



**Endocrine & Cell Communication Part I:
Introduction to Communication**




Why do cells need to communicate?

- There are many reasons, so name a few.





Signal Transduction Animation

- Click on this link to access the animation:
http://www.wiley.com/college/boyer/0470003790/animations/signal_transduction/signal_transduction.htm




How does a cell communicate?

He uses a cell phone.
HA HA HA

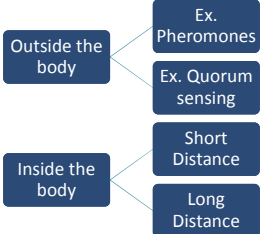




Why do cells need to communicate?

- Here are a few reasons:
 - Coordinate activities in multicellular organisms
 - Hormone actions
 - Cell recognition
 - To find mates (yeast cells)
 - Turn pathways on/off
 - apoptosis




Chemical Communication


AP Biology Curriculum Framework

- Enduring Understanding 3.D Cells communicate by generating, transmitting and receiving chemical signals.
- EK 3D1: Cell communication processes share common features that reflect a shared evolutionary history.
 - C. In single-celled organisms, signal transduction pathways influence how the cell responds to its environment.
 - D. In multicellular organisms, signal transduction pathways coordinate the activities within individual cells that support the function of the organism as a whole.




Evolutionary ties of cell communication

- Cell-to-cell communication is everywhere in biological systems from Archaea and bacteria to multicellular organisms.
- The basic chemical processes of communication are shared across evolutionary lines of descent.
- Signal transduction is an excellent example



Pheromones

- Members of the same animal species sometimes communicate with **pheromones**, chemicals that are released into the environment.
- Pheromones serve many functions, including marking trails leading to food, defining territories, warning of predators, and attracting potential mates.
- Here's an example of a termite following a "manmade" trail: <http://edutube.org/en/video/termites-and-pheromones-ink-trails>



Quorum sensing

- Quorum sensing in bacteria – single celled bacteria monitor their environment by producing, releasing and detecting hormone-like molecules called autoinducers.

Source: *Quorum Sensing* (2002) by *Quorum Sensing* (2002) *Quorum Sensing* (2002) *Quorum Sensing* (2002) *Quorum Sensing* (2002)

Direct Contact Communication

Ex. Plant cells communicate directly through openings called plasmodesmata.

Autocrine signals

- These chemicals affect the same cells that release them.
 - Ex. Interleukin-1 produced by monocytes and can bind to receptors on the same monocyte.
 - Tumor cells reproduce uncontrollably because they self-stimulate cell division by making their own division signals.

Chemical Communication

Short Distance Communication

- Paracrine signals diffuse to and affect nearby cells
 - Ex. Neurotransmitters
 - Ex. Prostaglandins

Long Distance Communication

- Endocrine hormones via signal transduction pathway:
 - Reception
 - Transduction
 - Response

AP Biology Curriculum Framework

EK 3.D.2 Cells communicate with each other through direct contact with other cells or from a distance via chemical signaling.

- Cells communicate by cell-to-cell contact.
- Cells communicate over short distances by local regulators that target cells in the vicinity of the emitting cell.
- Signals released by one cell type can travel long distances to target cells of another type.

Neurotransmitters and Neurohormones

Long Distance Communication

- Endocrine hormones via signal transduction pathway:

Hormones

- Endocrine glands produce hormones which are
 - Chemical signals
 - Transported in tissue fluids
 - Detected only by target cells

(a) Endocrine signaling

Communication Features

- Secreting cell** - releases the signal
- Signal** = chemical = ligand
- Receptor** - accepts and temporarily joins with the ligand forming receptor/ligand complex
- Target cell** - contains the receptor

$g = 9.8 \text{ m/s}^2$
 $x = -h \pm \sqrt{b^2 - 4ac}$
 $\int t^n dt$
 $\int \frac{1}{x} dx = \ln|x| + C$
 $\sin^2 x$
 $a^2 - 2ab + b^2 = (a-b)^2$
 $(a-b)^2 = a^2 - 2ab + b^2$
 $E = mc^2$

NATIONAL MATH + SCIENCE INITIATIVE

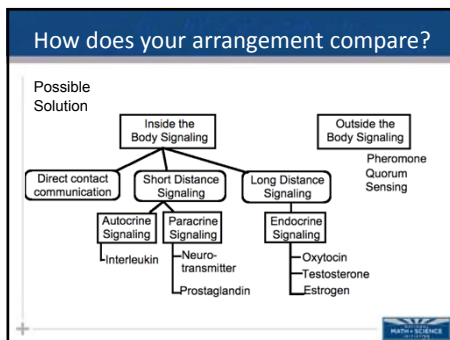
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Practice: Use the labels provided to create a cell communication graphic organizer.

Long Distance Signaling	Pheromone	Autocrine Signaling	Oxytocin
Short Distance Signaling	Quorum Sensing	Interleukin	Neuro-transmitter
Outside the Body Signaling	Paracrine Signaling	Prostaglandin	Direct contact communication
Inside the Body Signaling	Endocrine Signaling	Testosterone	Estrogen

Apply the features

- Insulin is secreted by beta cells of the pancreas. Once secreted, insulin travels around the body. When insulin docks with an integral protein on the membrane of a muscle cell, glucose can enter the cell.
- What is the secreting cell, the target cell, ligand, and the receptor?



Next time: Endocrine System