Digestive Lab Guide

I. Prelab Questions

1. Name the three vertical parts of a tooth and the three substances that form the layers of a tooth.

2. The front teeth are called ______________________________.

3. Name the tube that carries food to the stomach.

4. Name the four parts of the stomach

5. Name the vessels that supply blood to the liver and the vessels that collect blood from the liver.

6. Name the three parts of the small intestine from beginning to end.

7. What digestive structure has a head, neck, body, and tail?

8. Describe the biliary system.

9. Name the four sections of the colon.

10. Describe the cecum, vermiform appendix, and rectum.
II. Lab Exercises

The objective of this lab is to learn digestive anatomy from:

A. A short introduction to gross and microscopic anatomy.
B. Illustrations from your textbook and the *Anatomy and Physiology Coloring Book*, if you wish to purchase it.
C. The following models:
   1. Digestive organs model – all of the digestive organs displayed on a plaque.
   2. Somso torso – show organs but not as well as the digestive organs model.
   3. Head section model – same ones you used for respiratory system.
   4. Plastic plaque showing tooth anatomy and types of teeth.
   5. Large tooth model on stand – excellent for tooth anatomy.
   6. Half jaw model with teeth – old but good for types of teeth.
   7. Stomach model on stand – excellent for stomach anatomy.
      anatomy and has associated blood vessels.
   9. Intestinal wall model - use it for intestinal histology.
D. A.D.A.M. Interactive Anatomy software
E. Use of microscope slides to learn selected digestive histology.

1. Overview of Digestive Anatomy: Use figure 24.1 in your text, the Somso torso, and figure 1 below.

![Figure 1. Overview of the Digestive Tract](image-url)
2. **Gross Digestive Anatomy**
   ☀ **Oral cavity** or mouth
   ● Use figure 24.5 in your text and the head section model and the digestive organs model to find the following structures:
     a. The **tongue (1)** and its muscles form the floor of the oral cavity. The upper surface of the tongue is covered by various projections called **papillae (2)**.
     b. Extending from the tongue to the floor of the oral cavity is a mucous membrane called the **lingual frenulum (3)**. If it is too short, the tongue loses mobility, speech is thus affected, and the person is said to be tongue-tied.
     c. The **oral vestibule (4)** is a space between the lips, cheeks and gums.
     d. The proper name for gums is **gingivae (5)**.
     e. A pair of **palatine tonsils (6)** is located on either side of the boundary between the oral cavity and the oropharynx.
     f. A pair of **lingual tonsils (7)** is located at the base of the tongue.
   ☀ **Salivary glands**
   ● Use figure 24.6 in your text and a Somso torso to identify the following:
     a. The **parotid glands (8)** are the largest salivary glands. They are located in front of the ear lobes, between the skin and the masseter muscles.
     b. The **submandibular glands (9)** lie inside the body of the mandible just anterior to the mandibular angle.
     c. As their name implies, the **sublingual glands (10)** lie beneath the tongue.

![Figure 2. Parotid Salivary Gland](image-url)
Teeth

Use figure 24.7 in your text, the tooth model on a stand and the plastic

tooth plaque to identify the following tooth structures:

a. The crown (11) is the part of the tooth that extends above the gum-
line

b. The root (12) is the part that is anchored to the tooth socket

c. The neck (13) is the constricted part of the tooth between the
crown and the root.

d. Both the crown and neck are covered by enamel (14). It is the
hardest substance in the body.

e. A hard, slightly yellow material called cementum (15) covers the
tooth root. If a person’s gums have receded, this yellowish
cementum can be seen.

f. Deep to the enamel and the cementum is a hard material called
dentin (16). Extending through it from the pulp to the enamel are
numerous dentinal tubules, and cytoplasmic extensions of pulp
cells pass through these tubules.

g. The interior of the tooth is composed of a soft material called pulp
(17).

h. The tooth root is anchored to the tooth socket (alveolar bone) by
the periodontal (peridental) ligament (18).

i. Remember, the gums are properly called gingivae (5). What is
gum inflammation called?
• Use the jaw model, plastic tooth plaque and figure 24.8 in your text to identify the different teeth. To make it less confusing, only identify the teeth in one-half of the upper and lower jaws.
  a. The **incisors (19)** are the spade-like teeth used for biting-off pieces of food. There are two upper and two lower incisors.
  b. There is one **canine (cuspid) (20)** in the upper and lower jaw. They are cylindrical with a sharp point and are used for tearing-off pieces of food.
  c. Posterior to the canines are two upper and two lower **premolars (bicuspids) (21)**. As the name bicuspid indicates, each has two points or cusps.
  d. There are three upper and lower **molars (22)**; they are our largest teeth. Both the premolars and molars are our chewing teeth.

Figure 4. Sectioned Molar
Figure 5. Teeth Model

**Teeth Model Key**
- Crown – 17
- Root – 18
- Enamel – 19
- Dentin – 20
- Pulp (pulp cavity) – 21
- Root canal – 22
- Cementum – 23
- Gingiva – 25
- Periodontal ligament - 26
- Incisors – 1&2
- Canine (cuspid) – 3
- Premolars (bicuspids) – 4&5
- Molars – 6,7&8
The esophagus (23) is the muscular tube that carries food by peristalsis to the stomach. It extends from the laryngopharynx down through the thoracic cavity and through the diaphragm where it connects to the stomach. You may remember that it is behind the trachea and this is why the tracheal cartilages are C-shaped, so that we may swallow. Like the lips, tongue, mouth and parts of the pharynx, it is lined with nonkeratinized stratified squamous epithelium. This epithelium is replaced by simple columnar epithelium in the stomach. Use figure 24.9 in your text, a Somso torso and the digestive organs model.

The stomach (24) is a J-shaped enlargement of the GI tract just inferior to the diaphragm.

- Use figure 24.11 in your text and the models to identify the following stomach anatomy:
  a. The first and smallest part of the stomach, called the cardia (25), surrounds the opening where food enters the stomach from the esophagus.
  b. To the left and above the cardia is a dome-shaped part of the stomach called the fundus (26).
  c. The body (27) is the central part of the stomach below the fundus.
  d. The pylorus (28) is the last part of the stomach where it begins to curve upward like the letter “J”.
  e. The pyloric sphincter (29) is a valve, at the end of the pylorus that controls the movement of digesting food from the pylorus into the small intestine.
  f. The mucosa of an empty or partially empty stomach has numerous folds called rugae (30). Open the stomach model to see the rugae.
  g. The right (medial) side of the stomach has a shorter bend called the lesser curvature (31). A membrane called the lesser omentum (32) extends from the liver to the lesser curvature. The stomach is suspended below the liver by this membrane. The left (lateral) side of the stomach has the longer greater curvature (33). A strange, double-layered fatty apron called the greater omentum (34) hangs down from the greater curvature over the small intestine. Neither the lesser omentum nor the greater omentum are on any of the models; use the ADAM Interactive software to observe these. Ask your instructor for instructions.
  h. Unlike any other part of the GI tract, the muscularis externa of the stomach is composed of three layers. It has the usual longitudinal and circular layers plus an innermost oblique layer that runs at an angle to these layers. The stomach model shows these layers.
Figure 6. Digestive Organs Model
Figure 7. Stomach

Figure 8. Stomach, sectioned
The small intestine (35) is the longest part of the tract. Its relaxed length is about twenty-one feet. Most digestion and absorption of food occurs in the small intestine. It looks like a picture of a can of worms framed by the large intestine. Use figures 24.17 and 24.18 in your text, a Somso torso and the digestive organs model to identify the following sections of the small intestine:

- The first part is the duodenum (36). This ten inch long section begins at the stomach and curves to the left like the letter “U”. The pancreas (37) fits into its inner curvature like a ball in a catcher’s glove.
- After curving upward, the duodenum flexes forward and downward forming the second (middle) part called the jejunum (38). Its relaxed length is about eight feet.
- The last and longest part of the small intestine is the ileum (39); its relaxed length is about twelve feet. In the lower right quadrant, the ileum connects to the cecum of the large intestine. Inside this connection is the ileocecal valve (40); it prevents backflow of digested food.
- A double layer of visceral peritoneum called the mesentery proper (41) supports all of the loops of the small intestine, except the duodenum. The duodenum lies behind the parietal peritoneum; this position is referred to as retroperitoneal. The ascending and descending colon and the kidneys are also retroperitoneal.

Blood vessels, lymphatic vessels and nerves pass to and from the intestine between the layers of the mesentery.

Use figures 24.14 in your text; a Somso torso; the pancreas/duodenum model and the digestive organs model to identify the following structures associated with the duodenum.

- The four parts of the pancreas (37) are the head (42), neck (43), body (44) and tail (45). The head fits into the inner curvature of the duodenum; the neck is a constricted part between the head and body; and the tail is the pointed part that extends over to the spleen.
- The main pancreatic ducts (duct of Wirsung) (46) is a tube that passes through the pancreas from tail to head. In the head, it turns downward and joins the common bile duct before entering the duodenum. The pancreatic secretions and bile pass together into the duodenum.
- An accessory pancreatic (duct of Santorini) (47) may branch off of the main pancreatic duct in the pancreatic head. It enters the duodenum about an inch above the main ducts.
- The common bile duct (48) transports bile from the gall bladder and liver into the duodenum.
- The hepatopancreatic sphincter (sphincter of oddi) (49) is a ring of smooth muscle that controls the flow of bile and pancreatic secretions into the duodenum. It is derived from the muscularis externa of the duodenum.
Figure 10. Torso, liver removed
Figure 11. Torso, small intestine removed
Use figure 24.18 in your text and the intestinal wall model to identify the following:

- As mentioned in the “Histological Organization of the Tract” section, the serosa (50) is a serous membrane (part of the visceral peritoneum) that covers the outside of the abdominal organs; it is on the bottom of the model.
- The muscularis externa (51) consists of both an outer longitudinal and an inner circular layers of smooth muscle.
- The submucosa (52) is the prominent layer with gray connective tissue, large blood and lymphatic vessels, glands and nerves. It is a supportive layer, similar to the part of a house where the floor joists and plumbing are located.
- The mucosa (53) is the inner layer. It consists of a layer of simple columnar epithelium (54) interspersed with goblet cells (55). Deep to the epithelium is a loose connective tissue that contains blood and lymphatic vessels, nerve endings, glands, and lymphatic nodules (part of MALT). Adjacent to the submucosa is the muscularis mucosae (56); it contains thin layers of smooth muscle and connective tissue and is reminiscent of the muscularis externa, except much thinner.

The finger-like mucosal folds seen in the model are intestinal villi (57). The singular term for one of these projections is villus (58). Villi are unique to the small intestine. Note the orange colored simple columnar epithelium (54) lining the surface of the villi. The blue, oval structures in the epithelium represent goblet cells (55). Internally, the villi contain a lymph capillary called a lacteal (59).
(colored green) and **blood capillaries (60)** (colored red and blue). Muscle fibers from the muscularis mucosae and nerve endings extend up into the villus. The epithelium folds down between each villus to form crevices called **intestinal crypts (61)**.

Figure 13. Histology of Small Intestine
Liver (62): Use figure 24.14 in your text, a liver from one of the Somso torsos, a lab charts and the digestive organs model to identify the following parts of the liver:

- The large, thick right lobe (63)
- The gall bladder (64) is an elongated sac located under the right lobe; it stores and concentrates bile.
- The left lobe (65)
- The falciform ligament (66) is a supportive peritoneal membrane lying between the right and left lobes of the liver.
- The squared-off quadrate lobe (67) lies between the left lobe and the gall bladder.
- The smaller caudate lobe (68) is located between the inferior vena cava and the left lobe.
- Three prominent structures enter or exit the inferior surface of the liver where all four lobes meet. The small, red colored proper hepatic artery (69) and the larger, purple colored portal vein (70) carry blood into the liver while green colored ducts carry bile out of the liver.
  You probably recall that hepatic veins collect blood from the top of the liver.

Biliary System: Use figure 24.14 in your text; the liver model and the digestive organs model to identify the following:

- On the bottom of the liver, near the portal vein and proper hepatic artery, two hepatic ducts (71) unite to form the common hepatic duct.
- The cystic duct (72), from the gall bladder (64), unites with the common hepatic duct to form the common bile duct (73).
Figure 15. Liver, anterior

Figure 16. Liver, inferior
Large Intestine (74) is only about five feet long, but it is called “large” because it is wider than the small intestine. Its coliform bacteria turn the intestinal contents into digestive wastes called feces. These bacteria also form some vitamins. Some water and electrolytes are absorbed from the large intestine. Use figure 24.22 in your text, one of the Somso torsos and the digestive organs model to identify the following parts of the large intestine:

a. As described previously, the ileocecal valve (40) is located at the junction of the small and large intestine; it prevents backflow of digested food.

b. The cecum (75) is the pouch-like first part of the large intestine that connects to the ileum.

c. The finger-like vermiform appendix (appendix) (76) is a hollow tube that extends downward from the cecum.

d. The colon (77) forms most of the large intestine. It consists of four main parts:
   • The ascending colon (78) extends upward from the cecum to just beneath the liver.
   • The next part of the colon is the transverse colon (79). It passes under the stomach from the right to left side.
   • The descending colon (80) passes down the left side.
   • In the pelvis, the colon bends toward the middle of the body to form the S-shaped sigmoid colon (81).
   • Narrow bands of longitudinal muscle called the taenia coli (82) extend along each side of the colon and gather its wall into a series of pouches called haustra (83).
   • Distal to the sigmoid colon is a six-inch long, muscular part of the digestive tract called the rectum (84). When feces enter the rectum it expands producing the urge to defecate. The digestive organs model has an excellent longitudinal section of the rectum. Numbers 85&86 are not labeled on any of the photographs in this manual; ask your instructor to point them out.
   • As mentioned above, rings of muscle called anal sphincters surround the anorectal canal. An internal anal sphincter (87) is composed of smooth muscle, and it is involuntary. An external anal sphincter (88) is composed of skeletal muscle, and it is under voluntary control. They are clearly visible on the digestive organs model.
3. **Digestive histology – the tissues of the GI tract (optional)**

   ♦ **Jejunum cross-section** – Use figure 24.19 in your text and help from your lab instructor to identify the following:
   - muscularis externa
   - submucosa
   - mucosa with:
     - villi
     - simple columnar epithelium with goblet cells

   ♦ **Human liver: (optional)** Use figure 24.15 in your text to identify the following parts of the liver lobules:
   - six triads composed of branches of the hepatic artery, the hepatic portal vein and a bile duct
   - cords of hepatic cells (hepatocytes)
   - liver sinusoids
   - central vein

**A.D.A.M Interactive Anatomy Digestive System**

**Salivary Glands**

1. Click on open dissectible anatomy tab, if it is not already selected.
2. Select **lateral view**
3. Click on open
4. Click on resizing icon to enlarge window
5. Reposition the image over the head
6. Select layer #16 and identify the following:
   a) parotid gland
   b) parotid duct
7. Select layer #224 and identify the following
   a) submandibular gland (deep part or cut part)
   b) submandibular duct
   c) sublingual gland

**Teeth**

1. **Stay in lateral view**
2. Select layer #126 and identify the following upper jaw teeth
   a) central incisor
   b) lateral incisor
   c) canine (cuspid)
   d) first and second premolars
   e) first, second and third molars
Esophagus
1. Select anterior view
2. Reposition image over thorax
3. Select layer #259 and identify the esophagus

Stomach
1. Stay in anterior view
2. Reposition the image over the upper abdomen
3. Select layer #203
4. Select highlight mode
5. Identify the following parts of the stomach:
   a) cardiac part
   b) fundus
   c) body
   d) pyloric part
   e) greater curvature
   f) lesser curvature
6. Select layer #205
7. Stay in highlight mode
8. Identify the rugae of the stomach and the pyloric sphincter

Liver
1. Stay in anterior view
2. Stay in highlight mode
3. Select layer # 195 and identify the following:
   a) right lobe of liver
   b) left lobe of liver
   c) falciform ligament
   d) round ligament
   e) lesser omentum
   f) gallbladder
   g) greater omentum

Liver in Atlas Anatomy
1. Click on folder icon
2. Click on content
3. Click on Atlas Anatomy
4. Click on System radio button
5. Click on Digestive System
6. Select Liver inf
7. Identify the following:
   a) quadrate lobe
   b) caudate lobe
   c) round ligament
   d) fundus, body and neck of the gallbladder (just identify it as gallbladder)
   e) cystic duct
   f) right and left hepatic ducts (no common hepatic duct shown)
   g) bile duct
h) proper hepatic artery
i) portal vein
j) hepatic vein
k) inferior vena cava
l) lesser omentum

Colon
1. Click on folder icon
2. Click on content
3. Click on Dissectible Anatomy
4. Select anterior view
5. Click on open
6. Select highlight
7. Reposition the image over the abdomen
8. Select layer #209 and identify the following:
   a) cecum
   b) ascending colon
   c) right colic flexure
   d) transverse mesocolon
   e) left colic flexure
   f) descending colon
   g) sigmoid colon
   h) taenia coli
   i) vermiform appendix
   j) rectum
9. Select layer #207 and identify the transverse colon (not seen in layer #209)

Small Intestine
1. Stay in anterior view
2. Select highlight mode
3. Select layer #208 and identify the following:
   a) jejunum
   b) ileum
4. Select layer #214 and identify the following:
   a) Four parts of the duodenum (no need to know the four parts-just know duodenum)
   b) jejunum

Pancreas
1. Stay in anterior view
2. Stay in highlight mode
3. Stay on layer #214
4. Identify the head, neck, body and tail of the pancreas
5. Select layer #215 and identify the following:
   a) bile duct
   b) main pancreatic duct
   c) accessory pancreatic duct
Peritoneal membranes
1. Select medial view
2. Select highlight
3. Select layer #0 and identify the following:
   a) **peritoneum**
   b) **lesser omentum**
   c) **greater omentum**
   d) **transverse mesocolon**
   e) **mesentery**

Rectum and Anus
1. **Exit Dissectible Anatomy**
2. Click on folder icon
3. Click on content
4. Click on Atlas Anatomy tab
5. Click on System radio button
6. Click on Digestive System
7. Select Frontal Section of the Anal Canal, resize the image, if necessary, and identify the following:
   a) **sigmoid colon**
   b) **rectum**
   c) **anal column**
   d) **anal canal**
   e) **anus**
   f) **internal anal sphincter**
   g) **external anal sphincter**

**Digestive Focus Questions**

1. Name the innermost major layer of the GI tract. _________________________

2. Name the type of epithelium lining the GI tract from the stomach to the rectum. _________________________________________

3. Name the middle major layer of the GI tract; it consists of connective tissue, blood vessels, lymph vessels, nerves, and glands and elastic fibers. _________________________________________

4. Name the outer major layer. It has layers of longitudinal and circular smooth muscle _________________________________________

5. Name the part of pharynx posterior to the oral cavity. _________________________________________

6. Name the space between the lips/cheeks and gums. _________________________________________
7. What is the largest salivary gland? _______________________

8. What salivary glands lies inside the mandible?
   ____________________________________________

9. Name the material resembling bone that is deep to tooth enamel.
   ___________________________

10. Name the material that covers the outside of the tooth root.
    ____________________________.

11. Name the ligament that anchors the tooth to the tooth socket (alveolar bone).
    ________________________________________.

12. Name the paired teeth that are immediately posterior to the canines.
    ________________________________________

13. Name the teeth that are adapted for biting-off pieces of food.
    ________________________________________

14. Name the tube that connects the pharynx to the stomach.
    ________________________________________

15. Name the epithelium that lines tube in question 14.
    ________________________________________

16. Name the first part of the stomach where food enters from the esophagus.
    ____________________________

17. Name the dome-shaped part of the stomach that is to the left and superior to the stomach entrance.
    ____________________________

18. Name the main part of the stomach.
    ____________________________

19. Name the last part of the stomach.
    ____________________________

20. Name the valve between stomach and first part of small intestine.
    ________________________________________

21. Name the membrane that hangs down from the liver and attaches to the lesser curvature of stomach.
    ________________________________________

22. Name the double layered, fat-laden membrane attached to the greater curvature of stomach.
    ________________________________________

23. Name the extensive folds inside the stomach. They are much more extensive in an empty stomach.
    ____________________________
24. Name the first second and third parts of small intestine.
__________________________, __________________________ and
________________________
25. Name the small finger-like extensions of intestinal mucosa.
________________________
26. Name the lymph capillary in above extensions. ________________________
27. Name the peritoneal membrane that supports most of the small intestine.
_________________________
28. Name the structure that prevents back flow from the large intestine back into the
small intestine. _______________________
29. Name the pouch-like first part of the large intestine. __________________
30. Name the worm-like extension of above pouch. _______________________
31. Name the major portion of large intestine. ___________________
32. Name the four sections of the above part of the large intestine.
__________________________, _________________________,
_________________________ and _______________________
33. Name the pouch-like structures evident throughout the main part of the large
intestine. ______________________
34. Name the ribbon-like bands of longitudinal muscle seen on the surface of the
large intestine. __________________________
35. Name the membrane that supports the transverse and sigmoid colon.
_________________________
36. Name the expandable and muscular last part of the large intestine.
_________________________
37. Name the opening from item in question 36 to the exterior.
____________________
38. Name the four parts of the pancreas. ________________, ______________,
______________ and ___________________
39. Name the flask-like clusters of cells that secrete pancreatic juices.
_________________________
40. Name the lobes of the liver. __________________, __________________, __________________ and __________________

41. Name the membrane that supports the liver. ______________________________________

42. Name the two vessels that enter the inferior surface of the liver. ___________________________ artery and _________________________ vein

43. Name the duct leading directly out of the gall bladder. ______________________________

44. Name the main duct from liver formed by the union of the left and right hepatic ducts ______________________________________

45. Name the duct formed by union of duct from gall bladder and main duct from liver. ________________________________________________

46. Name the vessels that collect blood from the liver into the inferior vena cava. __________________________