

# MODULE 6: RESPIRATORY AND DIGESTIVE SYSTEM ANATOMY

The Respiratory System includes the structures of the upper and lower respiratory tract (or from the mouth to the alveoli). The Digestive System includes structure from the mouth to the anus. The branching point for these two systems is in the larynx where one conduit continues into the trachea past the vocal cords and the other continues down the esophagus into the stomach. The tables below includes a list of terms that you will be expected to identify on pictures, models and images. There will likely be images on the exam that you have not seen or studied before, so it is important for you to learn anatomical structures by their characteristics and avoid just memorizing the pictures you have available.

## List of Terms

Spend as much time as you need reviewing cardiovascular anatomy. Practice identifying all of the structures listed in the tables below. Use your online resources, open lab, and any other tool that you have to become confident in your identification skills. Even though the practice exam will be multiple choice, the real lab exams will ask you to identify and then write in (Fill in the Blank) the correct term for your identification. The tables below include a comprehensive list of all the terms from this section that we would consider asking about on an exam.

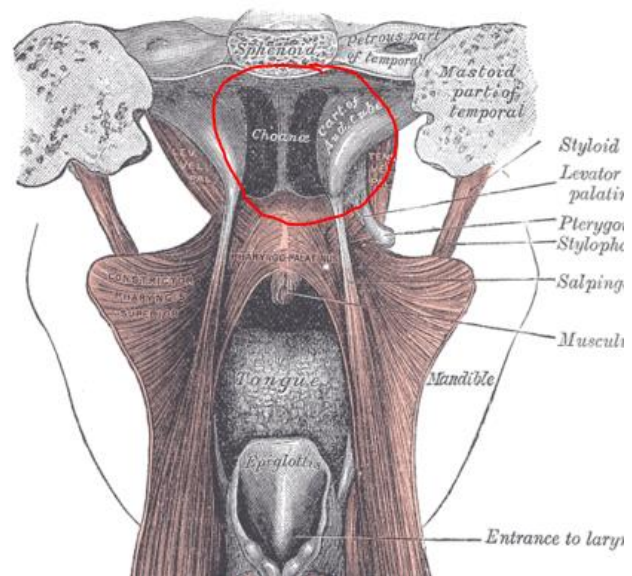
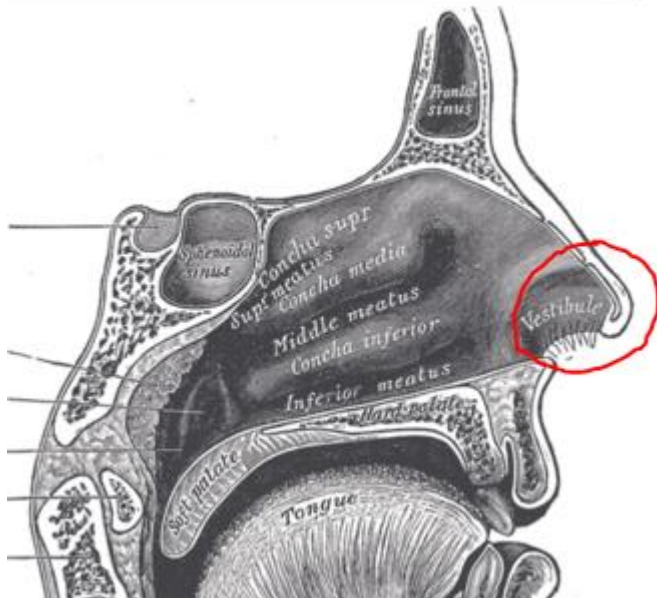
## LIST OF TERMS FOR THE RESPIRATORY SYSTEM

### Upper Respiratory Tract

#### Nasal Cavity

- **External Nares (Nostrils)**
- **Vestibule**
- **Nasal Septum**
- **Hard Palate**
- **Conchae**
  - **Superior Conchae**
  - **Middle Conchae**
  - **Inferior Conchae**
- **Meatus**
  - **Superior Meatus**
  - **Middle Meatus**
  - **Inferior Meatus**
- **Nasolacrimal Duct**
- **Choana (Internal Nares)**
- **Paranasal Sinuses**
  - **Frontal Sinus**
  - **Sphenoid Sinus**

Most folks are quite familiar with the **Nostrils**. Those two holes on the inferior end of our nose are hard to ignore. Just behind the nostrils is the **Vestibule**. This area can be hard to picture as we don't see it on the outside of the face. It is circled in the picture below and to the left. The **Nasal Septum** is a wall of bone and cartilage that separates the two nostrils from each other. Continuing back to the posterior end of the nostrils we reach a point where the nostrils join just before the nasal cavity dips inferiorly to become the back of the throat. This point is called the **Choana** and is in the picture below and to the right. The **Conchae** are curled bone shelves located on the lateral nasal cavity in each nostril. A **Meatus** is the "valley" separating each conchae. The **Nasolacrimal Duct** is a passage way for water on the eyes to enter the nose. The **Paranasal Sinuses** are hollow cavities in bones surrounding the nasal cavity.



## Pharynx

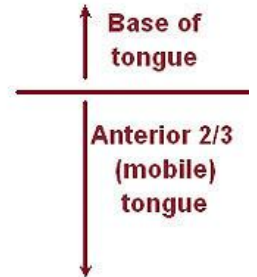
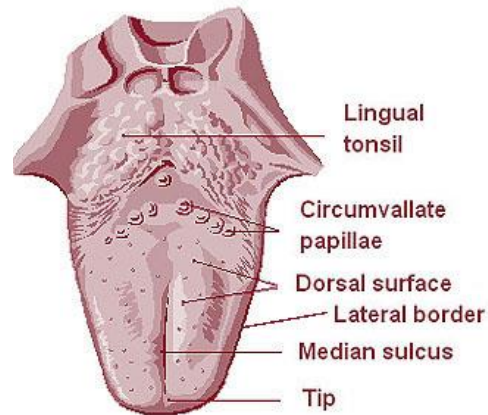
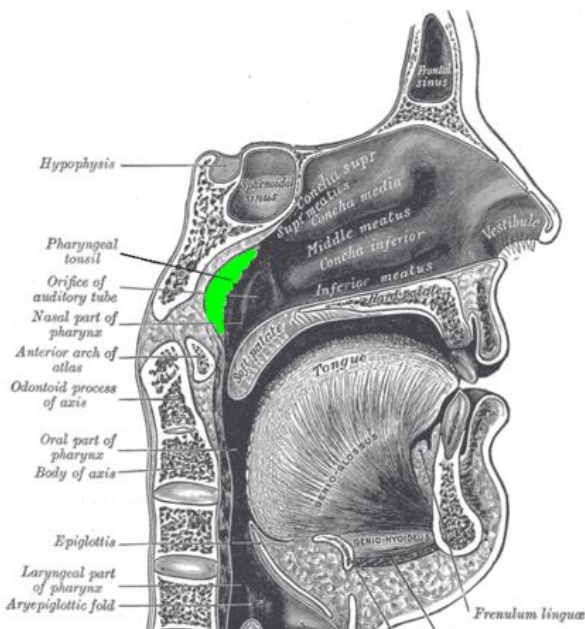
- **Nasopharynx**
  - **Pharyngeal Tonsil (Adenoid)**
  - **Soft Palate**
- **Oropharynx**
  - **Fauces**
  - **Palatine Tonsils**
  - **Lingual Tonsils**
  - **Uvula**
- **Laryngopharynx**

The **Pharyngeal Tonsils** are also called the **Adenoids**. This is a mass of lymphatic tissue located posterior to the nasal cavity. Basically, the adenoids are where the nose blends into the throat (See picture below). The **Palatine Tonsils** can be seen on the left and right sides of the throat in an anterior view through the mouth. The **Lingual Tonsils** are rounded masses on the posterior region of the tongue (See picture below).

The **Fauces** are the archway formed by the tongue, palatine tonsils and the soft palate.

The **Uvula** (sometimes called the palatine uvula) is a cone shaped projection from the posterior edge of the soft palate. It functions in the production of some sounds in human speech.

The **Laryngopharynx** is the bottom part of the throat that connects to the esophagus



## Lower Respiratory Tract

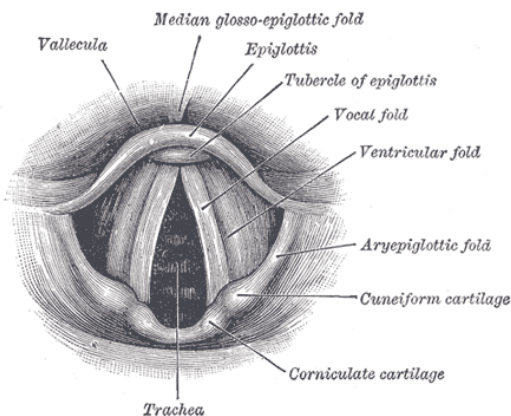
### Hyoid Bone

The **Hyoid Bone** (sometimes called the lingual bone) is a horseshoe shaped bone in the anterior midline of the neck. Unlike other bones this bone sits alone without any adjacent attachments to other bones. It functions in speech and swallowing.

### Larynx

- **Thyroid Cartilage**
- **Cricoid Cartilage**
- **Epiglottis**
- **Arytenoid Cartilage**
- **Vestibular Folds (false vocal cords)**
- **Vocal Folds (true vocal cords)**

There are 9 different cartilage structures that make up the larynx. The **Thyroid Cartilage** is the largest. Two plate like layers form a point anteriorly that has been called the adams apple. The **Cricoid Cartilage** refers to a "ring" "cricoid" is Greek for "ring shaped". It is the only complete ring of cartilage in the trachea. The **Epiglottis** is a flap of elastic cartilage that covers the entrance to the larynx while swallowing. The **Vestibular Folds** (sometimes called the false vocal cords) are two thick folds of tissue covered with mucus membrane. They sit just superficial to the vocal cords (see picture to left). They can constrict and close the opening to the larynx. The **Vocal Folds** are thin mucus membranes stretched just deep to the vestibular folds. They vibrate when they are brought close together and form sounds that become speech. The **Arytenoid Cartilage** are a pair of pyramid shaped structures that the vocal folds attach to. Movement of the arytenoid cartilage aids in the fine movement adjustments of the vocal folds.



The **Trachea** extends below the larynx and is composed of cartilage rings. Although the rings are not complete. The trachea is often referred to as the "wind pipe". Once the trachea branches into to conduits, we call the conduits **Primary or Main Bronchi**. The next branching creates bronchi referred to as **Secondary or Lobar Bronchi**. The next branching after this yields **Tertiary or Segmental Bronchi**. Branching after the tertiary bronchi produces air conduits that have no cartilage on them. They are tubes covered with smooth muscle and their diameters can be regulated. These tubes are collectively referred to as **Bronchioles**. Terminal Bronchioles do not branch anymore but dead end in a cluster of sac structures called **Alveoli**. There may be a small segment of terminal bronchiole that expresses some alveoli (before the main cluster). This segment is called the **Respiratory Bronchiole**.

### Respiratory Tree

- **Trachea**
- **Primary (Main) Bronchi**
- **Secondary (Lobar) Bronchi**
- **Tertiary (Segmental) Bronchi**
- **Bronchioles**
  - **Terminal Bronchioles**
  - **Respiratory Bronchioles**
- **Alveoli**

## Lungs

- **Hilum**
- **Right Lung**
  - **Superior Lobe**
  - **Horizontal Fissure**
  - **Middle Lobe**
  - **Oblique Fissure**
  - **Inferior Lobe**
- **Left Lung**
  - **Superior Lobe**
  - **Oblique Fissure**
  - **Inferior Lobe**

The **Hilum** refers to the “opening” into the lung. This opening is a place that the surface of the lung gives way to a depression that bronchi and blood vessels can enter the interior of the lung. The right lung has three lobes and the left lung has two. The lobes are separated by **Fissures** that are named by the direction that they run.

## Pleura

- **Parietal Pleura**
- **Visceral Pleura**
- **Pleural Cavity**

The pleura of the lung is a very thin simple squamous epithelium that covers the lung. There are two layers. The Parietal Layer actually runs along the chest wall and the Visceral Layer runs along the external surface of the lung itself. These two layers are in contact with each other as the lung fills the chest cavity. Even though these two layers contact each other, they are not bonded together and can actually slide against each other because of a small amount of lubricating fluid that lies between them. The space that the lubricating fluid occupies is called the Pleural Cavity (not to be confused with the thoracic or chest cavity that the lungs sit in). The Pleural Cavity can be expanded to much greater sizes if air or fluid is allowed in. This is what causes a collapsed lung. Basically, the pleural cavity expands in size and pushes the visceral pleura away from the parietal pleura.

## Muscles of Respiration

### Muscles of Inspiration

- **Diaphragm**
- **External Intercostals**

Any muscle that attaches to the ribs can help move the ribs. So, there are many muscles that help with inspiration not listed here. The muscles of the Thorax have already been addressed in the Bio 264 muscle labs. Here we will just focus on two muscles of inspiration that have not been shown before. First is the **Diaphragm**. This muscle separates the chest cavity from the abdominal cavity. When it contracts it moves inferiorly and expands the size of the chest cavity and air rushes in. The **External Intercostals** attach to the ribs and run their fibers in a direction that helps pull the ribs up. This also expands the chest cavity and air rushes in.

## **Muscles of Expiration**

- **Internal Intercostals**

The lungs are very elastic. After taking a breath in, the lungs will automatically recoil and let air out. Also the muscles of inspiration will relax allowing the chest cavity to decrease in size. This pushes air out. So, in a normal resting breath, not much muscular force is required to exhale. However, in forced expiration the abdominal muscle contract and force the diaphragm up more quickly. Also Abdominal muscles that attach to ribs can pull them down and decrease the size of the chest cavity. We will not address all the abdominal muscles here as that has been done in the Bio 264 lab. However, we will introduce the internal intercostal muscles. The **Internal Intercostal** muscles attach to ribs and run their fibers in a direction that pulls the ribs down when they contract. Be sure that you can tell the internal and external intercostal muscles apart. Paying close attention to the direction of fibers helps.

## LIST OF TERMS FOR THE DIGESTIVE SYSTEM

### Oral Cavity

- **Lips**
  - **Labial Frenulum**
  - **Vestibule**
- **Cheeks**
- **Gingiva**
- **Hard Palate**
- **Soft Palate**
- **Uvula**
- **Tongue**
  - **Papillae**
  - **Lingual Frenulum**
- **Salivary Glands**
  - **Parotid Glands**
  - **Submandibular Glands**
  - **Sublingual Glands**
- **Dentition**
  - **Incisors**
  - **Canines**
  - **Premolars**
  - **Molars**
- **Tooth Structure**
  - **Crown**
  - **Root**
  - **Enamel**
  - **Dentin**
  - **Pulp Cavity**
  - **Root Canal**
  - **Cementum**
  - **Periodontal Ligament**

The **lips** have a structure called the **labial frenulum**. This structure attaches to the center of the upper lip and on the gum between the two front teeth (for the superior frenulum) and from the lower lip to the gum near the bottom front teeth (for the inferior frenulum). The **vestibule** of the lips simply refers to the space between the lips and the gums. The **cheeks** technically refers to the area of the face below the eyes and the nose and left or right to the ears. The **gingiva** is the moist epithelium called mucosa that lines the gums in the mouth. The **hard palate** is the horizontal bony plate found in the roof of the mouth. The **soft palate** is the soft tissue on the posterior roof of the mouth. The **uvula** is a projection of cone shaped tissue extending from the center of the soft palate. The **tongue** is a muscular tissue lined with bumpy epithelium. The bumps are called papillae and contain the taste buds. The tongue is attached to the floor of the mouth by the **lingual frenulum**. There are three main **salivary glands** that we learn. The **parotid glands** are located near the ramus of the mandible. The **submandibular glands** are found beneath the floor of the mouth. The **sublingual glands** extend their openings just beneath the tongue. The **dentition** of the mouth refers to the teeth. There are 32 permanent teeth in the adult. Humans have 8 **incisors** located at the very front of the mouth. Next to the incisors are a total of 4 **canines**. Canine refers to the dog and their very large "fangs". There are a total of 8 Premolars or teeth just before

the large molars. There are 12 **molars** and of these 12, 4 are called "wisdom teeth" they are the last molars to come in and are found at the very back of the mouth. It is important to know **tooth structure** as well. The **crown** is the white part of the tooth that is seen. The **root** is the part of the tooth that extends below the gum and is anchored in the bony socket. **Enamel** refers to the outermost layer of the crown. **Dentin** is a bony like tissue that is found deep to the enamel and helps give the tooth support and structure. Dentin also is where the periodontal ligaments attach to keep the tooth stable in its socket. The **pulp cavity** is the central area of a tooth, it is a soft part of the tooth and it contains pain fibers. The **root canal** is a small tubular or canal like structure that connect the pulp cavity to the underlying source of blood vessels and nerves. **Cementum** is the surface layer that lies along the dentin and below the gum line. Cementum is a calcified layer that functions to attach the tooth to the alveolar bone. Periodontal ligaments are connective tissue that also attach the tooth to alveolar bone.

<p><b>Pharynx</b></p> <ul style="list-style-type: none"> <li>• <b>Nasopharynx</b></li> <li>• <b>Oropharynx</b></li> <li>• <b>Laryngopharynx</b></li> </ul>	<p>The <b>pharynx</b> is situated immediately posterior to the nasal cavity the oral cavity and the larynx. The <b>oropharynx</b> and <b>laryngopharynx</b> are part of the digestive system and the respiratory system.</p>
<p><b>Esophagus</b></p>	<p>The esophagus (also known as the gullet) is a muscular tube that connects the pharynx to the stomach. It is usually about 10 inches long.</p>
<p><b>Stomach</b></p> <ul style="list-style-type: none"> <li>• <b>Cardiac Part (Cardia)</b></li> <li>• <b>Lower Esophageal Sphincter</b></li> <li>• <b>Fundus</b></li> <li>• <b>Body</b></li> <li>• <b>Pylorus</b></li> <li>• <b>Pyloric Sphincter</b></li> <li>• <b>Lesser Curvature</b></li> <li>• <b>Greater Curvature</b></li> <li>• <b>Rugae</b></li> </ul>	<p>The <b>stomach</b> lies in between the esophagus and the small intestine. The stomach is divided into four different regions: the <b>cardia</b> or <b>cardiac part</b> is found immediately upon entering the stomach. The cardiac part follows the <b>lower esophageal sphincter</b> which serves to contain the contents of the stomach and to prevent them from going back up the esophagus. The <b>fundus</b> is the top most region of the stomach and formed by the <b>greater curvature</b> (which is found closest to the pancreas). The <b>body</b> of the stomach is the largest region of the stomach. The body has a concave curve on one side and this creates what is known as the <b>lesser curvature</b>. The body then leads into the <b>pylorus</b>, where the stomach begins to funnel down. A Smooth muscle constricture in the pylorus creates what is called the <b>pyloric sphincter</b>.</p>
<p><b>Small Intestine</b></p> <ul style="list-style-type: none"> <li>• <b>Duodenum</b></li> <li>• <b>Jejunum</b></li> <li>• <b>Ileum</b></li> <li>• <b>Ileocecal Junction</b></li> </ul>	<p>The <b>small intestine</b> is a long narrow tube that leaves the stomach. The small intestine can be over 20 feet long, but very condensed within the abdominal cavity. The first and shortest portion of the small intestine is known as the <b>duodenum</b>. It is in this region that the the pancrease, gallbladder and liver secrete digestive secretions and enzymes. The second portion of the small intestine is the <b>jejunum</b>. The last portion is the <b>ileum</b>. As food moves through the ileum, it will pass through the <b>ileocecal junction</b> before entering the large intestine.</p>



## Large Intestine

- **Haustra**
- **Teniae Coli**
- **Cecum**
- **Appendix**
- **Ascending Colon**
- **Hepatic (Right Colic) Flexure**
- **Transverse Colon**
- **Splenic (Left Colic) Flexure**
- **Descending Colon**
- **Sigmoid Colon**
- **Rectum**
- **Anus**

The **large intestine** (sometimes referred to as the colon) is the last section of the digestive system. The large intestine is much shorter and wider than the small intestine, measuring approximately 5 feet in length. The main purpose of the large intestine is to absorb fluid from the moving food and create feces (also called stools). The large intestine is surrounded longitudinally by small pieces of smooth muscle known as **teniae coli**. Since the teniae coli is smaller in circumference than the intestine, it causes pinching which in turn creates small pockets or pouches called **haustra**.

After exiting the ileum of the small intestine, food enters the **cecum**. This first portion is found in the lower, right region of the abdomen. Attached to the cecum is a small vestigial organ known as the **appendix**. Although it serves no known purpose, the appendix can get infected and this leads to inflammation and potentially shock and death. After the cecum the colon ascends and is called the **ascending colon**. The colon then bends, or turns, and this turn is known as the **hepatic, or right colic, flexure** (because it curves right near the liver). After the hepatic flexure, the next region is called the **transverse colon**. The transverse colon crosses horizontally across the upper abdomen. Just like the hepatic side, the colon bends back downwards. This curve in the large intestine is known as the **splenic, or left colic, flexure** (because it curves in an area near the spleen). The colon then descends inferiorly and is called the **descending colon**. Immediately following the descending colon, is a section called the **sigmoid colon**. Sigmoid refers to a Greek root that means to resemble a shape like an "s". Indeed the colon does loop as it enters the pelvic cavity and does resemble an "s". The large intestine becomes the **rectum** after the sigmoid section. The end of the rectum is called the **anus**.

<p><b>Liver</b></p> <ul style="list-style-type: none"> <li>• <b>Right Lobe</b></li> <li>• <b>Left Lobe</b></li> <li>• <b>Caudate Lobe</b></li> <li>• <b>Quadrate Lobe</b></li> <li>• <b>Common Hepatic Duct</b></li> </ul>	<p>The <b>liver</b> is one of the largest organs of the body (weighing approximately 3 lbs) and works to produce bile. It also remove wastes and toxins from the blood and metabolize and stores certain nutrients. The liver is divided into four lobes. The <b>common hepatic duct</b> emerges from the right lobe and drains bile.</p>
<p><b>Gallbladder</b></p> <ul style="list-style-type: none"> <li>• <b>Cystic Duct</b></li> <li>• <b>Common Bile Duct</b></li> </ul>	<p>The <b>gallbladder</b> receives and stores bile from the liver and lies immediately beneath or inferior to the liver. Bile enters the gallbladder through the <b>cystic duct</b> and empties from the gallbladder to the duodenum through the <b>common bile duct</b>.</p>
<p><b>Pancreas</b></p> <ul style="list-style-type: none"> <li>• <b>Pancreatic Duct</b></li> </ul>	<p>The <b>pancreas</b> is a small, pear-shaped gland that lies right in the concave bend of the duodenum. This organ produces important hormones like insulin and also excretes digestive enzymes into the duodeunu. The digestive enzymes enter the duodeunum through the <b>pancreatic duct</b>.</p>
<p><b>Membranes of the Abdominal Cavity</b></p> <ul style="list-style-type: none"> <li>• <b>Parietal Peritoneum</b></li> <li>• <b>Visceral Peritoneum</b></li> <li>• <b>Mesentery</b></li> <li>• <b>Lesser Omentum</b></li> <li>• <b>Greater Omentum</b></li> </ul>	<p>The parietal and visceral peritoneum are serous membranes that surround the visceral organs of the abdominal cavity. The parietal peritoneum lies along the abdominal wall while the visceral peritoneum intimately surrounds the visceral organs of the abdominal cavity. The Mesentery is the name given to visceral peritoneum when two layers come together and touch in between visceral organs like different sections of the intestines. The lesser omentum is mesentery that lies between the liver and the stomach and the greater omentum is a loop of two visceral peritoneal layers that loop inferiorly from the transverse colon. The greater omentum stores a significant amount of fat and contributes to the size of someone's "belly" girth.</p>