21.7B: Nonrespiratory Air Movements

The lungs have a number of metabolic functions in addition to their functions in gas exchange.

LEARNING OBJECTIVE

Discuss the non-respiratory air movements of the respiratory system

Key Takeaways

Key Points

- The lungs have a number of metabolic functions, such as the secretion of ACE (angiotensin converting enzyme), which converts angiotensin I to angiotensin II to stimulate changes in the renal system.
- Higher levels of ACE lead to higher blood pressure. ACE inhibitors are used to treat hypertension by reducing ACE to reduce blood pressure.
- Airway epithelial cells can secrete a variety of molecules—immunoglobulins (IgA), proteases, reactive oxygen species, and antimicrobial peptides—that all help protect the lungs and body from pathogens.
- Non-respiratory air movements are mechanical functions that aren’t involved in gas exchange, such as voice production and coughing.

Key Terms

- **ACE**: Angiotensin converting enzyme, which is secreted in the lungs and helps to increase blood pressure in the
body through renal system feedback loops.

- **Airway epithelial cells**: Airway epithelial cells can secrete a variety of molecules that aid in the immune system defense of lungs.

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**EXAMPLE**

Non-respiratory air movements do not involve gas exchange. Examples are: sneezing, coughing, burping, laughing, singing, and talking.

While the primary function of the lungs is gas exchange, they have several other functions, which are both metabolic and mechanical. These include the secretion of many enzymes and proteins involved in other body systems and nonrespiratory air movements.

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**Metabolic Functions**

The lungs secrete many enzymes and proteins that serve non-respiratory metabolic functions.

ACE (angiotensin converting enzyme) is an enzyme secreted by the endothelial cells of the capillaries in the lungs. ACE converts angiotensin I into angiotensin II, which are two important hormones in the renin-angiotensin feedback loop of the renal system.

The renin-angiotensin-aldosterone system: The renin-angiotensin-aldosterone system is dependent on ACE from the lungs to regulate blood pressure. ACE activity results in increased blood pressure.

This system works to regulate blood pressure and blood volume by changing the amount of water retained by the kidneys. In general, more ACE leads to more angiotensin II, which leads to more aldosterone, which leads to more retained water through sodium reabsorption in the kidney, which leads to increased blood volume and blood pressure.

ACE inhibitors are a common treatment for those with hypertension, as it will reduce the amount of ACE, which will cause the kidney to excrete more water, which lowers blood volume and blood pressure.

The epithelial cells and macrophages of the lungs secrete many molecules that have immune system functions. In general these molecules have anti-microbial functions.
• Immunoglobin A (IgA): An antibody that can attack pathogens and mark them for phagocytosis from macrophages and neutrophils.

• Protease: Secreted from lung macrophages and neutrophils during inflammatory response to damage pathogens. A fibrinolytic that can break up thrombosis (blood clots) in the lungs.

• Reactive oxygen species (ROS): Free radicals, which are any substance with an unpaired electron in the valence shell, can cause oxidative stress (damage) in cells. They are used to kill pathogens after being engulfed (phagocytized) by immune cells.

• Anti-microbial peptides: Various chemokines and proteins that are secreted by the mucus membranes of the airways. They can damage and inhibit pathogens and are considered a barrier component of the immune system.

### Mechanical Functions

There are several types of non-respiratory air movements that have important functions that are not primarily related to gas exchange. One example is voice production for speaking and singing, which involves fine control over the direction and flow of the air as it passes into the upper respiratory tract.

Other mechanical functions include sneezing and coughing, which protect the lungs and airways from irritants that could potentially cause damage. Coughing is a result of constriction from nervous stimulation in the trachea and larynx and also serves to dislodge mucus trapped inside the lungs.

### LICENSES AND ATTRIBUTIONS

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