Organs of the Respiratory System  
Laboratory Exercise 52

Background

The organs of the respiratory system include the nose, nasal cavity, sinuses, pharynx, larynx, trachea, bronchial tree, and lungs. They mainly function to process incoming air and to transport it to and from the atmosphere outside the body and the air sacs of the lungs. In the air sacs, gas exchanges take place between the air and the blood of nearby capillaries. The blood, in turn, transports gases to and from the air sacs and the body cells. This entire process of transporting and exchanging gases between the atmosphere and the body cells is called respiration.

Materials Needed

Textbook  
Human torso model  
Respiratory system model  
Compound light microscope  
Prepared microscope slides of the following:
- Trachea
- Lung (normal)
- Lung (smoker)
- Lung (emphysema)
Animal lung with trachea (pig)

Purpose of the Exercise

Review the structure and function of the respiratory organs and examine the tissues of some of these organs microscopically.

Procedure A – Respiratory Organs

1. Label figures 52.1, 52.2, 52.3 and 52.4.
2. Examine the human torso and the respiratory system model to locate the following features: nose, nostrils, nasal cavity, sinuses, pharynx, larynx, trachea, bronchi, lungs.
3. Complete Part A of the laboratory report.
Demonstration

Observe the animal lung and the attached trachea. Identify the larynx, major laryngeal cartilages, trachea, and the incomplete cartilaginous rings of the trachea. Open the larynx and locate the vocal folds. Examine the visceral pleura on the surface of a lung, and squeeze a portion of a lung between your fingers. How do you describe the texture of the lung?

Procedure B – Respiratory Tissues

1. Obtain a prepared microscope slide of a trachea, and use low-power magnification to examine it. Notice the inner lining of ciliated pseudostratified columnar epithelium and the deep layer of hyaline cartilage, which represents a portion of an incomplete (C-shaped) tracheal ring.
2. Use high-power magnification to observe the cilia on the free surface of the epithelial lining. Locate the goblet cells which secrete protective mucus in the epithelium.
3. Prepare a labeled sketch of a representative portion of the tracheal wall in Part B of the laboratory report.
4. Obtain a prepared microscope slide of human lung tissue. Examine it, using low-power magnification, and note the many open spaces of the air sacs (alveoli). Look for a bronchiole – a tube with a relatively thick wall and a wavy inner lining. Locate the smooth muscle tissue in the wall of this tube. You also may see a section of cartilage as part of the bronchiole wall.
5. Use high-power magnification to examine the alveoli. Note that their walls are composed of simple squamous epithelium. You also may see sections of blood vessels filled with blood cells.
6. Complete Part C of the laboratory report.

Critical Thinking Application

Why are the alveolar walls so thin?

Demonstration

Examine the prepared microscope slide of lung tissue of a person with emphysema, using low-power magnification. How does the emphysema patient’s lung tissue compare with the normal lung tissue?
Figure 52.1 Label the major features of the respiratory system.

Figure 52.2 Label the features of this sagittal section of the upper respiratory tract.
Figure 52.3 Label the major features of the larynx: (a) anterior view; (b) posterior view.

(a)

(b)

Figure 52.4 Label the features of the superior aspect of the larynx: (a) glottis closed; (b) glottis opened.

(a)

(b)
Figure 52.5 Micrograph of a section of the tracheal wall (63x).

Figure 52.6 Micrograph of human lung tissue (250x).
**Part A**

Match the structures in column B with the descriptions and functions in column A. Place the letter of your choice in the space provided.

<table>
<thead>
<tr>
<th>Column A</th>
<th>Column B</th>
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</thead>
<tbody>
<tr>
<td>___ 1.  Potential space between visceral and parietal pleurae</td>
<td>a. Alveolus</td>
</tr>
<tr>
<td>___ 2.  Most inferior portion of the larynx</td>
<td>b. Cricoid cartilage</td>
</tr>
<tr>
<td>___ 3.  Serves as a resonant chamber and reduces the weight of the skull</td>
<td>c. Epiglottis</td>
</tr>
<tr>
<td>___ 4.  Microscopic air sac for gas exchange</td>
<td>d. Glottis</td>
</tr>
<tr>
<td>___ 5.  Consists of large lobes</td>
<td>e. Lung</td>
</tr>
<tr>
<td>___ 6.  Opening between vocal cords</td>
<td>f. Nasal concha</td>
</tr>
<tr>
<td>___ 7.  Fold of mucous membrane containing elastic fibers responsible for sound</td>
<td>g. Pharynx</td>
</tr>
<tr>
<td>___ 8.  Increases surface area of nasal mucous membrane</td>
<td>h. Pleural cavity</td>
</tr>
<tr>
<td>___ 9.  Passageway for air and food</td>
<td>i. Sinus (paranasal)</td>
</tr>
<tr>
<td>___10. Partially covers opening of larynx during swallowing</td>
<td>j. Vocal cord (true)</td>
</tr>
</tbody>
</table>

**Part B**

1. Prepare a labeled sketch of a portion of the tracheal wall.
2. Prepare a labeled sketch of a portion of lung tissue.

Part C

Complete the following:

1. What is the function of the mucus secreted by the goblet cells?

2. Describe the function of the cilia in the respiratory tubes.

3. How is breathing affected if the smooth muscle of the bronchial tree relaxes?