

Name _____

Lab Time/Date _____

Functional Anatomy of the Digestive System

General Histological Plan of the Alimentary Canal

1. The basic structural plan of the digestive tube has been presented. Fill in the table below to complete the information listed.

Wall layer	Subdivisions of the layer	Major functions
Mucosa	- SIMPLE COLUMNAR EPITHELIUM - LAMINA PROPRIA - MUSCULARIS MUCOSAE	- SECRETION OF ENZYMES, MUCUS, HORMONES - ABSORPTION OF DIGESTED FOOD STUFF - PROTECTION
Submucosa	- BLOOD + LYMPHATIC VESSELS, LYMPH NODES + NERVES	- PROTECTION
Muscularis externa	- CIRCULAR SMOOTH MUSCLE INTERNAL - LONGITUDINAL SMOOTH MUSCLE EXTERNAL	- PRODUCES GI MOTILITY
Serosa	- SQUAMOUS EPITHELIUM WITH ASSOCIATED AREOLAR CONNECTIVE TISSUE	- SEROSAL FLUID LUBRICATES GI TRACT MOVEMENTS

Organs of the Alimentary Canal

2. The tubelike digestive system canal that extends from the mouth to the anus is the ALIMENTARY canal.

3. How is the muscularis externa of the stomach modified? THERE IS ANOTHER SMOOTH MUSCLE LAYER ADDED UNDER THE CIRCULAR LAYER WHICH IS OBLIQUE

How does this modification relate to the stomach's function? IT ALLOWS THE STOMACH TO CONTINUE TO CHURN, MIX, & PUMMEL THE FOOD PHYSICALLY BREAKING IT DOWN.

4. Using the key letters, match the items in column B with the descriptive statements in column A. (Some responses may be used more than once.)

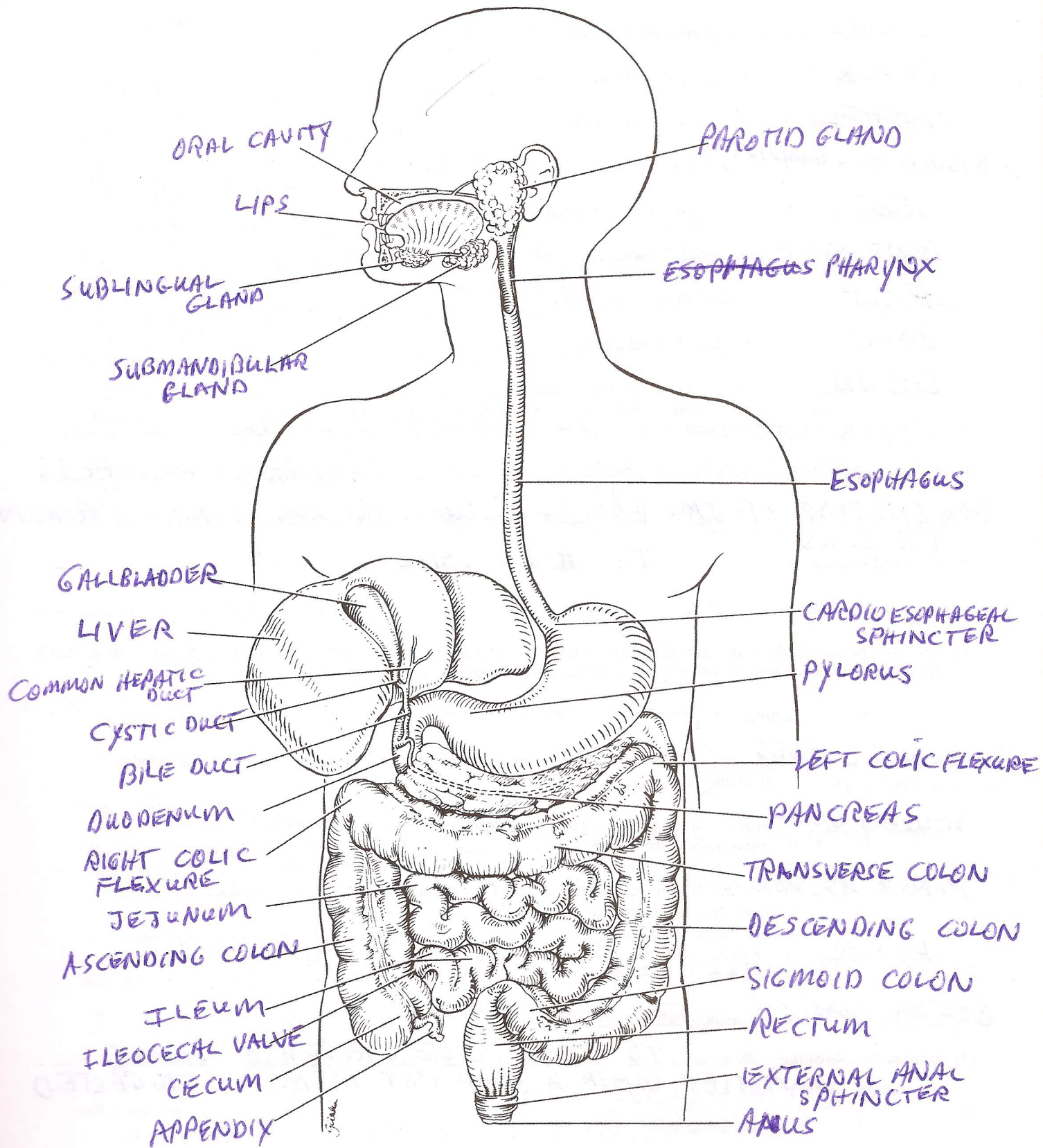
Column A

- K 1. structure that suspends the small intestine from the posterior body wall
- L, Q, Y 2. three modifications of the small intestine that increase the surface area for absorption
- O 3. large collections of lymphoid tissue found in the submucosa of the small intestine
- Q 4. deep folds of the mucosa and submucosa that extend completely or partially around the circumference of the small intestine
- M, V 5. regions that break down foodstuffs mechanically
- W 6. mobile organ that initiates swallowing
- P 7. conduit that serves the respiratory and digestive systems
- C 8. lies posterior to the trachea; conveys food from the pharynx to the stomach
- L 9. surface projections of a mucosal epithelial cell
- H 10. valve at the junction of the small and large intestines
- T 11. primary region of enzymatic digestion
- D 12. membrane securing the tongue to the floor of the mouth
- X 13. area between the teeth and lips/cheeks
- B 14. wormlike sac that outpockets from the cecum
- M 15. carbohydrate (starch) digestion begins here
- E 16. two-layered serous membrane attached to the greater curvature of the stomach
- I 17. organ distal to the small intestine
- R 18. valve preventing movement of chyme from the duodenum into the stomach
- U 19. posterosuperior boundary of the oral cavity
- T 20. location of the hepatopancreatic sphincter through which pancreatic secretions and bile pass
- Z 21. outermost layer of a digestive organ in the abdominal cavity
- I 22. principal site for the synthesis of vitamins (B, K) by bacteria
- A 23. distal end of the alimentary canal
- F 24. bone-supported part of roof of the mouth

Column B

- a. anus
- b. appendix
- c. esophagus
- d. frenulum
- e. greater omentum
- f. hard palate
- g. haustra
- h. ileocecal valve
- i. large intestine
- j. lesser omentum
- k. mesentery
- l. microvilli
- m. oral cavity
- n. parietal peritoneum
- o. Peyer's patches
- p. pharynx
- q. plicae circulares
- r. pyloric valve
- s. rugae
- t. small intestine
- u. soft palate
- v. stomach
- w. tongue
- x. vestibule
- y. villi
- z. visceral peritoneum

5. Correctly identify all structures depicted in the diagram below.



Accessory Digestive Organs

6. Use the key terms to identify each tooth area described below. (Some terms may be used more than once.)

- CROWN 1. visible portion of the tooth
- CEMENT 2. material covering the tooth root
- ENAMEL 3. hardest substance in the body
- PERIODONTAL LIGAMENT 4. attaches the tooth to bone and surrounding alveolar structures
- ROOT 5. portion of the tooth embedded in bone
- DENTIN 6. forms the major portion of tooth structure; similar to bone
- PULP 7. area of tooth below the dentin
- PULP 8. site of blood vessels, nerves, and lymphatics
- CROWN 9. portion of the tooth covered with enamel

- Key:
- cement
 - crown
 - dentin
 - enamel
 - gingiva
 - periodontal ligament
 - pulp
 - root

7. In humans, the number of deciduous teeth is 20; the number of permanent teeth is 32.

8. The dental formula for permanent teeth is $\frac{2,1,2,3}{2,1,2,3}$. Explain what this means: EACH SET OF NUMBER IS

FOR ONE SIDE OF JAW, ABOVE + BELOW, 2 INCISORS, 1 CANINE, 2 PREMOLARS, 3 MOLARS

9. What teeth are the "wisdom teeth"? THE #3 MOLARS

10. Various types of glands form a part of the alimentary tube wall or release their secretions into it by means of ducts. Match the glands listed in column B with the function/locations described in column A.

Column A

- DUODENAL GLANDS 1. produce(s) mucus; found in the submucosa of the small intestine
- SALIVARY GLANDS 2. produce(s) a product containing amylase that begins starch breakdown in the mouth
- PANCREAS 3. produce(s) a whole spectrum of enzymes and an alkaline fluid that is secreted into the duodenum
- LIVER 4. produce(s) bile that it secretes into the duodenum via the bile duct
- GASTRIC GLANDS 5. produce(s) HCl and pepsinogen

Column B

- duodenal glands
- gastric glands
- liver
- pancreas
- salivary glands

11. What is the role of the gallbladder? TO STORE BILE + RELEASE LARGE QUANTITIES WHEN A HIGH FAT MEAL IS INGESTED

Digestion of Foodstuffs: Enzymatic Action

12. Match the following definitions with the proper choices from the key.

- CATALYST 1. increases the rate of a chemical reaction without becoming part of the product
- CONTROL 2. provides a standard of comparison for test results
- ENZYME 3. biological catalyst: protein in nature
- SUBSTRATE 4. substance on which a catalyst works

Key:
 catalyst
 control
 enzyme
 substrate

13. The enzymes of the digestive system are classified as hydrolases. What does this mean?

THIS MEAN THAT WATER IS INVOLVED IN THE BREAKAGE OF BONDS BY THE DIGESTIVE ENZYMES

14. Fill in the following chart about the various digestive system enzymes described in this exercise.

Enzyme	Organ producing it	Site of action	Substrate(s)	Optimal pH
Salivary amylase	<u>SALIVARY GLANDS</u>	<u>MOUTH</u>	<u>CARBOHYDRATES</u>	<u>ALKALINE</u>
Trypsin	<u>PANCREAS</u>	<u>DUODENUM</u>	<u>PROTEIN</u>	<u>pH 8.0</u>
Lipase (pancreatic)	<u>PANCREAS</u>	<u>DUODENUM</u>	<u>LIPIDS</u>	<u>pH 8.0</u>

15. Name the end products of digestion for the following types of foods:

proteins: AMINO ACIDS carbohydrates: GLUCOSE
 fats: GLYCEROL + 3 FATTY ACIDS and _____

16. In the exercise concerning trypsin function, how could you tell protein hydrolysis occurred? _____

Why was tube 1T necessary? AS A CONTROL FOR BACKGROUND COLOR

Why was tube 2T necessary? AS A CONTROL FOR SPONTANEOUS BREAKDOWN OF BAPNA WITHOUT ENZYME

Why was 37°C the optimal incubation temperature? IT'S THE SAME AS BODY TEMP. WHICH IS WHERE THE TRYPSIN USUAL WORKS

Why did very little, if any, digestion occur in test tube 3T? BOILING DENATURED THE TRYPSIN ENZYME & UNFOLDED IT & IT LOST FUNCTION WHEN IT LOST STRUCTURE

Why did very little, if any, digestion occur in test tube 5T? OPTIMAL TEMP. FOR TRYPSIN IS 37°C SO AT 0°C THE ENZYME WORKS ONLY VERY SLOWLY IF AT ALL

Trypsin is a protein-digesting enzyme similar to pepsin, the protein-digesting enzyme in the stomach. Would trypsin work well in the stomach? NO Why? THE LOW pH OF THE STOMACH WOULD DENATURE THE TRYPSIN, PREVENTING IT FROM WORKING.

17. In the procedure concerning the action of bile salts, how did the appearance of tubes 1 and 2 differ? TUBE 1 THE VEGETABLE OIL FLOATED TO TOP OF WATER AFTER SHAKING STOPS
TUBE 2 OIL REMAINED SUSPENDED IN WATER (EMULSIFIED) AFTER SHAKING STOPS.
 Explain the difference. BILE SALTS IN TUBE 2 ALLOWED FAT TO PARTIALLY GO INTO SOLUTION IN THE WATER

18. Pancreatic and intestinal enzymes operate optimally at a pH that is slightly alkaline, yet the chyme entering the duodenum from the stomach is very acid. How is the proper pH for the functioning of the pancreatic-intestinal enzymes ensured?
THE PANCREAS ALSO SECRETES A LARGE AMOUNT OF SODIUM BICARBONATE WHICH NEUTRALIZES ALL STOMACH ACID WHEN CHYME ENTERS THE DUODENUM

19. Assume you have been chewing a piece of bread for 5 or 6 minutes. How would you expect its taste to change during this interval? IT WILL BECOME SWEETER
 Why? SALIVARY AMYLASE WILL RELEASE GLUCOSE MOLECULES FROM STARCH OF BREAD INCREASING SWEETNESS

20. In the space below, draw the pathway of a peanut butter sandwich (peanut butter = protein and fat; bread = starch) from the mouth to the site of absorption of its breakdown products, noting where digestion occurs and what specific enzymes are involved.

MOUTH (SOME BREAKDOWN OF STARCH TO GLUCOSE) → ESOPHAGUS → STOMACH (PEPSIN: SOME BREAKDOWN OF PROTEIN TO AMINO ACIDS; LINGUAL LIPASE: SOME BREAKDOWN OF FATS)
→ DUODENUM (TRYPSIN, LIPASE + PANCREATIC AMYLASE) (BREAKDOWN OF ALL STARCH, PROTEIN, & FAT FROM ENZYMES FROM PANCREAS + BILE FROM LIVER)
→ ILEUM (ABSORPTION OF GLUCOSE, AMINO ACIDS + GLYCEROL + FATTY ACIDS)

Physical Processes: Mechanisms of Food Propulsion and Mixing

21. Match the items in the key to the descriptive statements that follow.

- | | | |
|------------------------------|--|-----------------------|
| <u>UVULA</u> | 1. blocks off nasal passages during swallowing | Key: |
| <u>BUCCAL</u> | 2. voluntary phase of swallowing | buccal |
| <u>PERISTALSIS</u> | 3. propulsive waves of smooth muscle contraction | cardioesophageal |
| <u>CARDIOESOPHAGEAL</u> | 4. sphincter that opens when food or fluids exert pressure on it | peristalsis |
| <u>SEGMENTAL</u> | 5. movement that mainly serves to mix foodstuffs | pharyngeal-esophageal |
| <u>TONGUE</u> | 6. forces food into the pharynx | segmental |
| <u>PHARYNGEAL-ESOPHAGEAL</u> | 7. involuntary phase of swallowing | tongue |
| | | uvula |