

READING NOTES CHAPTERS 17 & 18: DIGESTIVE SYSTEM & NUTRITION

Name _____

Period ____ Due date _____

Mouth (Saliva)

Obviously, the mouth is the place where food is taken in, or **ingested**. **Digestion** begins in the mouth in 2 ways: **mechanically and chemically**. Mechanically, food is broken up by the teeth and mixed with saliva. This process is called _____.

The salivary glands are responsible for secreting **saliva**, which has many functions. One of these main functions is to begin chemical digestion. You produce 1 to 1.5 liters of saliva each day! Saliva contains the enzyme _____, which begins carbohydrate digestion, the enzyme **lingual lipase**, which will start digesting lipids once it hits the acid environment of the stomach and activates (inactive in the mouth), _____ ions to buffer the acid in the mouth, _____ to lubricate the food and assist in swallowing, an antibacterial agent called **lysozyme**, and an agent to slow bacterial growth called **immunoglobulin A**. (Be sure to know all 6 components of saliva and their functions)

Food is chewed and mixed into a _____ and then swallowed in a peristaltic action called **deglutition**. The bolus then enters the stomach (which varies greatly in size – from 50 mL to 4 L when full), where again **mechanical and chemical** digestion takes place. Food is mechanically digested further due to the fact that the stomach churns the food, mixing it further and physically breaking down the material. The chemical digestion truly begins in earnest (remember that carbohydrates begin in the mouth – all other nutrients remain intact) in the stomach, but it is important to note that no absorption of nutrients really happen in the stomach at all: it is simply a “holding tank” and mixing chamber.

Stomach

The stomach has **two** primary linings to it that secrete gastric juices: the layers contain **parietal cells** and **chief cells**. There are also mucus-secreting cells present. The **parietal layer** secretes **1) hydrochloric acid**, which helps to sterilize food and activate some enzymes (lingual lipase, pepsinogen) and **2) _____** which binds to vitamin B₁₂ and allows for the small intestine to absorb it.

The **chief cell layer** secretes **chymosin**, which serves to curdle the proteins in dairy products for easier digestion. Note that it is NOT an enzyme, but a vital part to the digestion of those proteins. The chief cells also secrete _____, which digests the lipids found in the butterfat of milk. One last secretion of the chief cells is the production of _____, which is inactive to begin with. When active, it will chemically digest proteins. To become active, just as it is with lingual lipase, this secretion needs to be exposed to the hydrochloric acid that the parietal cells made. It will then become an enzyme called _____. Food will be held in

the stomach for a wide range of time, depending upon its composition. Fatty foods will be held for _____ to _____ hours. More liquid-based foods only last a fraction of an hour. Protein-rich foods will be passed on to the small intestine faster as well, for that's where most of the protein digestion takes place.

Accessory organs: liver, gall bladder, pancreas

Remember that these are termed accessory organs (along with the salivary glands and tongue) in that they will secrete their fluids into the small intestine – they are not part of the “tube” itself! The **liver (p. 672)** has actually hundreds of functions, but there are **seven major digestive functions:**

- 1) **Help regulate the blood levels of _____ for proper carbohydrate metabolism.**
- 2) **Assist _____ metabolism by adding bile, which emulsifies them into smaller particles for the lingual and gastric lipase to work on.**
- 3) **Perhaps the most vital function is that of _____ metabolism. This is because the liver breaks this nutrient down into its amino acids and begins the process of reassembling the amino acids into other forms for the body to use. A by-product of this process is the formation of urea.**
- 4) **Storing substances such as glycogen, iron, and _____.**
- 5) **Destroying old and damaged _____, which includes the hemoglobin of them as well.**
- 6) **_____ blood to remove substances such as alcohol and drugs (and other toxins).**
- 7) **Serves as a blood _____, storing 200 to 400 mL.**

The **gallbladder (p. 674)** absorbs the water and electrolytes out of the liver secretions, so it serves to store and concentrate the bile. This can cause problems where the bile salts become too concentrated, forming _____, which could block the secreting duct and cause serious medical conditions.

The **pancreas (p. 668)** is essentially a turbo-charged salivary gland, so powerful in its secretions that it has the ability to digest the human body if allowed to over-secrete. It is also largely responsible for (along with its hormone conversations with the liver) regulating blood glucose levels. On the digestive side of things, it secretes:

- 1) _____ **to digest starch and other forms of carbohydrates.**
- 2) _____ **to continue digesting lipids.**
- 3) **What we will collectively call zymogens (which actually have the individual names of trypsinogen, chymotrypsinogen, and procarboxypeptidase – you don't need to know those names for the test) to digest _____.**
- 4) _____, **which digest DNA and RNA into nucleotides.**
- 5) _____, **which neutralizes the stomach acid to prevent damage to the small intestine walls. An interesting side-effect of this is that it “deactivates” lingual lipase and pepsin since those needed an acid environment to be active.**

Small intestine

The accessory organs all will collectively deposit their secretions into the small intestine by way of the hepatopancreatic ampulla, also called the ampulla of Vater. The small intestine lining will have some enzyme secretions of its own to finish the carbohydrate, protein, and lipid digestion, but the primary function of the small intestine is the _____ **of nutrients**. To help maximize surface area, recall that inside the small intestine are microscopic extensions (“fingers”) called _____. The material passes through the small intestine much the same way it passes through the rest of the tract: by peristalsis.

Large intestine (p. 685)

The primary function of the large intestine is to reabsorb (recycle) _____ and the electrolytes found in it. No more digestion really takes place here – at least none of the nutrients that are freed up at this point are of any use. The overall function of this region is simply to start drying out what is left from the food that we started with. However, the colon does contain special bacteria that can break down cell walls (no other part of our digestive system can – which explains our experience when eating corn) which they will use to synthesize vitamins _____, _____, _____, and _____. The large intestine in turn absorbs those vitamins for our use.

Rectum

This is the last of the “drying chamber”, where the last opportunity to extract water is found. It is here that _____ is formed, which passes on to the anus.

Anus

There are two sets of muscles that control the actions of the anus. The first is involuntary, the second voluntary. Nerve damage to the sacrum area can affect these muscles so that control is no longer possible, resulting in a person needing a colostomy bag. The function of the anus is to **excrete** the indigestible material.

In Summation:

The digestive system consists of 4 primary functions: ingestion (bringing food into the body), digestion (mechanical as well as chemical), absorption, and excretion. On the test, be able to discuss where each of the components take place or is accomplished!

Another essay question will be: when given a “meal” with certain nutrients in it (I will tell you which nutrients), discuss where each of the nutrients will be processed throughout the entire digestive system – again, in terms of ingestion, digestion, absorption, and excretion.

Nutrition – Chapter 18

Carbohydrates are used as the primary energy source (cellular fuel). If our energy demands are less than what we have available to our bodies, we will convert the carbohydrates and put those nutrients into storage as fat. To review from chapter 17, carbohydrates are digested in the mouth with _____, it continues in the stomach, and then finishes in the small intestine when exposed to _____ from the pancreas.

Carbohydrate sources include:

- 1)
- 2)
- 3)

Our average carbohydrate requirement is:

Fats (lipids) are used for **energy** (_____ times as much energy as carbohydrates or proteins) but also for making **cell membranes**.

Lipid sources include:

- 1)
- 2)
- 3)

Our average lipid requirement is:

Proteins are made of amino acids. These can be broken down, then reformed into new proteins; they can be used to make enzymes (enzymes are protein-based); they are the components of muscle fibrils (actin and myosin); compose certain hormones; and form antibodies. Proteins can also supply energy.

Protein sources include:

- 1)
- 2)
- 3)

Our average protein requirement is:

Vitamins and minerals are essential to our overall health. They are obtained primarily from the foods that we eat. Vitamins and minerals both fall into 2 separate categories. For each item list: 1) what function it serves, 2) the primary source for obtaining it, and 3) what health problems deficiencies will result in (or overdoses).

Fat-Soluble Vitamins:

A

- 1)
- 2)
- 3)

D

- 1)
- 2)
- 3)

E

- 1)
- 2)
- 3)

K

- 1)
- 2)
- 3)

Water-Soluble Vitamins:

B₁ (Thiamine)

- 1)
- 2)
- 3)

B₂ (Riboflavin)

- 1)
- 2)
- 3)

B₃ (Niacin)

- 1)
- 2)
- 3)

Water-Soluble Vitamins (Continued)

B₅ (Pantothenic acid)

- 1)
- 2)
- 3)

B₆

- 1)
- 2)
- 3)

B₇ (Biotin)

- 1)
- 2)
- 3)

B₉ (Folacin)

- 1)
- 2)
- 3)

B₁₂ (Cyanobalamin)

- 1)
- 2)
- 3)

C (Ascorbic acid)

- 1)
- 2)
- 3)

Major Minerals

Calcium (Ca)

- 1)
- 2)
- 3)

Phosphorus (P)

- 1)
- 2)
- 3)

Major Minerals (Continued)

Potassium (K)

- 1)
- 2)
- 3)

Sodium (Na)

- 1)
- 2)
- 3)

Chlorine (Cl)

- 1)
- 2)
- 3)

Magnesium (Mg)

- 1)
- 2)
- 3)

Trace Minerals (elements)

Iron (Fe)

- 1)
- 2)
- 3)

Manganese (Mn)

- 1)
- 2)
- 3)

Copper (Cu)

- 1)
- 2)
- 3)

Iodine (I)

- 1)
- 2)
- 3)

Trace Elements (Continued)

Cobalt (Co)

- 1)
- 2)
- 3)

Zinc (Zn)

- 1)
- 2)
- 3)

Fluorine (F)

- 1)
- 2)
- 3)

Selenium (Se)

- 1)
- 2)
- 3)

Chromium (Cr)

- 1)
- 2)
- 3)

****Notice with ALL of the vitamins and minerals that they are ALL obtained through natural foods, NOT SUPPLEMENTS!**** There is NO way to regulate amount, type, and quality of the above vital nutrients through supplements, nor is there ANY documentation of how the supplements affect different systems of the body and their impacts on the medications you may be taking. **NOTHING BEATS THE NUTRITIVE QUALITIES OF NATURE.**