Respiratory System: BREATHING

**Why Breathe?**
- oxygen is necessary for aerobic cellular respiration to generate ATP
- carbon dioxide is a waste product of cellular respiration and must be removed from the body

**3-Step Process** (see Fig. 2, pg. 282)

1. **Breathing** - muscular actions that move air into/out of respiratory passages

2. **Gas Exchange** - movement of gases (O\(_2\) and CO\(_2\)) by diffusion across cell membranes of alveoli (air sacs)

3. **Cellular Respiration** - use of O\(_2\) to produce ATP from glucose; production of CO\(_2\) waste gas

(ER: External Respiration - occurs outside of cells)
(IR: Internal Respiration - occurs inside cells)

**Mechanics of Breathing** (see Fig. 3 and 4, pg. 288)
- intercostal muscles attach from rib above to rib below
- lungs are connected to rib cage and diaphragm by pleural membranes
- between pleural membranes is pleural fluid (water-like fluid)

**Inspiration (Inhalation)**
- intercostal muscles contract pulling rib cage up and out
- diaphragm contracts pulling downwards
- both actions pull on pleural membranes which therefore pull the lungs open
- increased volume in lungs means pressure is reduced (below atmospheric pressure)
- air enters lungs (down pressure gradient)

**Expiration (Exhalation)**
- intercostal muscles and diaphragm relax allowing rib cage to lower and lungs to decrease in size
- reduced volume in lungs means pressure is increased (above atmospheric pressure)
- air is forced out of lungs (down pressure gradient)

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**Homework: Comparative Respiratory Systems**
Make your own notes from pp. 282-284. Include reference to the following in your notes:

- importance of size/surface area in breathing
- earthworm breathing (skin)
- fish breathing (gills and countercurrent exchange)
- insect breathing
- frog breathing
- sketch Fig. 3 (a, b) on pg. 283 and Fig. 5 (blow-up only) on pg. 284