This lab activity is aligned with Visible Body's Human Anatomy Atlas app.

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A. Digestive System Overview

Open the Atlas app. From the Views menu, go to Systems Views and scroll down to Digestive System Views. Select 6. Alimentary Canal. Make the following observations.

You are responsible for all bold terms and diagram labels.

1. Zoom out so that the entire model is visible. The **alimentary canal** is a continuous tube that begins at the **mouth** and ends at the **anal canal**. Rotate the model and zoom out as required to see the entire length of the tube.

2. Deselect the skeletal system (the skull icon) in the systems menu to hide the pelvis and spine. Rotate the alimentary canal to view it from all angles.

3. Use the image below to locate the main sections of the alimentary canal.

![Diagram of the alimentary canal](image)

- **Mouth**
- **Pharynx**
- **Esophagus**
- **Stomach**
- **Colon**
- **Small Intestine**
- **Rectum**
B. Upper Digestive System

Go to the Views menu and select 1. Upper Digestive System from the set of digestive system views.

1. By rotating the model and selecting the large muscles attached to the mandible, locate the left and right masseter and the left and right temporalis. Select each muscle and read the definition (book icon) to learn more.

2. What are the origins and insertions for the masseter and the temporalis?

**Origin Masseter:**
Superficial portion: the maxillary process of the zygomatic bone, and the inferior border of the zygomatic arch.
Deep portion: the zygomatic arch

**Insertion Masseter:**
The mandible.

**Origin Temporalis:**
The parietal bone and the superior surface of the sphenoid bone.

**Insertion Temporalis:**
The coronoid process (of the mandible).
Go to the Views menu and select Muscle Actions. View Mandible elevation, Mandible retraction, and Mandible protraction.

3. What are the actions of the masseter and the temporalis?

**Action Masseter:**
Elevation (and protrusion) of the mandible.

**Action Temporalis:**
Elevation and retraction of the mandible.

Go to the Views menu and select 3. Salivary Glands from the set of digestive system views.

4. Locate the large **parotid glands**. Select then hide the **mandible** and locate the **submandibular** and **sublingual glands** in the lower part of the head. How do these glands participate in digestion?

**Function Salivary Glands:**
Lubricates food in the mouth and contributes salivary amylase, which begins the chemical digestion of carbohydrates.
5. Locate the **teeth** and the **gingiva**. What roles do these structures play in digestion?

**Function Teeth and Gingiva:**  
Teeth masticate (chew) food and break it into pieces small enough to swallow. Gingiva protect the roots of teeth.

6. Deselect the skeletal system, then rotate the model so that you can see and select the **tongue**. How does the tongue participate in **mechanical digestion**?

**Function Tongue:**  
The tongue manipulates food in the mouth in order that the teeth can mechanically digest food into portions small enough to swallow. The tongue also can mechanically digest soft food and form the chewed food into a bolus, in preparation for swallowing.

7. Deselect the muscular system and hide the parotid glands by clicking on them and selecting “hide”. Locate the **oropharynx**, the **laryngopharynx**, and the **esophagus**.

8. After being chewed, the mixture of food and salivary juices that is swallowed is called a ____**bolus**____. Smooth muscles in the pharynx and the esophagus create waves of ____**peristalsis**____ that carry the food mixture to the stomach.

**TIME TO PRACTICE! GO TO THE DIGESTIVE SYSTEM QUIZZES AND TAKE QUIZ 6, UPPER TRACT.**
C. Lower Digestive System Overview

Go to the Views menu and select 2. Lower Digestive System from the set of digestive system views. Rotate the model to see how the digestive system fills most of the space in the abdominal cavity.

1. Deselect the skeletal system and locate the junction of the esophagus and the **stomach**. Locate the **cardiac sphincter**. When does the cardiac sphincter open?
   
   *When there is food in the esophagus that must pass into the stomach.*

2. Using an anterior view locate the **greater omentum**. What tissues make up the greater omentum and what is its function?

   *The greater omentum is a large piece of visceral peritoneum (mesentery) folded to form a double layer. It consists of serous membranes and may contain adipose tissue.*
3. Hide the greater omentum and locate the following parts of the alimentary canal:

   a. **Stomach**
   b. **Small intestine**
   c. **Large intestine (colon)**
   d. **Rectum**
   e. **Anus**
4. Rotate the model so that you can locate the following accessory organs: liver, pancreas, and gall bladder. Fade portions of the liver as necessary in order to see the entire gall bladder.

5. Use the Multi-Select tool to select all the anterior lobes of the liver and then hide them in order to have a good view of the stomach.
D. Stomach

Go to the Views menu and select 7. Stomach Vasculature from the digestive system set of views. Deselect the circulatory system.

1. In this view you can see the layers of the stomach. Starting with the outermost layer, find the following structures:
   a. Serosa
   b. Longitudinal muscle layer
   c. Circular muscle layer
   d. Oblique muscle layer
   e. Mucosa

2. The stomach is the only part of the alimentary canal with three muscular layers. Why does the stomach need three layers of muscle?
   So that it can churn food in all directions.

3. The mucosa secretes ____acid (HCl) and pepsin____ that chemically digests food. After food is mixed with these secretions it is called ____chyme____.

4. Locate the pyloric sphincter and the junction of the stomach and the small intestine. When does this sphincter open?
   When the food in the stomach is completely mixed with stomach secretions and is in a liquid form, ready to be passed into the small intestine.

5. The curved shape of the stomach presents a lesser curvature and a greater curvature. Locate these two surfaces on the stomach.

TIME TO PRACTICE! GO TO THE DIGESTIVE SYSTEM QUIZZES AND TAKE QUIZ 7, STOMACH.
E. Intestines

Go to the Views menu and select 2. Lower Digestive System from the digestive system set of views. Deselect the skeletal system and hide the greater omentum.

1. Rotate the model in order to locate the three sections of the small intestine: the duodenum, the jejenum, and the ileum.
2. Rotate the model to an anterior view and select then hide the transverse colon. You should be able to see the pyloric sphincter where the duodenum connects to the stomach. Select the section of the duodenum labeled Duodenum, sectioned (front) and hide it. You will now see the five layers of the duodenum (note they are not separately selectable). Starting with the outermost layer they are the:

a. **Serosa**

b. **Longitudinal muscle layer**

c. **Circular muscle layer**

d. **Submucosa**

e. **Mucosa**

3. Select the section of the duodenum labeled Duodenum, sectioned (back) and fade it. Locate the places where the **common bile duct** and the **pancreatic duct** enter the duodenum.
4. Which is the shortest section of the small intestine?
   **The duodenum**

5. Which is the longest section of the small intestine?
   **The ileum**

6. Find the junction of the ileum and the large intestine. Fade the ileum and locate the **ileocecal sphincter**. What is the function of this sphincter?
   **This sphincter controls the passage of material into the colon. It also prevents reflux into the small intestine.**
7. Select the ascending colon and use the Radius Blast button (small yellow and blue circle) to restore the transverse colon to view. Rotate the model to find the following structures:

   a. **Cecum**  
   b. **Appendix**  
   c. **Ascending colon**  
   d. **Transverse colon**  
   e. **Descending colon**  
   f. **Sigmoid colon**  
   g. **Rectum**  
   h. **Anal canal**

8. Bands of smooth muscle called **taenia coli** extend along the surface of the large intestine. What is the function of the taenia coli?  
   **These bands of muscle contract to form haustra (compartments, or pouches, of the colon).**

9. The transverse colon is aligned with the greater ____curvature____ of the stomach.

10. Select the rectum and then select the skeletal system. Note how the rectum and anal canal pass through the pelvis.

11. Select the anal canal and select the muscular system. Rotate the model to see the anal canal passing through the muscular floor of the pelvis. Locate the **external anal sphincter**.

   **In the digestive system set of views select 12. Colon (M) and view the model from the side.**

   12. Note how the sigmoid colon and the rectum follow the curvature of the spinal column around the bladder. Locate the **internal anal sphincter** at the junction of the rectum and the anal canal. Using the toggle in the ribbon at the top, switch to the female model. Note how the sigmoid colon and the rectum follow the outer curvature of the uterus and the vagina.

**TIME TO PRACTICE! GO TO THE DIGESTIVE SYSTEM QUIZZES AND TAKE QUIZZES 12, 13, AND 14 (INTESTINAL TRACT, SMALL INTESTINE, AND LARGE INTESTINE).**
F. Accessory Organs

In the digestive system set of views select 9. Accessory Organs.

1. Rotate the model so you can see the pancreas, the gall bladder, and the liver.

2. The liver has ____ lobes. The _______ lobe is the biggest.

3. The left lobe is separated from the rest of the liver by the ________________ ________________.

4. The left posterolateral segment of the liver has a(n) ____ fossa, indentation, or impression____ to accommodate the ____ gall bladder ____.

5. Find the five ligaments that anchor the liver to the diaphragm and the abdomen. These ligaments are the:
   - a. coronary ligament
   - b. left triangular ligament
   - c. falciform ligament
   - d. round ligament (ligamentum teres hepatis)
   - e. ligamentum venosum

6. Fade the lobes of the liver in order to see the right and left hepatic ducts. Locate the common hepatic duct and the common bile duct.

7. Bile can be transferred to the gall bladder for storage via the ____ cystic (or the common hepatic duct to the cystic) ____ duct. Bile can be released from the gall bladder into the small intestine when the sphincter of ____ Oddi (hepatopancreatic sphincter) ____ is open.

8. Fade the head and the body of the pancreas to see where the pancreatic duct joins the common bile duct. The common bile duct enters the small intestine at the main duodenal papilla.

9. Locate the head, body, and tail of the pancreas. Locate the main pancreatic duct and the accessory pancreatic duct (of Santorini). The accessory pancreatic duct enters the duodenum at the minor duodenal papilla.
10. Pancreatic digestive secretions include:
   a. **Bicarbonate** to buffer acidic gastric juices.
   b. **Water** to dilute acidic gastric juices.
   c. **Enzymes** to continue chemical digestion in the small intestine.

**TIME TO PRACTICE! GO TO THE DIGESTIVE SYSTEM QUIZZES AND TAKE QUIZ 1, 9, AND 10 (OVERVIEW, DIGESTIVE, PANCREAS, AND GALL BLADDER).**
G. Head Cross Section

In the Views menu, scroll over to Cross Sections. Scroll down to the Head (Sagittal) sections and select 1. Head (Midsagittal). Identify the following structures:

1. Orbicularis (lips)
2. Tongue
3. Hard palate
4. Soft palate
5. Oral cavity
6. Laryngopharynx
7. Select any tooth

H. Thorax Cross Section

Go back to the Cross Sections menu and find the Thorax sections. Select 2. Thorax (T03-T04). The view displays an inferior view. Identify the following structures:

1. Right and left lungs
2. Right and left brachiocephalic veins
3. Aortic arch
4. Trachea
5. Esophagus
6. T04 vertebra
I. Abdominal Cross Section

Go back to the Cross Sections menu and find the Abdomen sections. Select 2. Abdomen (T12-L01). The view displays an inferior view. Identify the following structures:

1. Peritoneum
2. Three liver segments (medial segment, anteromedial segment, and right anterolateral segment)
3. Gall bladder
4. Right and left kidneys
5. Lesser omentum
6. L01 Vertebra
7. Stomach
8. Pancreas (body and tail)
9. Descending aorta
10. Inferior vena cava
11. Spleen

Select the right-hand arrow in the title box to go to the next abdominal section (L01-L02). Identify the following structures:

1. Peritoneum
2. Stomach
3. Transverse colon (both parts, on either side of the stomach)
4. Spleen
5. Right and left kidneys
6. Duodenum
7. Inferior vena cava
8. Descending aorta
9. L01 vertebra
Select the right-hand arrow in the title box to go to the next abdominal section (L02-L03). Identify the following structures:

1. Peritoneum
2. Greater omentum
3. Ileum
4. Jejunum
5. Ascending colon
6. Descending colon
7. Right and left kidneys
8. Inferior vena cava
9. Descending aorta
10. L03 vertebra

**J. Pelvis Cross Section.**
Go back to the Cross Sections menu and find the Pelvis sections. Select 2. Pelvis (Coccyx) (M). Identify the following structures:

1. Peritoneum
2. Bladder
3. Rectum
4. Coccyx
Student Practice

Label the structures in the following figures
Source: Digestive System Views: View 6. Alimentary Canal

- Mouth
- Esophagus
- Pharynx
- Stomach
- Colon
- Small Intestine
- Rectum
Right temporalis muscle

Right masseter muscle

Mandible

Source: Digestive System Views: View 1. Upper Digestive System
Source: Digestive System Views: View 3. Salivary Glands

Gingiva
Teeth
Left submandibular gland
Tongue
Right sublingual gland

Left parotid gland
Oropharynx
Laryngopharynx
Esophagus
Source: Digestive System Views: View 2. Lower Digestive System

- Esophagus
- Cardiac sphincter
- Stomach
- Greater omentum
Source: Digestive System Views: View 2. Lower Digestive System
Source: Digestive System Views: View 2. Lower Digestive System
Common bile duct
Mucosa
Submucosa
Pancreatic duct
Serosa
Longitudinal muscle layer
Circular muscle layer

Source: Digestive System Views: View 2. Lower Digestive System
Transverse colon

Ascending colon

Cecum

Appendix

Taenia coli

Descending colon

Sigmoid colon

Rectum

Anal canal

Source: Digestive System Views: View 2. Lower Digestive System