

Section 3: Cell Communication

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Bellringer

Write several sentences that describe where hormones are produced, how they reach the cells they stimulate, and how those target cells recognize the hormones.

Key Ideas

- How do cells use signal molecules?
- How do cells receive signals?
- How do cells respond to signaling?

Sending Signals

- We communicate in many ways to share information.
- Cells in both multicellular and unicellular organisms need to communicate in order to coordinate activities.
- Cells use various methods of communication.
- These methods vary depending on whether the target is specific or general. They also depend on whether the target is nearby or far away.

Sending Signals, *continued*

- Cells communicate and coordinate activity by sending chemical signals that carry information to other cells.
- A *signaling cell* produces a **signal**, often a molecule, that is detected by the *target cell*.
- Typically, target cells have specific proteins that recognize and respond to the signal.

Sending Signals, *continued*

- Neighboring cells can communicate through direct contact between their membranes.
- Short-distance signals may act locally, a few cells away from the originating cell.
- Long-distance signals are carried by hormones and nerve cells.
- Hormones are signal molecules that are made in one part of the body.

Sending Signals, *continued*

- Hormones are distributed widely in the bloodstream throughout the body, but they affect only specific cells.
- Nerve cells also signal information to distant locations in the body, but their signals are not widely distributed.
- While most signal molecules originate within the body, some signals come from outside. For example, light has a great effect on the action of hormones in plants. The length of day determines when some plants flower.

Receiving Signals

- A target cell is bombarded by hundreds of signals. But it recognizes and responds only to the few signals that are important for its function.
- This response to some signals, but not to others, is made possible by **receptor proteins**, such as the ones in the cell's membrane.
- A receptor protein binds specific substances, such as signal molecules.

Receiving Signals, *continued*

- The outer part of the receptor protein is folded into a unique shape, called the *binding site*. A receptor protein binds only to signals that match the specific shape of its binding site.
- Only the “right” shape can fit into the receptor protein while the “wrong” shape have no effect on that particular receptor protein.
- A cell may also have receptor proteins that bind to molecules in its environment.

Binding Site of Receptor Proteins

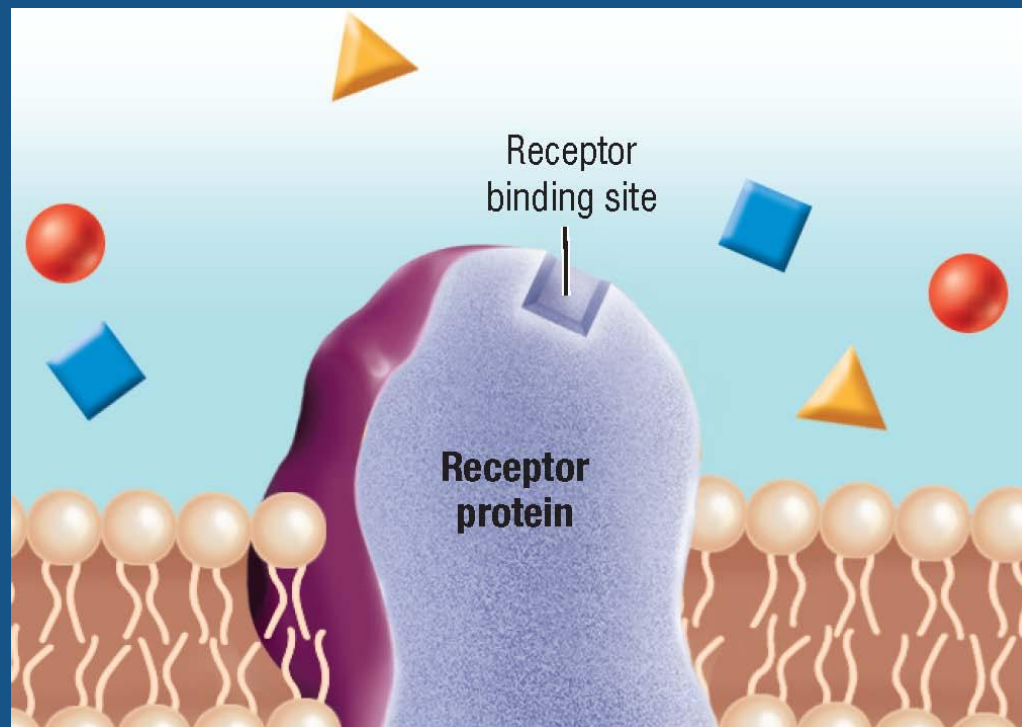


Figure 12 The binding site of this receptor protein has a specific shape to which only one type of signal molecule can bind. ➤ Which of these molecules would bind with the receptor?

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Receiving Signals, *continued*

- Receptor proteins enable a cell to respond to its environment.
- Once it binds the signal molecule, the receptor protein changes its shape in the membrane.
- This change in shape relays information into the cytoplasm of the target cell.

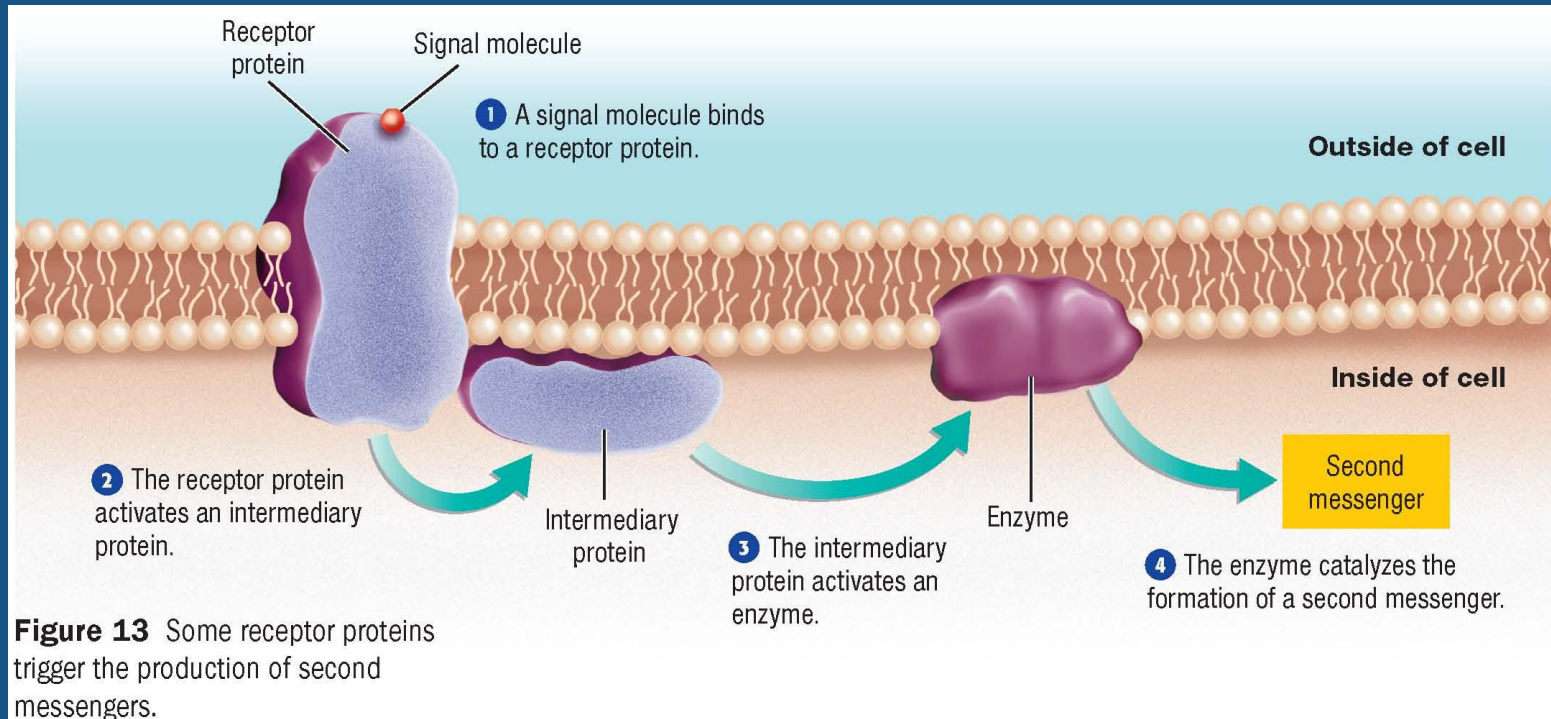
Responding to Signals

- When a signal molecule binds to a receptor protein, the protein changes shape, which triggers changes in the cell membrane.
- The cell may respond to a signal by changing its membrane permeability, by activating enzymes, or by forming a second messenger.
- Transport proteins may open or close in response to a signal.

Responding to Signals, *continued*

- Some receptor proteins are enzymes or they activate enzymes in the cell membrane. Enzymes trigger chemical reactions in the cell.
- Binding of a signal molecule outside the cell may cause a second messenger to form. The **second messenger** acts as a signal molecule within the cell and causes changes in the cytoplasm and nucleus.

Second Messengers of Receptor Proteins



Summary

- Cells communicate and coordinate activity by sending chemical signals that carry information to other cells.
- A receptor protein binds only to the signals that match the specific shape of its binding site.
- The cell may respond to a signal by changing its membrane permeability, by activating enzymes, or by forming a second messenger.