

# Regulation of Breathing

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## CHAPTER

## 1

# Regulation of Breathing

## Learning Objectives

- Explain how the rate of breathing is regulated.



## What allows you to take a deep breath?

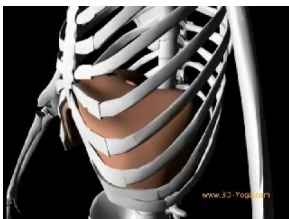
Deep breath in... now blow out those candles. We've all done that. Taking that deep breath in is an active process. You can usually feel your chest move. Why? Obviously, muscles in your chest are doing the work.

## Regulation of Breathing

To understand how breathing is regulated, you first need to understand how breathing occurs.

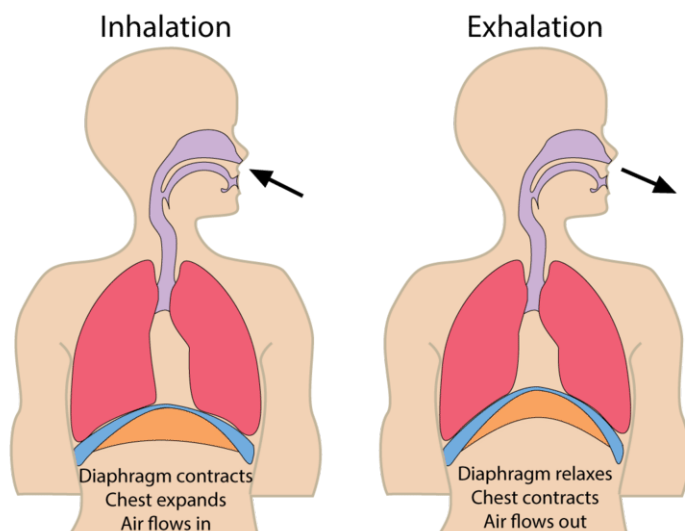
## How Breathing Occurs

**Inhaling** is an active movement that results from the contraction of a muscle called the diaphragm. The **diaphragm** is large, sheet-like muscle below the lungs (see **Figure 1.1**). When the diaphragm contracts, the ribcage expands and the contents of the abdomen move downward. This results in a larger chest volume, which decreases air pressure inside the lungs. With lower air pressure inside than outside the lungs, air rushes into the lungs. When the diaphragm relaxes, the opposite events occur. The volume of the chest cavity decreases, air pressure inside the lungs increases, and air flows out of the lungs, like air rushing out of a balloon.



### MEDIA

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**FIGURE 1.1**

Breathing depends on contractions of the diaphragm.

## Control of Breathing

The regular, rhythmic contractions of the diaphragm are controlled by the brain stem. It sends nerve impulses to the diaphragm through the autonomic nervous system. The brain stem monitors the level of carbon dioxide in the blood. If the level becomes too high, it “tells” the diaphragm to contract more often. Breathing speeds up, and the excess carbon dioxide is released into the air. The opposite events occur when the level of carbon dioxide in the blood becomes too low. In this way, breathing keeps blood pH within a narrow range.

## Summary

- Breathing occurs due to repeated contractions of a large muscle called the diaphragm.
- The rate of breathing is regulated by the brain stem. It monitors the level of carbon dioxide in the blood and triggers faster or slower breathing as needed to keep the level within a narrow range.

## Review

1. Explain why contraction of the diaphragm causes the lungs to fill with air.
2. Explain how the rate of breathing is controlled.

## References

1. Hana Zavadska. [CK-12 Foundation](#) . CC BY-NC 3.0

2. Zachary Wilson;Hana Zavadska. [CK-12 Foundation](#) . CC BY-NC 3.0

