Digestion Overview
- The body uses a variety of small molecules (amino acids, fatty acids, glucose) for its metabolic needs - food is mechanically and chemically broken down into thesis molecules during ________, after which they can be taken up by body cells through the separate process of________
- Food travels in a ___________ from mouth to esophagus to stomach to small intestine to large intestine to anus
- Organs and structures in the digestive system are _________ for specific functions in digestion
- Digestive enzymes are specific ________ enzymes that have an optimal functioning ________ and ________
- Proper nutrition is necessary for health. After all, you are what you eat!

What happens during the digestive process?
1. Digestion: the ________ and ________ breaking down of ingested food into particles, then into molecules small enough to move through epithelial cells and into the internal environment
   - Mechanical digestion uses ____________________________ to physically breakdown food into smaller pieces; this precedes chemical digestion
   - Why?
     - Chemical digestion uses ________ enzymes to breakdown macromolecules into unit molecules
2. Absorption: the passage of digested ________ from the gut lumen into the blood or lymph, which distributes them through the body
3. Elimination: the expulsion of _________________ material from the body

1. DIGESTION
   - During digestion, carbohydrates are broken down into ____________, proteins into ____________, fat into ____________, and nucleic acids into ____________
   - Digestion is an ________ process.
   - What type of transport is needed for the hydrolytic enzymes to be excreted out of the cell that produces them? __________

A. Mouth
   - Structure
     - divided into an anterior ________ (contains several bones) and a posterior ________ which is composed of muscle tissue
   - Function
     a. receives food
     b. mechanical digestion of food
     c. chemical digestion of ________
   - There are three sets of salivary glands that produce ________ for digesting starch:
     1. Parotid (below ears)
     2. Sublingual (below tongue)
     3. Submandibular (under lower jaw)
   - Saliva
     - consists of ________, ________, and a hydrolytic enzyme called ________, which functions to breakdown ________ into maltose
     - Once food has been chewed, it is called ______
     - Food is then passed through the back of the mouth when you swallow
     - The first region it enters is called the __________ which is simply the region between ________ and esophagus where ________ food and air meet
Swallowing is a ______________ (requires no thought)
➡ Why is it impossible to breathe and swallow at the same time?
➡ When you swallow, the following happens in order to block air passage:
1. the soft palate moves back to cover nose (nasopharyngeal opening)
2. the tongue moves up and a flap of tissue called the __________ which prevents food from entering the respiratory tract
➡ What happens when food goes down the “wrong way” (ex. down the trachea)?
➡ What is reverse peristalsis?
➡ What are the esophageal muscles? (analogy: squeezing a tube of toothpaste)
- Phasic circular and longitudinal muscle layer
- Longitudinal muscle (for lubrication)
- Taenial muscle
➡ Food bolus reaches the end of the esophagus and arrives at the
➡ What is reverse peristalsis?
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➡ The esophagus
- Long and muscular
- Lined with mucous membrane (for lubrication)
- Circular and longitudinal muscle for __________, rhythmic contractions of muscle (analogy: squeezing a tube of tooth paste)
- Reverse peristalsis
➡ Food bolus reaches the end of the esophagus and arrives at the __________ connecting to the stomach
- Made of muscles that encircle tubes, open them when they relax, close them when
➡ Why is it impossible to breathe and swallow at the same time? (requires no thought)
C. Stomach

- Functions
  a. temporary food storage (2-6 hours)
  b. mechanical digestion
  c. chemical digestion of ________

- has folds called _____ that can stretch to hold _______ of food
- Three layers of muscle to contract to _____ and _____ its contents
- “hunger pains” are felt when an empty stomach churns
- The mucus lining of the stomach contains inner ___________ which produce gastric juice

- Components of gastric juice:
  a. Pepsinogen (pepsin = active form)
  b. Hydrochloric acid (pH 2-3)
  c. Mucus

- Why is it important to keep pepsin in its inactive form, pepsinogen, when there is no food in the stomach?

- What is an ulcer? How does it form?

- After 2-6 hours (depending on the type of food), the food has been turned into a semi-liquid food mass called ___________, and the stomach empties into the first part of the small intestine (called the ___________)
- This emptying is controlled by the ___________ at the bottom of the stomach
Functions of the liver:

1. Keeps blood concentrations of nutrients, hormones, etc. constant (e.g., converts glucose to glycogen and back to keep blood glucose levels constant).

2. Interconversion of nutrients (e.g., carbohydrates to fats, amino acids to carbohydrates and fats).

3. Removes toxins from the blood = detoxifies (e.g., breaks down alcohol using alcohol dehydrogenase).

4. Production of bile (up to 1.5 litres of bile per day!).

5. Destroys old red blood cells (red blood cells can live approximately ________).

6. Production of urea (deamination of amino acids and excretion of resulting ammonia as urea, uric acid, etc.).

7. Manufacture of plasma proteins such as fibrinogen and thromboplastin (for blood clotting) and albumin.

8. Manufacture of cholesterol - needed for making steroid hormones such as estrogen and testosterone, and helps with membrane permeability.

• Produces _______ which is sent to the duodenum via bile duct.

• Bile is thick, _____ liquid produced in liver, stored in gall bladder, contains bile salts which break fat into ____________.

Why do feces smell?

_____________________________________

Why do you fart?

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Why do feces smell?

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Why do you fart?

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Why do feces smell?

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Why do you fart?
2. ABSOPTION

D. Small Intestine

- Functions
  - Completing the chemical digestion of proteins, carbohydrates, and lipids
  - Absorption of unit molecules into blood (circulatory system) or lymph (lymphatic system)

- Total length is approximately _______ _________

- 3 sections: ________, ________, and ______
  - Duodenum
    - first 25 cm
    - Receives ____ and ______________
    - Site of major chemical digestion of proteins, carbohydrates, and lipids
  - Jejunum & ileum
    - Completion of chemical digestion and ________ of nutrients into circulatory or lymphatic system

- Walls of duodenum and small intestine are lined with millions of ____________ that produce juices containing enzymes that finish the digestion of proteins and starch.

- Secretions from the interstitial glands contain digestive enzymes: peptidases digest _______ to amino acids, maltase digests ______ to glucose.
  - Other enzymes made here digest other disaccharides (ex. lactase digests _______ [the sugar in milk], and sucrase digests _______)

- The small intestine’s structure is specialized for its function of digestion and absorption
  - Long
  - Convoluted
  - Has villi (each with microvilli)
  - Mitochondria for ATP production (needed for active transport)

- The structure of the small intestine is well related to its function of absorption
  - Long and convoluted walls increase ______ _______
  - Surface area is further increased by presence of finger-like projections called ___ (singular one is called a "villus")
  - Interstitial glands are at the base of each villus

- Absorption occurs across the walls of each villus
  - This can happen _______ or ________
  - Recall that active transport across cell membranes requires ATP. The nutrient can now enter the blood or the lymphatic system, depending on what type it is.

- ________ and ________ are absorbed across the villi, are recombined into ___ molecules in the epithelial cells of the villus.
  - The fats then move into the _______ of each villus and enter the ________ system.

Common Disorders of the Digestive System

- Diarrhea
  - Too much liquid is expelled in the feces
  - Usually caused by ______ (in food, polluted water, etc.) or stress
  - Symptom is body’s defense against pathogen (attempts to "flush it out")
  - Loss of H2O can lead to severe dehydration
  - Causes millions of deaths per year in developing nations

- Constipation
  - Feces are ___, hard, difficult to expel
  - Leading cause is lack of ____
    - Diet can be supplemented by fiber or natural fiber supplements
    - Most chemical laxatives are irritants—cause increased peristalsis. They may weaken intestinal wall such that their continued use is perpetuated (you grow to “depend” on them).