RESPIRATORY SYSTEM

I. OVERVIEW OF THE RESPIRATORY SYSTEM AND THORAX

A. Upper respiratory tract (Fig. 23.1) Use the half-head models.
   - Nasal cavity
   - Pharynx (fare-rinks)

B. Lower respiratory tract (Fig. 23.1) Use the torso models.
   - Larynx (lare-rinks)
   - Trachea
   - Bronchi (singular is bronchus, "branch")
   - Lungs

C. Transverse section of the thoracic cavity (Fig. 23.12) Study this illustration.
   - Esophagus
   - Posterior mediastinum
   - Right and left lungs
   - Right and left bronchi
   - Heart
   - Anterior mediastinum
   - Sternum
   - Pleural cavity
   - Visceral pleura
   - Parietal pleura
   - Parietal pericardium
   - Visceral pericardium
   - Pericardial cavity
II. RESPIRATORY ANATOMY

A. Nasal cavity (Fig. 23.2). The nasal conchae and septum are covered with warm, moist, mucus-secreting epithelium. The conchae stir up the air that enters, warming, moistening, and cleansing it—true “air conditioners.” Study these on the half-head models.

- External naris (naris; plural is nares [nare-eetz])
- Superior concha (cong-ka; plural is conchae [cong-key])
- Middle concha
- Inferior concha
- Superior meatus
- Middle meatus
- Inferior meatus
- Choana (koe-an-a; plural is choanae)
- Nasal septum (not shown)
- Hard palate
- Soft palate

B. Paranasal sinuses (Fig. 23.2). (These can be seen on the half-head models and on the half-heads of the torso models.)

- Frontal sinus
- Maxillary sinus (not on illustration)
- Sphenoid sinus

C. Pharynx (Fig. 23.2) Use the half-head models.

1. Nasopharynx (posterior to the nasal cavity to the level of the soft palate)
   - Pharyngeal tonsil
   - Opening of the eustachian tube (auditory tube)

2. Oropharynx (or-o-fare-rinks)
   - Palatine tonsils
   - Uvula

3. Laryngopharynx (lare-ing-go-fare-rinks; opens into esophagus and larynx)
   - Epiglottis
4. Seven openings are found in the pharynx. They are the __________________, __________________, __________________, __________________, __________________(2), __________________(2)

D. **Larynx** (Fig. 23.2, 23.3, 23.4) Use the half-head models, the torso models, and the small larynx models.

   - Hyoid bone
   - Epiglottis
   - Vestibular folds (false vocal cord)
   - Vocal folds (true vocal cord)
   - Thyroid cartilage
   - Cricoid cartilage
   - Glottis (opening between vocal folds)

   **Thyroid gland** (Fig. 18.8 a]) This endocrine gland is not part of the respiratory system, but its location inferior to the larynx should be noted.

E. **Trachea and bronchial tree** (Fig. 23.3, 23.6) Study the small larynx models and the torso models.

   - Tracheal cartilages
   - Primary bronchus
   - Secondary bronchus
   - Tertiary bronchus

F. **Lungs** (Fig. 23.6] Use the torso models. These structures are easily seen but not labeled on the illustration.

   1. **Right lung**
      - Superior lobe
      - Horizontal fissure
      - Middle lobe
      - Oblique fissure
      - Inferior lobe

   2. **Left lung**
      - Superior lobe
      - Oblique fissure
      - Inferior lobe
3. Why is the left lung smaller than the right?

4. Helpful tip for remembering number of lobes with each lung: Upper case “L” is written with two strokes—left lung has two lobes. Upper case “R” is written with three strokes—right lung has three lobes.

G. Bronchioles and alveoli (Fig. 23.7) These microscopic structures are seen on the illustration only. Oxygen and carbon dioxide exchange between blood and air across these structures.

   - Terminal bronchiole
   - Alveolar duct
   - Alveolar sac (wider area in the middle of individual alveoli)
   - Alveolus (plural is alveoli)
   - Pulmonary capillaries

H. Muscles of ventilation (Fig. 23.10). These are on the torso models.

<table>
<thead>
<tr>
<th>Muscle</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diaphragm</td>
<td>Principal inspiration</td>
</tr>
<tr>
<td>External intercostals</td>
<td>Principal inspiration</td>
</tr>
<tr>
<td>Sternocleidomastoid</td>
<td>Accessory inspiration (forced or active)</td>
</tr>
<tr>
<td>Scalene</td>
<td>Accessory inspiration</td>
</tr>
<tr>
<td>Pectoralis minor</td>
<td>Accessory inspiration</td>
</tr>
<tr>
<td>Internal intercostals</td>
<td>Forced expiration</td>
</tr>
<tr>
<td>Abdominal muscles</td>
<td>Forced expiration</td>
</tr>
</tbody>
</table>
Optional notes on the anatomy of the respiratory system

1. *Pleurisy* is a painful inflammation of the *pleurae*.

2. Each *paranasal sinus* drains via an opening in a *nasal meatus*. Sometimes recurrent *sinusitis* causes scar tissue that blocks the drainage, and surgery may be needed to reopen them.

3. *Laryngitis* causes loss of speech volume because the *vocal cords* become too swollen to vibrate.

4. *Pneumothorax* occurs when air enters the *pleural cavity*, either through a wound from the outside, or from injury to the delicate lung tissue and *visceral pleura*. Because the pleural cavity is normally sealed below atmospheric pressure (“vacuum-sealed”), air rushes into the pleural cavity. The lung, which is normally held open by the suction of the “vacuum-seal,” collapses. Since each lung is separately wrapped in its own pleural membrane, the other lung can sustain life if pneumothorax occurs.
Notes and Sketches
III. LUNG VOLUMES AND LUNG CAPACITIES

A. Lung volumes (Text p. 841 [846]; Fig. 23.15) Each of the four volumes of air are independent of any other volume. Learn the following on the illustration, and learn the definitions in items 2-4 below.

1. Inspiratory reserve volume
   Tidal volume
   Expiratory reserve volume
   Residual volume

2. Which volume is the normal amount of air that is breathed in and out? ____________________ ___________________

3. Which volume is left in the lungs after all air is exhaled as completely as possible? ____________________ ___________________

4. Exhale normally. Now, without inhaling again, exhale all the air that you possibly can. Which volume was the second exhalation?
   ____________________ ____________________ ____________________

5. Inhale normally. Now, without exhaling, continue to fill up your lungs a full as possible. Which volume is the second part of the inhalation?
   ____________________ ____________________ ____________________

B. Lung capacities (Text p. 846 [849]; Fig. 23.15) The four capacities are formed from the sum of two or more volumes. Learn the following on the illustration, and learn the definitions in items 2-5 below.

1. Inspiratory capacity
   Functional residual capacity
   Vital capacity
   Total lung capacity

2. Which capacity is the sum of all the volumes above? ____________________ ____________________ ____________________

3. Which capacity is the total amount of air that can be exhaled after a maximal inhalation? ____________________ ____________________
4. Which capacity represents the air left within the lungs after a normal exhalation?

______________________________ ____________________ ____________________

5. Which capacity represents the sum of the inspiratory reserve volume and the tidal volume?

______________________________ ____________________ ____________________

C. Measurement of vital capacity

1. The **vital capacity** is a test for efficiency of ventilation, performed by asking the subject to inhale maximally, and then to exhale maximally into a spirometer. The volume of air exhaled is measured and compared to that of others of the same sex and height. A significant decrease in vital capacity can result from a number of factors: tight clothing, pregnancy, weak inspiratory and/or expiratory muscles, paralysis of respiratory muscles, hiatal hernia, kyphosis (hunchback), scoliosis, pneumonia, collapse of a lung, emphysema, fibrosis of the lungs, or lung cancer.

2. You will need a student spirometer ("whistle" spirometer). Sterilized mouthpieces are to be placed on the spirometer, and a receptacle for used mouthpieces is provided. A table of data which allows you to determine how your vital capacity compares to others of your gender and height is necessary.

3. To measure the vital capacity: An intense effort should be made to inhale maximally of room air, and then to exhale maximally into the spirometer. Each student should measure his or her vital capacity three times; the results should be averaged. Your instructor will show you how to read the measurement on the spirometer. *Please place the used mouthpiece in the “used” receptacle!*

   Trial 1 _______ Trial 2 _______ Trial 3 _______ Ave. _______

4. Using the table, convert your own average vital capacity in milliliters into a percent of average for your height and sex. ________ %

5. Swimmers and musicians who play wind instruments often find that their vital capacity is above average. Body build, as in a large-boned individual versus a lanky build, can also influence the results. Can you see these effects among others in the lab?