Breathing and the Nervous System

by Sophia

WHAT'S COVERED

This lesson focuses on the relationship between breathing and the nervous system. Specifically, this lesson will cover:

1. The Role of the Nervous System

The nervous system plays a role in certain aspects of our breathing, such as muscle movement and frequency of breathing. It can control the intercostal rib muscles (the muscles in between each of your ribs) and your diaphragm. These muscles are important for regulating the pressure in your chest cavity.

The nervous system also can control your frequency of breathing. The frequency of breathing is determined by carbon dioxide levels. The brain is able to detect carbon dioxide levels in the blood and then, depending on what those levels are, adjust your breathing.

↱ EXAMPLE If carbon dioxide levels are high, you will breathe more frequently; if carbon dioxide is low, you need to breathe less frequently.

2. Control of Respiration

Respiration is controlled by your brainstem, which is composed of the medulla oblongata and the pons. Neurons in your medulla act as the pacemakers for breathing. Additionally, they are able to detect and regulate the carbon dioxide and oxygen levels in your blood.

IN CONTEXT

You have seen this regulating happen when you had a moment of increased activity (like exercise). When you exercise, your muscles work harder and your cells produce more carbon dioxide. When more oxygen is needed; your breathing pattern changes. You will have to breathe more heavily and more frequently to take in the oxygen that you need and to get rid of the carbon dioxide that is building up.

Chemoreceptors are a type of sensory receptor that detects chemicals (including carbon dioxide and oxygen) dissolved in gases or liquids (like your blood). They are found in your brain and arteries. The ones found in

your arteries are called **carotid** and **aortic bodies**. As blood passes through these carotid and aortic bodies, they can take an inventory on how much carbon dioxide and how much oxygen are being carried by the blood. It can then be determined if respiration has to change to maintain homeostasis.

While you can control some aspects of breathing, generally most aspects of our breathing are involuntary. You don't need to think about it; your body will breathe on its own. For this to happen, a stimulus has to be detected.

> ↱ EXAMPLE The chemoreceptors in your body detect a rise in carbon dioxide concentration levels, making this a stimulus. To make up for that rise in carbon dioxide, your breathing rate and your tidal volume will change (increase) to maintain homeostasis, which is an example of a negative feedback loop.

TERMS TO KNOW

Chemoreceptors

A sensory receptor that detects chemicals dissolved in liquids or gases.

Carotid Bodies

Located within the carotid artery, carotid bodies are clusters of cells including chemoreceptors; these chemoreceptors are sensitive to changes in blood pH, and are in constant communication with the brainstem via the glossopharyngeal nerve.

Aortic Bodies

Located within the aorta, aortic bodies are clusters of cells that include chemoreceptors; these chemoreceptors detect changes in blood pH and are in constant communication with the brainstem via the vagus nerve.

SUMMARY

The role of the nervous system in respiration is to control muscle movement associated with breathing and the frequency of breath. Your body determines the frequency of breath with chemoreceptors, which measure the amount of carbon dioxide in the blood. You have chemoreceptors in the carotid and aortic bodies as well as the medulla oblongata. While you can control some of this, **control of respiration** is mostly involuntary. When the chemoreceptors detect a stimulus, such as high carbon dioxide levels, they will signal your breathing to become deeper and more frequent.

Keep up the learning and have a great day!

Source: THIS WORK IS ADAPTED FROM SOPHIA AUTHOR AMANDA SODERLIND

TERMS TO KNOW

Aortic Bodies

Located within the aorta, aortic bodies are clusters of cells that include chemoreceptors. These chemoreceptors detect changes in blood pH, and are in constant communication with the brainstem via

the vagus nerve.

Carotid Bodies

Located within the carotid artery, carotid bodies are clusters of cells, including chemoreceptors. These chemoreceptors are sensitive to changes in blood pH, and are in constant communication with the brainstem via the glossopharyngeal nerve.

Chemoreceptors

A sensory receptor that detects chemicals dissolved in liquids or gases.