

# Lab 7 - THE RESPIRATORY SYSTEM

Use **text images p. 832–843 / 805-817** to identify the following on the human torso models.

**NASAL CAVITY** (p. 834 / 808)

**CONCHAE** (pronounced “con-kay”) – These are depicted best on the removable ½ head on the darker torso models. Find 3 thin, mucous membrane covered bony plates on the lateral walls of the nasal cavity. They increase the surface area exposed to incoming air, thus improving the warming, moistening, and cleansing of incoming air.

**PHARYNX** (pronounced “fair-inks”) (p. 834 / 808)

This also is best depicted on the ½ head of the darker torsos models. It is the area at the back of the nasal cavity and oral cavity and before entering the trachea to lungs or esophagus to stomach. Anything in the pharynx has the possibility of going down either the esophagus to the stomach or the trachea to the lungs. The epiglottis determines which path is taken. (See **epiglottis** below.)

Note the slit-like opening of the **EUSTACHIAN TUBE** (pronounced “U station”) into the wall of the pharynx (a.k.a. **AUDITORY TUBE** on diagrams.) OYO: What is the function of the **EUSTACHIAN TUBE**? What is the benefit?

**LARYNX** (pronounced “Lair-inks”) (p. 836 & 834 / 810 & 808)

The larynx is a group of cartilages, ligaments, and muscles at the bottom of the **pharynx** and the top of the **trachea**. Lots of people simply call it the “voice box” or “Adam’s apple.” While the larynx is depicted on each torso model it is best depicted on the separate larynx models.

**On the larynx models identify:**

**THYROID CARTILAGE** - the largest, shield shaped cartilage protruding anteriorly. It supports and protects the vocal cords. Palpate this on yourself and on another student. Feel it move as you swallow.

**CRICOID CARTILAGE** – a smaller ‘wrap around’ cartilage just below the thyroid cartilage. With your finger find the narrow soft space between the thyroid and cricoid cartilages.

**OYO: What is a TRACHEOTOMY (A.k.a. cricothyrotomy)?**

**EPIGLOTTIS** – If you’re looking down into the larynx this will appear as a tongue-like flap. Separate the larynx model and view it from the medial view also. When the larynx is raised upward when swallowing this cartilage acts like a moveable flap that pushes down to cover the entrance to the larynx / trachea. It is supposed to divert food and water into the esophagus.

Occasionally, solids or liquids will begin to enter the trachea by mistake causing an immediate and violent cough reflex to expel the object.

**OYO: Describe / explain the “Heimlich Maneuver.”**

**VOCAL CORDS** - visible as white folds of mucous membrane on the inner walls of the thyroid cartilages.

**CONDUCTING ZONE PASSAGES** (p. 840 / 813) (usually pale blue on the models) THESE are the passageways for air to flow between the atmosphere and the alveoli during ventilation.

**TRACHEA** – the tubular passageway for air from just below the larynx to the lungs.

C-shaped rings of cartilage found in the walls keep this airway open. The Cs open toward the posterior side facing the esophagus. OYO: Why have the ‘open’ portion of the C face the esophagus?

**L & R PRIMARY BRONCHI** (each is a **BRONCHUS**, a.k.a. “**MAIN STEM BRONCHUS**”)

These are the first two branches of the trachea. One leads to the L lung; the other to the R lung.

The single, larger cartilage where they fork is called the **CARINA**. This is depicted best on the lighter colored torsos.

The trachea and larger bronchi are lined with ciliated epithelial cells that constantly produce and move mucus upwards toward the pharynx where it is swallowed.

OYO:

Why the **mucus**?

Why the **cilia**? (Good images p. 837 / 812)

How much mucus do you swallow per day? \_\_\_\_\_ Eewwwwww!

One of the effects of cigarette smoke is to paralyze the movement of cilia.

Relate this to the classic “**smoker’s cough**.”

Inhaled foreign objects usually end up lodged in the R main stem bronchus or the R lung and not the left.

Why?

This is depicted best on the lighter torsos.

**CONFIRM ACCURACY OF THESE FIRST 2 PAGES WITH YOUR INSTRUCTOR.**

**BRONCHIOLES** – (p. 841 / 814) the very smallest subdivisions of the bronchi.

- They supply air to the microscopic alveolar air sacs.
- Their walls contain smooth muscle under involuntary control.
- Airway constriction/dilation is most significant here and can dramatically increase/decrease resistance to airflow. e.g. asthma, anaphylaxis

#### **ASTHMA**

- Asthma is actually a form of allergic reaction involving the bronchioles.
- Many different allergens (pollens, cigarette smoke, stress, and exercise) may trigger an “attack.”
- What **3 physiologic changes** cause breathing to become so difficult during an asthma attack?

Emergency treatment for asthma often involves the medication **ALBUTEROL** and in severe cases **EPINEPHRINE**. Both are adrenergic (**sympathomimetic**) drugs.

OYO: What will they cause the bronchioles to do?

#### **LUNGS** (p. 844 / 817)

- There are 3 lobes in the right lung and 2 in the left lung and various numbers of lobules in each lobe.
- The **PRIMARY BRONCHI** subdivide and the branches are called **SECONDARY BRONCHI**. The secondary bronchi subdivide to become **TERTIARY BRONCHI**, etc. to supply air to the many millions of **ALVEOLI**. The very smallest tubes are called **BRONCHIOLES**. They incomplete rings of cartilage or none at all and are therefore capable of constriction/dilation called **bronchoconstriction / bronchodilation**.
- Lung tissue is very **elastic**. This **elasticity** combined with the **surface tension** inside alveoli contributes to **lung recoil**.

**ALVEOLI** – (p. 841 & 843 / 814 & 816) are the only true **RESPIRATORY ZONE STRUCTURES**. These are the only structures where gas exchange occurs by diffusion across the walls.

- Are microscopic air sacs resembling clusters of grapes at the ends of the bronchioles.
- Are surrounded by blood capillaries
- Is where exchange of gasses between the air and blood takes place.
- If all of your alveoli were laid out flat they would cover both side walls the full length of the lab.
- **Surface tension** on the inside of each alveolus contributes to **lung recoil**.
- Explain why (how) oxygen moves into the blood and carbon dioxide moves out of the blood at this location.

Which respiratory “law” (from lecture) explains the movement of gas molecules from a liquid to a gas or from a gas to a liquid? \_\_\_\_\_

**PULMONARY ARTERIES** (blue) and **PULMONARY VEINS** (red) (p. 844 / 817) -- supply blood to and from the capillaries surrounding the alveoli. Explain why the arteries are blue and not red.

**PLEURAL MEMBRANES** (p. 844 & 846 / 817 & 819)

- Serous membranes surrounding the lungs.
- They secrete **SEROUS FLUID** (or **PLEURAL FLUID**)
  1. for lubrication between the lung surfaces and thoracic wall.
  2. to provide surface tension to “hold” the lungs against the thoracic wall
- Distinguish between **VISCERAL PLEURA** and **PARIETAL PLEURA**.

**PLEURAL CAVITY** (p. 844 & 846 / 817 & 819)

- The extremely thin space between the visceral and parietal pleural membranes.
- The two membranes are actually in contact with each other but slide freely due to pleural fluid.
- The pressure here is slightly negative (**-4 mmHg**) because lung recoil causes the visceral pleural membrane to always try to ‘pull away’ from the parietal pleural membrane of the thoracic wall.

Distinguish between **PNEUMOTHORAX** and **HEMOTHORAX**.

OYO: How is a pneumothorax treated/reversed?

**INTERNAL AND EXTERNAL INTERCOSTAL MUSCLES** (p. 848 / 821)

- Two layers of muscle between the ribs.
- The externals lift the ribs up & out for inspiration. The internals can pull the ribs down and in for expiration. The internals normally are not involved with expiration except when you need a forceful expiration. Expiration is usually a passive process accomplished by \_\_\_\_\_ .

**DIAPHRAGM** (p. 846 & 848 / 819 & 821)

The dome shaped sheet of muscle that separates the thoracic cavity from the abdominal.

- When it relaxes it raises into a dome shape it decreases thoracic cavity size for expiration.
- When it contracts it moves downward and somewhat flattens out to increase thoracic cavity size and cause inspiration.

Define **Pulmonary Ventilation**:

Explain why (how) air moves in and out of the lungs in response to contraction / relaxation of these respiratory muscles.

Which respiratory “law” (from lecture) explains this process? \_\_\_\_\_

**CONFIRM ACCURACY WITH YOUR INSTRUCTOR**

## INSTRUCTIONS FOR LUNG DISSECTIONS

**\*\*Note:** Not all specimens will have all structures present.

Identify the **LARYNX**, **TRACHEA**, **ESOPHAGUS**, **LUNGS**, and if present, the **HEART** and any remnants of the **PERICARDIAL SAC**.

Use a metal probe to separate the **esophagus** from the **trachea**. The **thoracic aorta** may also be present. The walls of the aorta will be whiter and firmer and hold its shape better. Examine the **trachea** more closely and identify:

### **LARYNX (not present on many specimens because they cut too low)**

Scrape away superficial tissues and muscle to expose and ID the **THYROID CARTILAGE** and **CRICOID CARTILAGE**. Note that the posterior wall of the trachea is soft and flexible allowing for easier passage of food. The wall flexes inward as a bolus of food passes down the esophagus.

Find the soft space between the thyroid and cricoid cartilages. This is where a tube can be inserted during a **TRACHEOTOMY (A.K.A. CRICOTHYROTOMY)**.

Locate the **EPIGLOTTIS** and “make it work” the way it would when swallowing.

What is its function? \_\_\_\_\_

Look into the opening, called the **GLOTTIS**, and see the **VOCAL CORDS**. The cords are more like a pair of shelves than cords.

Stick your finger or a probe into the **esophagus** where food would go. If you have one on your specimen, find the distal end of the esophagus where it connects to the stomach. What **sphincter** would be here? \_\_\_\_\_ For what purpose? \_\_\_\_\_

What disorder develops when this sphincter doesn't work well? \_\_\_\_\_

### **TRACHEA**

Run your fingers up and down the anterior side of the trachea and feel the **C-SHAPED RINGS OF CARTILAGE**. What is their purpose? \_\_\_\_\_

What kind of membrane lines the lumen of the trachea? \_\_\_\_\_ For what purpose?

### **BRONCHI and BRONCHIOLES**

Follow the trachea down until it splits and locate two or more **PRIMARY BRONCHI**. (These animal specimens may have more than two primary bronchi and the trachea may not split at a well-defined carina. Also their lungs don't necessarily have 3 lobes on the right and 2 on the left.)

Feel the smooth outer surface of the lungs. What membrane is this? \_\_\_\_\_ What do you call the fluid that lubricates it? \_\_\_\_\_

Find any remnants of the **PERICARDIAL SAC** and heart and major blood vessels. Often you can see portions of the aorta, pulmonary trunk, and atria. Identify all that you can.

**\*\*Invite your instructor over and confirm your identifications of all of the above.**

**OVER →**

**1) INTUBATION:** You'll need an **AMBU BAG, ET TUBE,** and **SYRINGE.**

If the lungs are small, insert the endotracheal tube through the larynx into the trachea. [If the lungs are large then sever the trachea near the carina and insert the ET tube into a 1° or 2° bronchus.] Inflate the cuff with 10-20 cc air from a syringe to seal the airway. There should be a 'snug' fit and you should feel some resistance when you try to pull the tube out. Now connect the ambu bag to the ET tube and inflate the lungs.

What are the microscopic air sacs being inflated.? \_\_\_\_\_

Why do they tend to deflate immediately? (2 reasons) \_\_\_\_\_ and \_\_\_\_\_

**2) Using scissors or knife, insert one point into the trachea or a primary bronchus and split open the top side as you trace a portion of the bronchial tree as far out as you can go.** Use paper towel to soak up any "foam" present so you can see the numerous branches of the bronchial tree.

**3) Make a cross section** midway through an intact lung to create a superior or inferior view. Identify bronchial tubes, arteries, and veins.

**4) \*\*Invite your instructor over and confirm your identifications of all of the above.**