Unit 14: The Respiratory System
See what you already know!

1. Fill in the diagram on your own
2. Collaborate with your partner
The Respiratory System

• The major function of the respiratory system is *gas exchange*.  
  – oxygen \((O_2)\) to the bloodstream  
  – carbon dioxide \((CO_2)\) from the bloodstream.

• Breathing involves  
  – Inspiration / inhalation  
  – Expiration / exhalation
The Paranasal Sinuses

- These are air-filled spaces within the skull bones
- Serve to reduce weight of the skull and give your voice a certain tone
- Skull bones with sinuses include:
  - Frontal
  - Sphenoid
  - Ethmoid
  - Maxillae bones
The Nasal Cavity
Nasal septum divides the cavity into right and left portions

*Nasal conchae* extend from walls of nasal cavity

Mucous membrane warms and moistens the air and cilia helps eliminate particles
Some reasons your nose likes to run:

1. Cold weather inhibits regular cilia activity, allowing the mucus to get out of control.
2. Colds/flu cause the body to create more mucus to flush out the infection.
3. Crying means there are tears coming from lacrimal glands which ultimately drain into the nasal cavity.
Pharynx

Three parts: Nasopharynx, laryngopharynx, oropharynx

Please put in order from superior to inferior
Nasopharynx
-Tonsils
-Uvula (soft palate)
-Auditory tubes

Oropharynx
-Passage for both food and air

Laryngopharynx
-Where food and air pathways diverge
-Inferior end: anterior opening is to larynx, posterior opening is to esophagus
The Larynx

- The “voice box”

- Composed of three cartilages:

  1. Thyroid cartilage (anterior)

  2. Epiglottic cartilage (superior)

  3. Cricoid cartilage (inferior)

- Cartilage allows flexibility
Vocal Cords

- The *glottis* is the opening between the vocal cords.
- The more vocal cords are stretched, the higher the voice pitch.
- [https://www.youtube.com/watch?v=VRAU33_s4ec](https://www.youtube.com/watch?v=VRAU33_s4ec)
Activity: Vocal Cord Models!!

1. Choose a rubber band to wrap around a cup
2. Use a straw and blow on the rubber band
3. Add on a different size rubber band
4. What is the difference between wide and narrow, tight and loose bands?
5. How does blowing fast or slow alter the intensity of noise?
The Trachea, Bronchi and Bronchioles

- Referred to as the windpipe
- Tubular organ made of rings of cartilage and smooth muscle
- Extends from the larynx to the bronchi.
- Lined with cells possessing cilia

*Cilia moves mucus up to the throat where it is swallowed. Smoking destroys cilia.*

Try breathing through a straw for 1 minute
The Lungs

- Cone-shaped organs
- Right lung has three lobes and the left lung has two lobes
- The membranes surrounding the lungs is called the pleura

The lungs contain connective tissue, the bronchial tree, nerves, lymphatic vessels and blood vessels.
Inside the Lungs

- Each lobe of the lung divided into smaller lobules
- Bronchi branch into smaller bronchioles
- Bronchioles end in small air pockets called alveoli
- Each alveoli surrounded by pulmonary capillaries

GAS EXCHANGE HAPPENS HERE!!!!

https://www.youtube.com/watch?v=KL4cU9sG_08
s
urfactant (lipoprotein)
Apply Your Knowledge

Which of the following sites would be the most lethal if obstructed by a foreign body?

a. Right bronchus
b. Left bronchiole
c. Trachea
Apply Your Knowledge - Answer

Which of the following sites would be the most lethal if obstructed by a foreign body?

a. Right bronchus  
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The Mechanisms of Breathing

Inspiration

- Air rich in O\textsubscript{2} enters the lungs from the atmosphere
- The diaphragm contracts or flattens
- The intercostal muscles raise the ribs

Expiration

- Air rich in CO\textsubscript{2} exits the lungs
- The diaphragm relaxes
- The intercostal muscles lower the ribs
Breathing or pulmonary ventilation, consist of inspiration (inhalation) and expiration (exhalation). The medulla oblongata controls the rhythm and depth of breathing and the pons controls the rate of breathing.

Why do we yawn?

https://www.youtube.com/watch?v=I0dQx4SNSwE
Respiration

Breathing in: diaphragm contracts

Breathing out: diaphragm relaxes

Rib pair positions during inspiration and expiration
Movement of Oxygen and Carbon Dioxide In and Out of the Respiratory System

- Nasal cavities
- Pharynx
- Larynx
- Trachea
- Bronchi
- Bronchioles
- O₂ to blood
- Alveoli
- Bronchioles
- Trachea
- Larynx
- Pharynx
- Nasal cavities
Respiratory Volumes

- **Tidal Volume**: Reflects the amount of air that moves in or out of the lungs during a normal breath.
- **Inspiratory Reserve Volume**: Amount of air that can be forcefully inhaled following a normal inhalation.
- **Expiratory Reserve Volume**: Amount of air that can be forcefully exhaled following a normal exhalation.
Volume, L

Inspiratory reserve volume

Functional residual capacity

Tidal volume

Vital capacity

Expiration reserve volume

Total lung capacity

Residual volume
Respiratory Volumes

Residual Volume

- Represents the volume of air that always remains in the lungs even after a forceful exhalation.

Vital Capacity

- Amount of air that can be forcefully exhaled after the deepest inhalation possible.

Total Lung Capacity

- This measure reflects the total amount of air the lungs can hold.
Activity: measuring lung capacity

1. You will need:
   - 1 balloon
   - 1 ruler

2. Measuring:
   - Tidal volume
   - Vital capacity
   - Expiratory volume
   - Residual volume

3. Do THREE trials for each

4. Locate lung volume using graph

5. Conversions: 1,000 cm$^3$ = 1 qt

6. Answer questions with partner
Why do people snore?

Muscles become very relaxed ("hypotonic" state)

Turbulent air flow when breathing

Vibrations of unsupported membranous airways

Could be a symptom of sleep apnea: airway obstruction

https://www.youtube.com/watch?v=inmop4Kv8PI
# Common Respiratory Conditions

<table>
<thead>
<tr>
<th>Disease</th>
<th>Symptoms</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>• Swelling of airways</td>
<td>• Irritation induced by exercise, allergies, cold temperatures, or pollutants</td>
</tr>
<tr>
<td></td>
<td>• Bronchioconstriction—smooth muscles contract (feeling of chest tightening)</td>
<td></td>
</tr>
<tr>
<td>Chronic bronchitis (COPD)</td>
<td>• Excess mucus (phlegm) production</td>
<td>• Irritation induced by virus, pollutants, or smoking</td>
</tr>
<tr>
<td></td>
<td>• Swelling of airways</td>
<td></td>
</tr>
<tr>
<td>Emphysema (COPD)</td>
<td>• Difficulty exhaling completely</td>
<td>• Walls of alveoli lose their “springy-ness”</td>
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