

Cell Communication - Advanced

Douglas Wilkin, Ph.D.
Niamh Gray-Wilson

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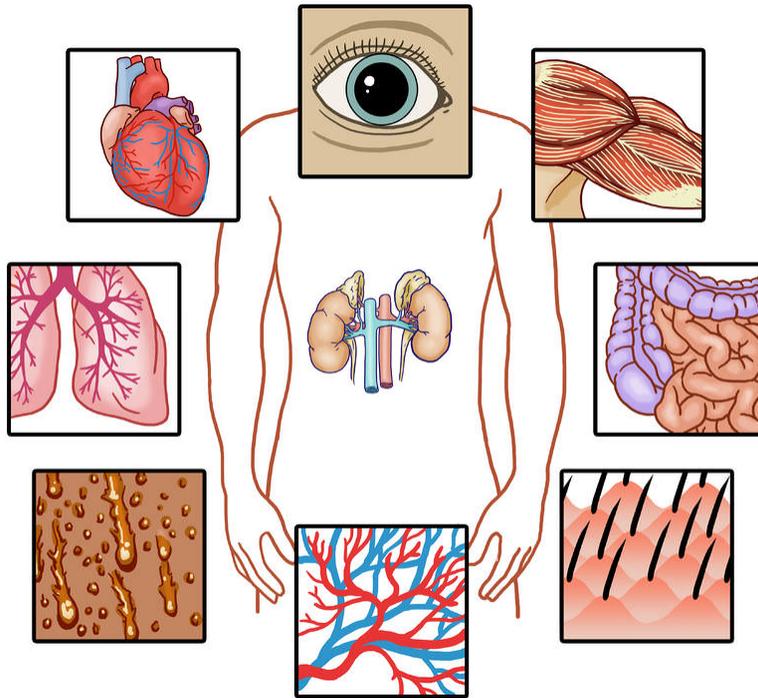
Douglas Wilkin, Ph.D.

Niamh Gray-Wilson

CHAPTER 1

Cell Communication - Advanced

- Describe what is meant by *cell communication*.



What does adrenaline do?

Adrenaline, or epinephrine, is a hormone and a neurotransmitter. It increases heart rate, constricts blood vessels, dilates air passages, and participates in the fight-or-flight response of the sympathetic nervous system. Adrenaline is produced in the adrenal medulla of the adrenal gland. So how does it effect processes all over the body?

The Language of Cells

To survive and grow, cells need to be able to communicate with their neighboring cells and be able to detect change in their environment. "Talking" with neighboring cells is even more important to a cell if it is part of a multicellular organism. Cell communication, or **cell signaling**, is the basis of development, tissue repair, and immunity. It is also necessary for normal tissue homeostasis. The trillions of cells that make up your body need to be able to communicate with each other to allow your body to grow, and to keep you alive and healthy. The same is true for any organism. Cell signaling is part of a complex system of communication that governs basic cellular activities and coordinates cell actions. Cell signaling is a major area of research in biology today. Defects in cell signaling are associated with diseases such as cancer, autoimmunity, and diabetes.

Recently scientists have discovered that many different cell types, from bacteria to plants, use similar types of communication pathways, or cell-signaling mechanisms. This suggests that cell-signaling mechanisms evolved long before the first multicellular organism did.

For cells to be able to signal to each other, a few things are needed:

- a signal,
- a **cell receptor**, which is a protein usually on the plasma membrane, but can be found inside the cell,
- a response to the signal.

Cells that are communicating may be right next to each other or far apart. In **juxtacrine signaling**, also known as contact-dependent signaling, two adjacent cells must make physical contact in order to communicate. Cell communication may also occur over short distances, which is known as **paracrine signaling**, or over large distances, which is known as **endocrine signaling**.

The type of chemical signal a cell will send differs depending on the distance the message needs to go. For example, **hormones**, ions, and **neurotransmitters** are all types of signals that are sent depending on the distance the message needs to go. Endocrine signals are hormones, produced by endocrine organs. These signals travel through the blood stream to reach all parts of the body.

The target cell then needs to be able to recognize the signal. Chemical signals are received by the target cell on receptor proteins. Most receptor proteins are found associated with the plasma membrane, but some are also found inside the cell. Receptor proteins are very specific for only one particular signal molecule, much like a lock that recognizes only one key. Therefore, a cell has lots of receptor proteins to recognize the large number of cell signal molecules. There are three stages to sending and receiving a cell "message:" reception, transduction, and response.

1. Reception occurs when a ligand binds to its receptor.
2. Through transduction, the signal is then internalized. The ligand does not have to be internalized for this process to occur.
3. The response may initiate a cascade of reactions including the activation/deactivation of enzymes and/or an alternation in gene transcription.

Summary

- Cell communication or cell signaling describes how cells share information.
- Cell communication usually begins when a molecule (a ligand) binds to its receptor.
- Cell communication can be over short or long distances.

Review

1. Define cell communication.
2. Compare juxtacrine, paracrine, and endocrine signaling.
3. Describe the process of cell signaling.