra dermatitis due to niacin deficiency
- Bleeding of gums is a symptom of scurvy, a vitamin C deficiency

Figure 14.17

![Rickets](a.png)  ![Pellagra](b.png)  Bleeding of gums is a symptom of scurvy; a vitamin C deficiency

- a: rickets
- b: pellagra dermatitis due to niacin deficiency
- c: © Biophoto Associates/Photo Researchers, Inc.; b: © Ken Greer/Visuals Unlimited

Uranus is an exoplanet located in the outer solar system. It is the largest of the four gas giant planets and is characterized by its thick, windswept atmosphere and ice-covered surface. Uranus is known for its unusual tilt, which gives it a unique appearance in the sky. Its atmosphere consists primarily of hydrogen and helium, with traces of methane and other volatile compounds. The planet's rings are composed of ice and rock particles, and are the most extended of any planet in the solar system.
Minerals

- Minerals are inorganic chemical elements also required by the body.
  - Major Minerals
    - Body contains more than 5 grams
    - Constituents of cells and body fluids
    - Structural components (Ca$^{2+}$ in bones)
  - Trace Minerals
    - Body contains less than 5 grams
    - Components of larger molecules (Fe$^{2+}$ in hemoglobin)
Diet and Osteoporosis

- Many people take Ca$^{2+}$ supplements to counteract osteoporosis, a bone degenerative disease.
- Disease develops due to osteoclasts being more active than osteoblasts.
- Bones become more porous and break more easily.
- Ca$^{2+}$ intake 1,000 mg/day for men or premenopausal women
- Ca$^{2+}$ intake 1,300 to 1,500 mg/day for women who are premenopausal
- Vitamin D is also used to promote Ca$^{2+}$ absorption

Sodium and Hypertension

- Recommended daily amount of sodium intake is less than 2,400 mg; the average American takes in 4,000 to 4,700 mg.
- High sodium intake is linked to hypertension.
- Sources of sodium:
  - One-third is naturally in foods
  - One-third added by commercial processing
  - One-third added during home cooking

TABLE 14.9 Reducing Dietary Sodium

<table>
<thead>
<tr>
<th>To reduce dietary sodium:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use spices instead of salt to flavor foods.</td>
</tr>
<tr>
<td>2. Add little or no salt to foods at the table, and add only small amounts of salt when you cook.</td>
</tr>
<tr>
<td>3. Eat unsalted crackers, pretzels, potato chips, nuts, and popcorn.</td>
</tr>
<tr>
<td>4. Avoid hot dogs, ham, bacon, luncheon meats, smoked salmon, sardines, and anchovies.</td>
</tr>
<tr>
<td>5. Avoid processed cheeses and canned or dehydrated soups.</td>
</tr>
<tr>
<td>6. Avoid home-cured hams, such as pickles or salami.</td>
</tr>
<tr>
<td>7. Read labels to avoid high-salt products.</td>
</tr>
</tbody>
</table>
Dietary Supplements

- Dietary supplements are nutrients or plant products used to enhance health.
- They are not required to undergo safety and effectiveness testing as are prescription drugs.
- Therefore, many supplements have not been tested scientifically to determine their benefits.
- They can be useful to correct deficiencies, but ingesting too much of any particular nutrient can be harmful.
- Protein or amino acid supplements are not recommended by most nutritionists.

Food Additives

- Food additives are substances added to food as preservatives, or to enhance flavor or appearance.
- Food dyes are the most controversial since color is an important psychological part of tasting food.
- Nine synthetic dyes are currently approved by the FDA for food use.
- The effect of food coloring on health is less certain than the psychological effect.
- Studies have been done, but links to illnesses were not conclusive.

14.5 Eating Disorders

- People with eating disorders have attitudes and behaviors towards food which cause serious disturbances in their diet.
- Eating disorders can develop in anyone regardless of ethnicity, socioeconomic status or intelligence.
- Eating disorders are usually treated with a combination of medication and psychological counseling.
  - Disorders include anorexia nervosa, bulimia nervosa, and eating disorders not otherwise specified
Anorexia Nervosa

- **Anorexia nervosa**
  - Irrational fear of getting fat - no matter how thin they become, they think they're overweight
  - Preoccupation with a perceived body defect
  - 90% of sufferers are women
  - Behavioral symptoms include
    - Self-imposed starvation
    - Purging episodes by self-induced vomiting
    - Laxative abuse
    - Extreme physical activity

Anorexia Nervosa

- Physical symptoms
  - Symptoms of starvation
    - Low blood pressure
    - Irregular heartbeat
    - Constipation
    - Constantly feeling cold
  - Decreased bone density
  - Many organs cease optimal function
  - Dried skin

Bulimia Nervosa

- **Bulimia nervosa**
  - Pattern of binge eating and purging to avoid gaining weight
  - As in anorexia, preoccupation with body shape and weight
  - Restrictive diet brings desire to binge, usually on high-calorie foods
  - Resulting sense of guilt usually leads to the next phase, purging
Bulimia Nervosa

- Can coexist with obesity or anorexia nervosa
- Physical symptoms
  - Abnormal heart rhythm
  - Damage to kidneys
  - Inflammation of pharynx and esophagus
  - Possible rupturing of stomach and esophagus
  - Erosion of teeth

Figure 14.19b

Figure 14.19a

Copyright © The McGraw-Hill Companies, Inc. Permission required for reproduction or display.
Eating Disorders Not Otherwise Specified—Binge Eating Disorder

• Binge eating disorder is the most common in US.
• Individuals with disorder often eat large amounts of food while feeling a loss of control over eating.
• Sufferers usually do not purge afterward, therefore are not as likely to have immediate medical problems.
• People with the disorder are often overweight.
• The cause is unknown, but many with this disorder claim they suffer a variety of emotional issues.

Pica

• Pica is the repeated ingestion of nonfood items, such as ash, charcoal, cotton, soap, soil or wool.
• Pica usually affects young children and stops before adolescence.
• Pica is often associated with intellectual disability, lack of proper parental care, and neglect.
• Children are at greater risk for poisoning.

14.6 Disorders of the Digestive System Disorder of the Digestive Tract

• Stomach Ulcers
  – A thick layer of mucus normally protects wall of stomach.
  – A breakdown in mucus layer causes the stomach wall to be damaged by the acidic pH resulting in a stomach ulcer.
  – Most are caused by bacteria Helicobacter pylori.
    – Treatment involves antibiotic therapy
  – They can also occur in duodenum due to acidic chyme.
Intestinal Disorders

- **Diarrhea**
  - The most common problem of the small and large intestines
  - Can be acute or chronic
    - Acute cases usually due to infections of the lower intestinal tract
    - Food poisoning can be mild or life-threatening
    - Chronic diarrhea
      - **Crohn's disease** – persistent inflammation of intestine

Intestinal Disorders

- **Constipation**
  - Dry, hard feces
  - May be due to ignoring the urge to defecate
  - Chronic constipation can lead to hemorrhoids
  - Can be treated with increased fluid and fiber intake
  - Laxatives and enemas should be used infrequently

Polyps and Colon Cancer

- **Polyps** are small growths arising from the epithelial lining in the colon.
  - May be benign or cancerous
  - Detected by a colonoscopy
  - May be due to high fat diet which increases bile secretion
  - Fiber may inhibit polyp development by promoting bile excretion
Disorders of the Accessory Organs-
Disorders of the Pancreas

- **Pancreatitis**
  - Inflammation of the pancreas due to alcohol, gallstones, or unknown factors
  - Pancreatic enzymes damage the organ
  - Can eventually lead to diabetes

- **Pancreatic Cancer**
  - Almost always fatal
  - Pancreas has essential functions, resistance to treatment, and spread of cancerous cells

Disorders of the Liver and Gallbladder

- **Jaundice** - abnormally large amount of bilirubin in blood
  - A common side effect of liver disorders

- **Hepatitis** – inflammation of liver
  - Usually caused by one of several viruses

- **Cirrhosis**
  - Often due to alcoholism where the liver develops fibrous scar tissue

- **Gallstones** - crystallized cholesterol blocks the common bile duct, causing obstructive jaundice
  - Often requires removal of gall bladder