

## Unit 3: Human Biology I

LESSON 31

→ Systems Covered:

- 1) Digestive System
- 2) Circulatory System
- 3) Respiratory System
- 4) Lymphatic System

→ the human body is organized into systems

→ each system has an increasing level of complexity.

Cell types → Tissues → Organs → System  
ex. Nerve cells → nervous tissue → Brain → Nervous system

## Digestive System

Function: to breakdown and absorb the nutrients from food and to excrete indigestibles as waste.

- the digestive system is a continuous tube that runs from the mouth to the anus.

3 accessory organs are attached to the tube:

- 1) Liver
- 2) Pancreas
- 3) Gall Bladder

## The Path of Food

→ food enters the mouth

→ teeth break down food by chewing (mechanical digestion)

→ saliva is secreted by salivary glands and mixed with food using tongue. (food is now termed "bolus")

\* saliva contains the enzyme Salivary Amylase.

↳ begins carbohydrate digestion (starch → glucose)

...cont

- tongue pushes the bolus to the pharynx.
- involuntary muscle contractions move the bolus to the esophagus. (swallowing)
- bolus moves past the trachea which is covered by the epiglottis during swallowing, this prevents food entering the trachea.

Peristalsis: a series of involuntary contractions that move food down the esophagus.

## LESSON 32

### Review Questions

1) What 2 types of digestion occur in the mouth?

mechanical digestion & chemical digestion

2) Which enzyme is present in saliva and what function does it perform?

Salivary amylase - begins carbohydrate digestion  
breaking starch into glucose.

3) How does food move down the esophagus?

peristalsis

# WORD WALL

mouth

uvula

cardiac sphincter

tongue

epiglottis

salivary amylase

teeth

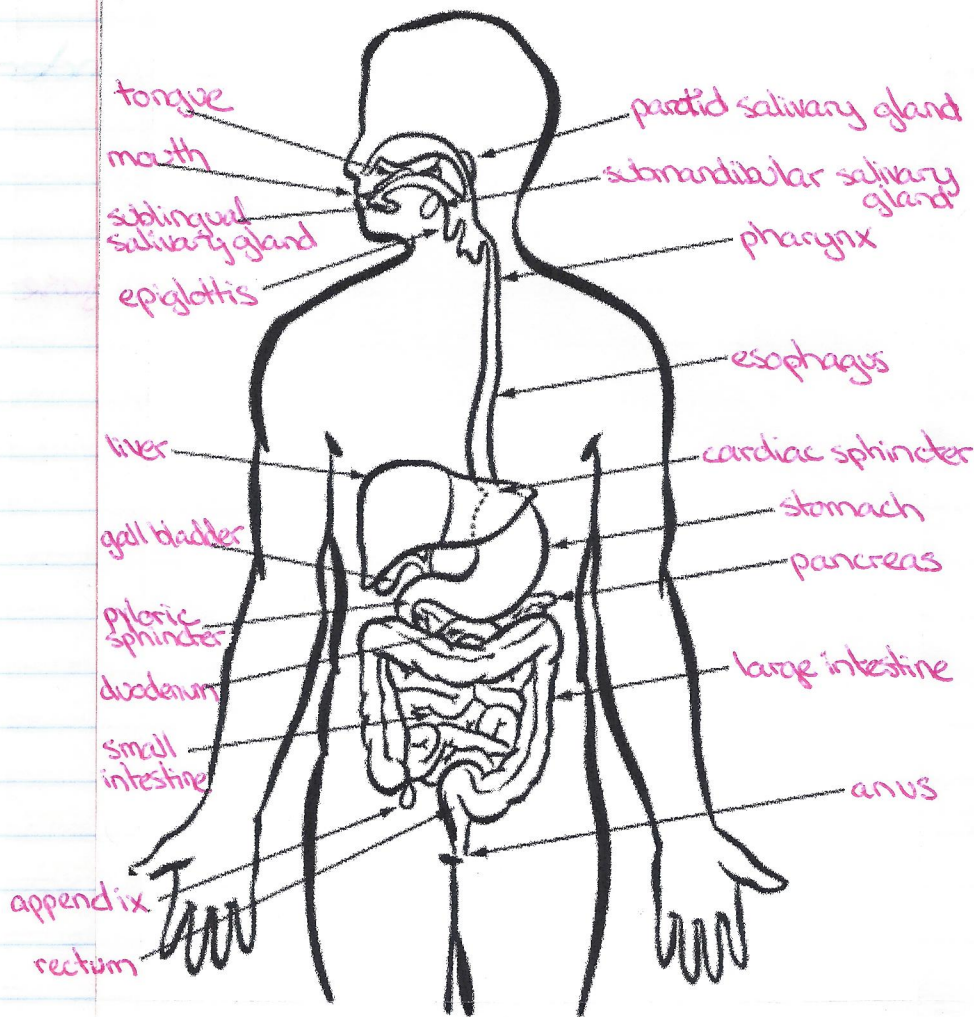
peristalsis

bolus

esophagus

pharynx

*[Faint, mirrored handwriting from the reverse side of the page, likely bleed-through from a previous page.]*



### The Path of Food...continued

- the esophagus and the stomach are joined by the cardiac sphincter.
- cardiac sphincter relaxes during peristalsis to allow food to enter the stomach.
- cardiac sphincter closes to prevent stomach contents from entering the esophagus.
- \* heartburn and acid reflux are caused by stomach contents moving into the esophagus.

..... cont

- the bolus now enters the stomach.
- the stomach is a muscular organ, able to contract to break the bolus into smaller pieces. (mechanical digestion)
- the wall of the stomach is able to expand because it contains folds. (rugae)

\* fully expanded, the stomach holds about 4L.

- gastric pits in the stomach wall secrete gastric juice.

Gastric juice contains:

- 1-  $H_2O$  (solvent)
- 2- HCl (Kills bacteria, lowers pH to 2)
- 3- Pepsinogen (begins <sup>(protein)</sup> peptide digestion), has an optimal pH of 2.
- 4- Mucous (protects the stomach)

chemical digestion

\* stomach empties every 2-6 hrs.

- bolus leaves through the pyloric sphincter.
- once food leaves the stomach it is called "chyme".

### LESSON 33

#### Review Questions

1) what causes heartburn?

stomach contents moving into the esophagus.

2) what are the 4 main components of gastric juice?

$H_2O$ , HCl, Pepsinogen, Mucous

3) what 2 sphincters are associated with the stomach and where are they located?

Cardiac Sphincter - at the beginning of the stomach

Pyloric Sphincter - at the end of the stomach

4) which structure allows the stomach to expand?

Rugae

## Disorders of Stomach

**Gastric Ulcers:** a breakdown in the protective mucous lining of the stomach.

- the lining is exposed to HCl and damaged.

Ulcers can be caused by:

1) *Helicobacter Pylori* infection  
(bacteria)

2) Overuse of anti-inflammatory medications  
ex. Ibuprofen

\* treatment can include antibiotics or acid reducing medications.

## The Path of Food ... cont

→ Chyme leaving the stomach through the pyloric sphincter enters the duodenum.

\* the duodenum is the first 10cm or so of the small intestine.

→ Ducts from the liver and pancreas join to enter the duodenum.

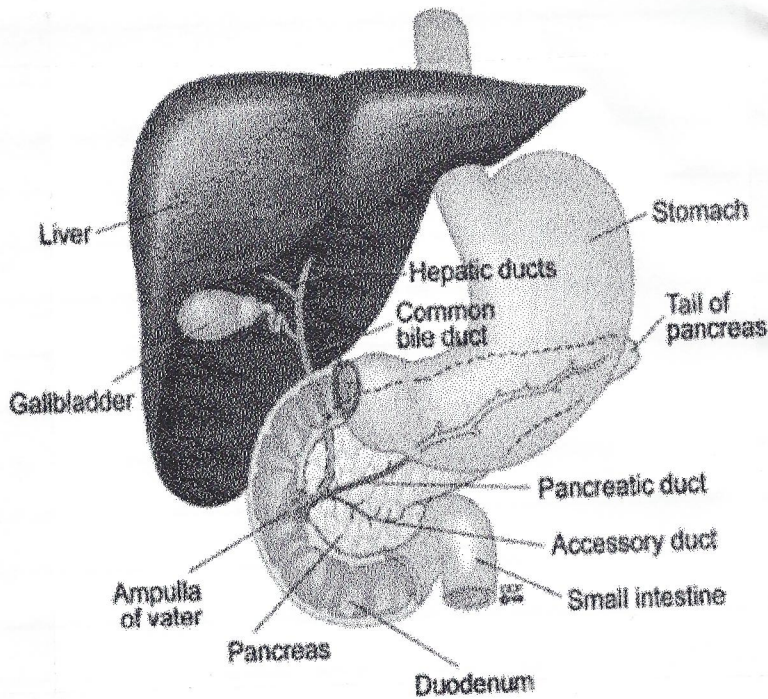
## Liver has 6 main functions:

- 1) detoxifies blood
- 2) produces bile
- 3) stores vitamins and minerals
- 4) stores glucose as glycogen
- 5) helps regulate blood sugar
- 6) removes bilirubin

## LESSON 34

### The Path of Food... cont

- Liver produces **bile**, stored in the gall bladder.
- bile enters the duodenum through the common bile duct.
- \* bile emulsifies (breaks up) fats.



→ Pancreas secretes pancreatic juice into the duodenum

PANCREATIC juice contains:

- 1) Sodium bicarbonate - raises the pH of chyme.
- 2) Pancreatic Amylase - continue carbohydrate digestion.
- 3) Lipase - Lipid (fat) digestion.
- 4) Trypsin - protein digestion.

→ the pancreas and the liver work together to regulate blood sugar.

\* after a meal, blood sugar is high.

→ the pancreas secretes **Insulin**

↳ signals the liver to store glucose, ↓ blood sugar

\* if blood sugar gets too low, pancreas secretes **glucagon**.

\* Glucagon signals the liver to break down glycogen into glucose,  $\uparrow$  blood sugar.

### Review Questions

1) What does Pancreatic juice contain?

sodium bicarbonate, pancreatic amylase, lipase, trypsin

2) What does the liver produce and where is it stored?

bile stored in the gallbladder

3) Which two organs regulate blood sugar?

liver and pancreas

4) What emulsifies (breaks up) fats?

bile

5) Which substance raises the pH of chyme and where is this substance produced?

sodium bicarbonate produced by pancreas.

6) How does the body react to high or low blood sugar?

Secretes Insulin to  $\downarrow$  blood sugar or Glucagon to  $\uparrow$  blood sugar.



## LESSON 35

### The Path of Food... cont

→ chyme moves through the duodenum into the small intestine.

\* "small" refers to diameter. It is much longer than the large intestine.

→ cells in the small intestine secrete digestive enzymes:

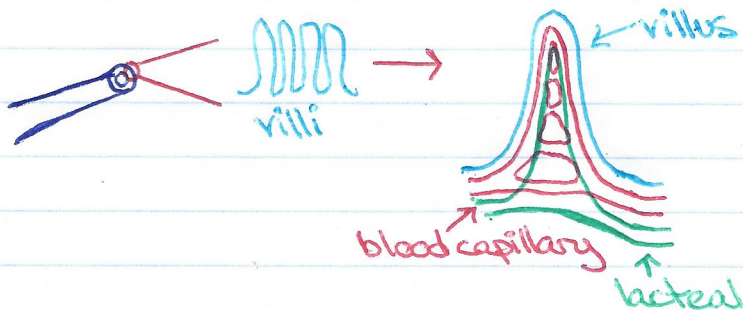
- Digestive Enzymes
- 1) Maltase: breaks down maltose
  - 2) Peptidase: breaks down proteins
  - 3) Nucleosidase: breaks down nucleic acids

\* these are the last enzymes to mix with chyme.

→ Absorption now takes place.

→ the inner lining of the small intestine is covered in "villi"-plural

→ the villi increase the surface area so more can be absorbed. "villus"-sing.



— blood capillaries absorb amino acids, glucose, nucleotides, salts

— lacteals absorb fats (glycerol & fatty acids)

→ Indigestibles now pass into the large intestine.

3 main functions of the large intestine:

1) Absorb water

2) Store fecal matter until defecation

3) Vitamin Production - through bacterial digestion of fecal matter.

Feces is:

- 1) 40% bacteria

- 2) 30% undigestibles (fiber)

- 3) 20% fat

- 4) 10% water

[First Nations](#) ▶ [BI12](#) ▶ [Resources](#) ▶ **Digestive System Written Response Questions**

## Written Response

### Instructions

Answer the following questions.

1. Describe in your own words the mechanical and chemical processes in the mouth that result in the formation of a bolus.
2. Summarize the composition and functions of gastric juice. Include the pH, the components and the function of each component in your answer.
3. Name three digestive enzymes, two hormones, and one other compound produced in the pancreas.
4. Describe how the two hormones produced in the pancreas act to regulate blood sugar levels.
5. Patients with Type I diabetes do not produce sufficient amounts of insulin. How does this affect an individual, what are the symptoms, and how is the disease treated?
6. What is the name of the blood vessel that connects the small intestine to the liver?
7. What is the function of the gall bladder?
8. What are the six functions of the liver?
9. What is the function of bile?
10. Describe how fats are emulsified, digested, and absorbed in the small intestine.
11. Sketch and label a villus. Include an explanation of how the structure of the villus facilitates absorption of nutrients.
12. When nutrients are absorbed into the villus, which enter the bloodstream and which enter the lacteals?
13. Name three enzymes found in intestinal juice and describe their functions.
14. Name 3 functions of the large intestine. Why is the large intestine important for regulation of water levels in the body?
15. Describe the composition of human feces.
16. Describe how bacteria normally found in the large intestine help to maintain good health.

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Fill in the blanks in the following table

<b>Digestive Enzymes Summary Table</b>				
<b>Enzyme</b>	<b>Glandular Source</b>	<b>Site of Action and pH</b>	<b>Substrate or food acted upon</b>	<b>Product</b>
Salivary Amylase				
Pepsin				
Pancreatic Amylase				
Trypsin				
Lipase				
Nuclease				
Peptidases				
Maltase				
Nucleosidases				