

11 Digestion

I. Chapter Outline

- A. The Digestive System
 1. Mouth: Food Receiver
 2. Pharynx: A Crossroad
 3. Esophagus: Food Conductor
 4. Stomach: Food Storer and Grinder
 5. Small Intestine: Food Processor
 6. Large Intestine: Water and Salt Processor
 7. Two Accessory Organs
- B. Digestive Enzymes
 1. Best Conditions for Digestion
- C. Nutrition
 1. Proteins: Supply Building Blocks
 2. Carbohydrates: Eat More Complex
 3. Lipids: Risky Excess
 4. Vitamins and Minerals: Need Them All
- D. Dieting
 1. Three Eating Disorders

II. Chapter Review

- | Page | Questions |
|------|---|
| 172 | 1. Define digestion as used in this text. Why is this process important? |
| | 2. List the 4 functions of the digestive system. |
| | 3. How many teeth do adults have? List the 4 types of teeth and give their functions. |
| 173 | 4. What measures can be used to help prevent dental caries? |
| 174 | 5. List the 3 pairs of salivary glands. How do they contribute to the formation of a bolus? |
| | 6. What prevents food from entering the nasal chamber and the trachea during swallowing of food? |
| | 7. The opening to the larynx is called the _____, which is covered when the trachea moves up by the _____. |
| 175 | 8. List the 4 layers of the esophageal wall. What causes the food to be pushed along in the esophagus? |
| 176 | 9. What is responsible for heartburn and how is it normally prevented from occurring? |
| | 10. List the functions of the stomach. What is chyme? |
| | 11. What is the function of the gastric glands in the stomach? |
| | 12. What is an ulcer and why does it form? |
| 177 | 13. List 4 functions of the small intestine. What molecule from the pancreas neutralizes the acidity of chyme? |
| | 14. Describe the structure of villi and microvilli in the small intestine. |
| | 15. How are the small nutrient molecules absorbed across the wall of each villus? What do they enter? |
| 178 | 16. What is the function of the large intestine? How does its size compare with the small intestine? |
| | 17. Which organ of the large intestine may play a role in immunity and if inflamed leads to appendicitis? |
| | 18. Over 99% of the colon bacteria are _____, bacteria that die in the presence of oxygen. |
| | 19. Describe the effects of bacteria in the large intestine. What does a high coliform count in swimming water mean? |
| 179 | 20. Why will food poisoning and nerve stimulation cause diarrhea? Why is this dangerous to our health? |
| | 21. How does milk of magnesia and mineral oil work to overcome constipation? |
| 180 | 22. What is the exocrine function of the pancreas? How does its products get to the duodenum? |
| | 23. Name the 2 hormones secreted from the duodenal wall that signal the pancreas and the gallbladder to release their products. |
| | 24. What are the components of bile? Give their function. What organ produces bile? Where is it stored? |
| | 25. Explain why the liver is said to act as the gatekeeper to the blood. |
| 181 | 26. Define deamination. What happens to those amino groups in the liver? How is urea excreted? |
| | 27. List 6 functions of the liver. |
| | 28. Distinguish between hemolytic jaundice and obstructive jaundice. What is viral hepatitis due to? |
| 182 | 29. Name the enzyme found in the stomach. What is it formed from? What does it act upon? What products will it form? |

- 183 30. Name the pancreatic enzyme that in the duodenum will:
- digest starch: _____ . It forms the product _____
 - digest protein: _____ . It forms the product _____
 - digest fat droplets: _____ . It forms the end products _____ that will rejoin within the villi cells to form fat that enters the _____
31. Name the 2 enzymes produced by the epithelial cells to complete the digestion of peptides and maltose. What end products are formed from these reactions?
32. What is lactose intolerance due to? What are the consequences of drinking milk in these individuals?
- 184 33. Define a nutrient. How is a balanced diet achieved?
34. Define an essential amino acid. Distinguish between a complete and incomplete protein source.
- 185 35. Why do some dietitians refer to simple carbohydrates as "empty calories"?
- 186 36. What is the advantage of using insoluble and soluble fiber in our diets?
37. Which substance will provide most of our dietary calories? Which substance provides the most Kcalories/gram? Name the essential fatty acid that the liver cannot produce.
- 187 38. List 4 ways to reduce dietary fat.
- 188 39. Distinguish between the functions of low-density lipoproteins and high-density lipoproteins.
40. What are vitamins? Give their function.
41. List several macrominerals. What function do they serve in the body?
- 190 42. What is the most effective defense against osteoporosis in older women?
- 192 43. What is the best way to lose weight according to nutritionists? Describe the set-point hypothesis regarding body weight control.
- 193 44. Distinguish between obesity, bulimia, and anorexia nervosa.

III. Objective Chapter Test

Completion and Short Answer Questions

- The stomach is directly connected to the _____ above and the _____ below.
- The major food digested in the stomach is _____, which is hydrolyzed by the enzyme _____.
- Among its chemical aspects, every digestive enzyme has a preferred _____.
- Before fats are digested by the enzyme _____, they are first emulsified by _____.
- Pancreatic juices enter the small intestine by way of the _____ duct and contain _____ for the digestion of every type of food.
- The liver first receives the products of digestion by means of the _____ vein; any excess glucose is stored as _____.
- The secretion of digestive juices is controlled in general by _____ and _____.
- Surface area in the small intestine is increased greatly by the presence of _____ and _____.
- Every diet should include the _____ amino acids, the _____ fatty acids, and _____.
- The four different types of teeth found in the jaw are: _____, _____, _____, and _____.
- Complete the following table.

| Hormone | Where Produced | Cause of Release | Affects What Organ | Affected Organ Releases |
|-------------|----------------|------------------|--------------------|-------------------------|
| a. gastrin | | | | |
| b. secretin | | | | |
| c. CCK | | | | |

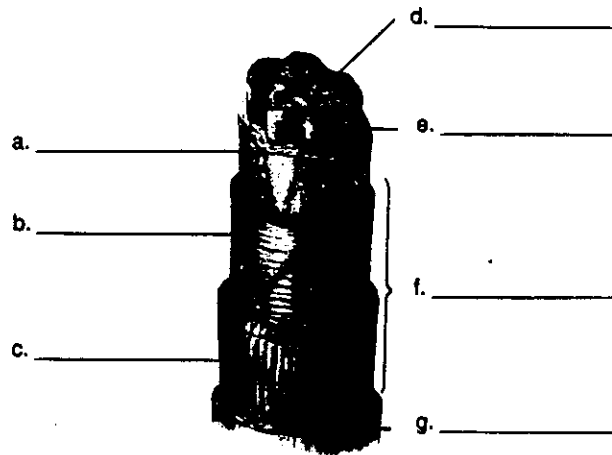
12. Liver. List 6 functions of the liver.

- a. _____
- b. _____
- c. _____
- d. _____
- e. _____
- f. _____

13. Vitamins are often portions of _____, necessary for cellular metabolism.

14. _____ is defined as a body weight of more than 20% above the ideal weight.

15. Label the parts of the esophageal wall below with the following terms: *serosa, muscularis, mucosa, submucosa, lumen, circular muscle, longitudinal muscle.*



16. Answer the following questions about the digestive tract.

- a. In which part of the digestive tract are nutrient molecules absorbed? _____
- b. The absorbed nutrient molecules enter what vein associated with the intestine? _____
- c. In which part of the digestive tract does pancreatic juice enter? _____
- d. In which part of the digestive tract does bile enter? _____
- e. What parts of the digestive tract do not actually contain food and might be called accessory organs of digestion?

- f. What parts of the digestive tract do not have ducts entering them and do not secrete digestive juices?

17. Digestion of carbohydrate (starch).

Starch digestion begins in the (a) _____ . Here the ducts empty from the (b) _____ glands. The salivary juice contains the enzyme (c) _____ , and this enzyme breaks down starch to the disaccharide (d) _____ . Starch is also acted on in the (e) _____ . Here a duct empties from the (f) _____ . Pancreatic juice contains the enzyme (g) _____ , which breaks down starch to the disaccharide (h) _____ . Starch digestion is complete when this disaccharide is broken down to (i) _____ , a monosaccharide, which can be absorbed by intestinal villi. The enzyme that converts maltose to glucose is called (j) _____ , and this enzyme is secreted by (k) _____ cells of the intestinal villus.

18. Digestion of protein (meat).

Protein digestion begins in the (a) _____ . The (b) _____ glands line the wall of the stomach. They secrete the enzyme (c) _____ , which breaks down protein to (d) _____ . Another enzyme called (e) _____ is secreted by the (f) _____ , and this enzyme acts on protein in the (g) _____ , also breaking down protein to (h) _____ . Protein digestion is complete when peptides are broken down to (i) _____ , molecules small enough to be absorbed by the villi. This is achieved by the enzyme (j) _____ that is produced by the epithelial cells of the intestinal villus.

19. Digestion of fat (butter).

Fat is first emulsified by (a) _____ , a substance made by the liver and stored in the (b) _____ . The contents of the latter enter the small intestine by way of the (c) _____ duct. After the fat has been emulsified, it is broken down by the enzyme (d) _____ , also found in pancreatic juice, which enters the small intestine by way of the pancreatic duct. Fats are broken down to (e) _____ and fatty acids, molecules small enough to be absorbed by intestinal villi. After resynthesis, fats enter the (f) _____ , which are a part of the lymphatic system.

20. Path of food.

- a. Food consists of the large organic molecules (1) _____ , (2) _____ , and (3) _____ . In the mouth, the only type of food digested is (4) _____ . The mouth has a (5) _____ pH. The food passes down the long tube called the (6) _____ . A rhythmic contraction called (7) _____ pushes the food along.
- b. After passing through a sphincter (circular muscle), the food enters the (1) _____ . Here the primary food acted on is (2) _____ . This organ has a(n) (3) _____ pH. The food, now called the *chyme*, passes through another sphincter into the (4) _____ .

- c. Two ducts enter this organ; they are the (1) _____ duct from the (2) _____ and the (3) _____ duct from the (4) _____. Bile contains an (5) _____, which divides fat up into fat droplets. Pancreatic juice contains enzymes that act on (6) _____, (7) _____, and (8) _____. Lining the walls of the intestine are (9) _____ with (10) _____ on the apical surface of each cell. The epithelial cells produce enzymes that finish digestion by converting (11) _____ to glucose and (12) _____ to amino acids. Thus the small nutrient molecules that are absorbed by the villi are (13) _____, (14) _____, (15) _____, and (16) _____. Fat products enter the (17) _____ and the other molecules enter the (18) _____ portal vein.
- d. This vein takes the nutrients to the (1) _____, an organ of homeostasis. For example, this organ stores glucose as (2) _____ and always keeps the blood glucose level constant. This organ can also remove amino groups from (3) _____ and convert the amino groups to (4) _____, a nitrogenous waste product.

21. What happens to a person who takes in more calories (energy) than needed? _____
22. What type of food (carbohydrate, fat, or protein) usually supplies the greatest number of calories in the diet? _____
 Why is sugar termed *empty calories*? _____
23. Define essential amino acids and essential fatty acids. _____
24. Why is a vegetarian diet often inadequate? _____
25. A _____ is a chemical secreted in one part of the body that controls the activities of other parts.
26. _____ can develop in individuals if they lack the enzyme lactase and drink milk containing lactose.

Digestive Enzyme Activity. For each combination of substances below, decide whether digestion will or will not occur at the maximum rate. Give an explanation if digestion will *not* occur maximally.

27. trypsin, NaHCO_3 , egg white, warm gently

28. salivary amylase, water, egg white, warm gently

29. pepsin, HCl, egg white, freeze

30. pancreatic amylase, HCl, starch, heat to boiling

31. lipase, NaHCO_3 , fats, warm gently

32. maltase, HCl, maltose, warm gently

33. peptidases, fat, HCl, warm gently

34. pepsin, HCl, egg white, warm gently

35. trypsin, starch, water, warm gently

36. HCl, egg white, water, warm gently

Medical Conditions. For each of the statements given below, match the condition to the following: a. ulcer b. periodontitis c. gallstones d. jaundice e. hepatitis B f. cirrhosis g. obesity

- ___ 37. weight more than 20% of the ideal weight
- ___ 38. yellowish cast to skin that indicates liver dysfunction
- ___ 39. open sore in stomach or intestinal wall caused by oversecretion of gastric juice
- ___ 40. viral infection of the liver transmitted by blood transfusions, unsterile needles, semen, urine
- ___ 41. crystals that can block the bile duct
- ___ 42. infected and bleeding gums
- ___ 43. fatty liver often caused by excessive alcohol consumption

Multiple Choice Questions

44. As a result of the digestive process, _____ are absorbed into the body.
- proteins
 - fats
 - starches
 - proteins and fats
 - proteins, fats, and starches
45. The two enzymes involved in the digestion of proteins are
- salivary amylase and lipase.
 - trypsin and hydrochloric acid.
 - pancreatic amylase and bile.
 - pepsin and trypsin.
46. Bile
- is an important enzyme for the digestion of fats.
 - is made by the gallbladder.
 - contains products from hemoglobin breakdown.
 - emulsifies fat.
 - Answers *c* and *d* are both correct.

47. HCl

- a. is an enzyme.
- b. creates the acid condition necessary for pepsin to work.
- c. is found throughout the intestinal tract.
- d. digests fats.

48. Pancreatic juice is directly regulated by

- a. the presence of food in the intestine.
- b. the sight of food.
- c. the thought of food.
- d. the smell of food.
- e. secretin.

49. The large intestine

- a. digests all types of food.
- b. is the longest part of the intestinal tract.
- c. absorbs water.
- d. is connected to the stomach.

50. Which of the following organs does not produce digestive enzymes?

- a. salivary glands
- b. stomach
- c. pancreas
- d. small intestine
- e. large intestine

IV. Subjective Chapter Test

51. What is meant by saying that the liver is the "gatekeeper" to the blood?

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