Chapter 11:
Digestion and Excretion
Introduction to Digestion

Read pages 352-358

Make summary notes on this section

Create a Concept Map on the Essential Nutrients, including:

• the six nutrients
• their building blocks (ie: the simple molecules that make them up, if any)
• their dietary sources
• their importance in the body
Review Homework

Fill in the Information for each of the essential nutrients:

**Carbohydrates**
- Building blocks: monosaccharides
- Dietary sources: chocolate, cake, candy, pasta, potatoes, fruit, vegetables
- Importance in the body: Source of energy

**Fats (lipids)**
- Building blocks: fatty acid & glycerol
- Dietary sources: nuts, eggs, cheese, meat, vegetable oil
- Importance in the body: cell membranes, energy, insulation, protection, nerve impulses
Review Homework

Fill in the Information for each of the essential nutrients:

**Cholesterol**
- Building blocks: Lipid
- Dietary sources: Shellfish, meat, eggs
- Importance in the body: Nerve insulation, vitamin D production, component of membranes, formation of steroid hormones

**Proteins**
- Building blocks: Amino Acids (peptides)
- Dietary sources: Meats, seafood, dairy products, eggs, beans, nuts, many veggies, nuts
- Importance in the body: Build & repair body tissues, cell membranes, ENZYMES
Review Homework

Fill in the Information for each of the essential nutrients:

**Minerals**  
Building blocks: Simple inorganic chemicals (ex: Fe, Ca, Na, K)  
Dietary sources: Grains, meats, fruits, veggies.  
Importance in the body: Wide variety of functions; important for many structures & reactions.

**Vitamins**  
Building blocks: Simple organic compounds (ex: vitamins A, C, D, etc.)  
Dietary sources: Many sources, specific to each vitamin.  
Importance in the body: Coenzymes, and are needed for many functions in the body.
Review Homework

And one more:

**Water**

Building blocks: \( \text{H}_2\text{O} \)

Dietary sources: Water, any fluids, many fruits & vegetables

Importance in the body:
- Maintain fluid volume in the body
- Lubrication, chemical reactions occur in solution

Which of the items on this list is not really considered an essential nutrient?

Why not?
* Read 359-362
* List organs of the digestive system, in the order that food passes through (Alimentary Canal).
* Describe in point form the function of each organ.
* If there are several sections, list the sections.
* List any accessory organs and their function. (These are structures which aid digestion, but that food doesn't pass through.)
Group Work

Individually, read pages 359-362.
Don't worry about trying to remember everything at this point, this is just an initial reading to get a general feel for the topic.

Number off to form groups of up to three people
Group Work

In your group, use the markers and chart paper provided to complete an graphic outline showing all organs of the digestive system.

You will keep and continue work on this chart later, so be sure to complete this carefully!

- Draw the organs food passes through in order, starting with the mouth
- Label each organ, using large capital letters
- Using smaller letters, briefly explain the organ's in digestion
- If the organ has multiple sections, such as the small intestine, label the sections
- Finally, draw any accessory organs, and label them with their function as well
**Group Work**

**Note:** Draw all organs so that they form a *straight pathway*; you don't need, for example, to draw the small intestine as a coiled mass.

*Accessory organs* are ones that aid in digestion, but which the food doesn't actually pass through. (For example, *saliva glands*)

Not all of the accessory organs are included in this section, so keep your chart in the classroom when you are done...we will be completing it later.
Example: Getting Started

- **Mouth**
  - Begins mechanical and chemical breakdown of food

- **Saliva Glands**
  - Moistens and lubricates food, assists in chemical breakdown
Homework

Read pages 363-370, stopping when you reach the section titled Health and the Digestive System.

Create a concept map to show the major enzymes secreted by each organ of the digestive system, and their actions. Review on page 373
Add the remaining accessory organs to your digestive system diagrams.

Add all enzymes and other secretions to the diagram. List each secretion with the organ of origin, and include its action in digestion.

**Digestive Enzymes**

**Saliva Glands**

**Salivary Amylase**

- Secreted into the mouth
- Breaks starch into disaccharides
The tube food passes through is called the Alimentary Canal.
Modelling Digestion

Use the models of large nutrients to model the stages of digestion in the various organs.

Protein

Carbs
Polysaccharide

Fat (triglyceride)
Modelling Digestion

Mouth

Protein

Polysaccharide

Fat (triglyceride)

Amylase
Modelling Digestion

Stomach

Protein

Polysaccharide

Fat (triglyceride)

Peristalsis

Pepsin
Modelling Digestion

Small Intestine

Protein

Polysaccharide

Fat (triglyceride)

Bile - emulsifies fats

Small Int 
- Peptidase
- Maltese
- Lactase
- Sucrase

Pancreas 
- Amylase
- Protease
- Lipase

Sodium Bicarbonate
Homework

Study the digestive system summary sheet, and complete the questions (1-11) on the sheet.

Come to class tomorrow prepared to review for your unit test.
1) What are the six essential nutrients, and why are they important in the human body? Of the six, which need to be digested before being absorbed into the bloodstream?

   Water - lubrication, temperature control, chemical reactions are dissolved in water

   Minerals - Many different roles in maintaining body function

   Vitamins - Simple organic compounds, often needed as coenzymes

   Proteins - Structure, transport, communication (hormones) control of chemical reactions (enzymes), antigens and antibodies

   Fats - Insulation, structure of cell membrane, energy storage

   Carbohydrates - Primary energy source for cell respiration

   Only proteins, fats, and carbohydrates need to be digested.
2) Compare mechanical digestion and chemical digestion. In what ways are they similar and different?

Mechanical digestion involves physically breaking down food into smaller pieces. This includes chewing, emulsifying fats (by bile from the liver), churning of the stomach, etc.

Chemical digestion is the separation of large molecules into their components by chemical reactions (hydrolysis). This is controlled by digestive enzymes.

Both involve breaking food into smaller parts, but only chemical digestion involves enzyme-controlled reactions; in mechanical digestion, the molecules themselves are not changed.
3) How would digestion be affected if mechanical digestion did not occur? What is one secretion into the digestive system which acts to break down a nutrient mechanically, but not chemically?

If mechanical digestion did not occur, chemical digestion would still happen, but it would be much slower. Why? Because if the food isn't broken into smaller pieces, the surface area is much smaller, meaning the enzymes cannot act on as many molecules at once.

One secretion which helps with mechanical digestion but not chemical digestion is bile, which emulsifies fats (breaks them apart into little bubbles) but doesn't break apart the fat molecule.)
4) What triggers the glands in the stomach?  
What do these secretions act on?

The stomach secretes hydrochloric acid and the proteinase pepsin. This begins the breakdown of proteins into polypeptide chains.

Stomach secretions are triggered by the hormone gastrin, which is released when a person sees, smells, or even thinks of food, or when food entering the stomach touches or stretches the stomach wall.

The stomach also releases a mucus coating which lines the stomach and protects it.
5) What is an ulcer, and how does it develop? (see pgs. 368-369)

An ulcer occurs when the acids in the stomach penetrate the mucus lining, and begin to eat at the wall of the stomach itself. (So an ulcer is really an acid burn on the inside of the stomach!)

Most ulcers are caused by bacteria which attach to the stomach wall and remove the mucus layer; smoking, alcohol, and caffeine can also contribute to ulcers. They can often be controlled by diet and other behavior changes (such as quitting smoking), and in severe cases can be surgically repaired.
6) What are three major functions of the liver? *Note*: only one is directly related to digestion

The liver's role in digestion is the production of bile salts, which dissolve in water to form bile. This is stored in the gallbladder and released into the small intestine, where it emulsifies fats.

The liver also detoxifies blood, removing harmful chemicals and converting them into harmless forms which are removed from the body by excretion.

Finally, the liver controls several nutrient levels in the blood, most importantly glucose (which it stores as glycogen) but also other chemicals, such as some fat-soluble vitamins.
7) Describe the structure of villi and microvilli. What is their function in digestion?

Villi are small, finger-like projections on the inside lining of the small intestine. They are covered with cells which have brush-like membranes, forming even smaller projections called microvilli. They increase surface area in the small intestine to increase the absorption of nutrients.

Villi contain capillaries, which absorb most of the products of digestion, and lacteals, small lymph vessels which absorb the larger fat particles which cannot enter the capillaries.
8) What is lacteal? Why is it important in digestion?

Lacteals are small lymph vessels which absorb the larger fat particles which cannot enter the capillaries. These flow into the lymph vessels, which carry fluid and return it to the circulatory system near the base of the throat (the subclavian veins).
Homework Questions: Answers

9) What four purposes does peristalsis serve in the small intestine?

Peristalsis:

1) moves food through the small intestine

2) helps mechanically digest food with muscular contractions

3) mixes food with enzymes to aid in chemical digestions

4) pushes food past villi to aid in absorption of nutrients
10) What is the appendix? What condition can develop if the appendix becomes infected?

The appendix is a small projection of the large intestine, near where it joins the small intestine. It serves no function in humans, although there is speculation that it may be related to the immune system.

If it becomes infected, this is called appendicitis. Without treatment, the bacteria could cause the appendix to rupture, leaking toxins into the abdominal cavity. This condition is potentially fatal, but routine surgery can remove the appendix. Since the appendix plays no real role in maintaining homeostasis, if it is removed, most people suffer no long-term effects.
Homework Questions: Answers

11) Give two examples of vitamins produced by bacteria in the large intestine. Why are these vitamins important? (see pg. 371)

Vitamin B₁₂ (which is important for metabolism, maintaining a healthy nervous system, and red blood cell development) and Vitamin K (needed for blood clotting) are both formed by bacteria in the large intestine.
You may use the remainder of the class to study for the unit test, or to ask questions.

Remember, this test covers:

- Circulatory system
- Immune system (and the other defenses)
- Respiratory (or gas exchange) system
- Digestive system