

Introduction to Cell Communication

Packet #5

Why Communication Between Cells is Important

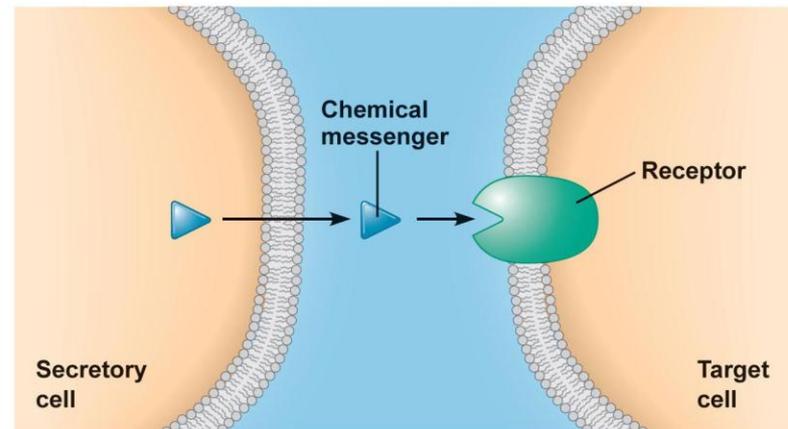
- ◆ A typical free-living cell must be able to
 - ◆ Sniff out nutrients
 - ◆ Sense the difference between light and dark
 - ◆ Detect and avoid poisons and predators
- ◆ Cells must also be able to communicate to provide long range integration of metabolism.
- ◆ Therefore, cells must be able to communicate with each other.

Players of Cell Signaling

The slide features a solid blue background. At the bottom, there are several overlapping, wavy, light blue shapes that create a sense of movement and depth, resembling stylized waves or a modern graphic design element.

The Players

- ◆ The Signal
- ◆ Signaling Cell
 - ◆ Cell sending the message
- ◆ Target Cell
 - ◆ Cell receiving the message
- ◆ Ligand
 - ◆ Molecule such as a hormone or a neurotransmitter that binds to a specific site on a protein (receptor protein)
- ◆ Receptor Protein*
 - ◆ Recognizes and responds specifically to the signal molecule
 - ◆ Performs the first step in a series of transduction processes at the receiving end

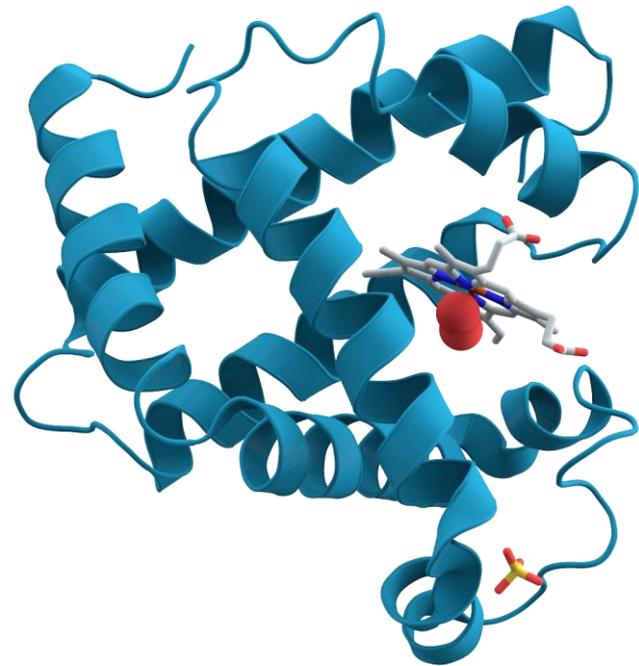


(b) Communication via chemical messengers

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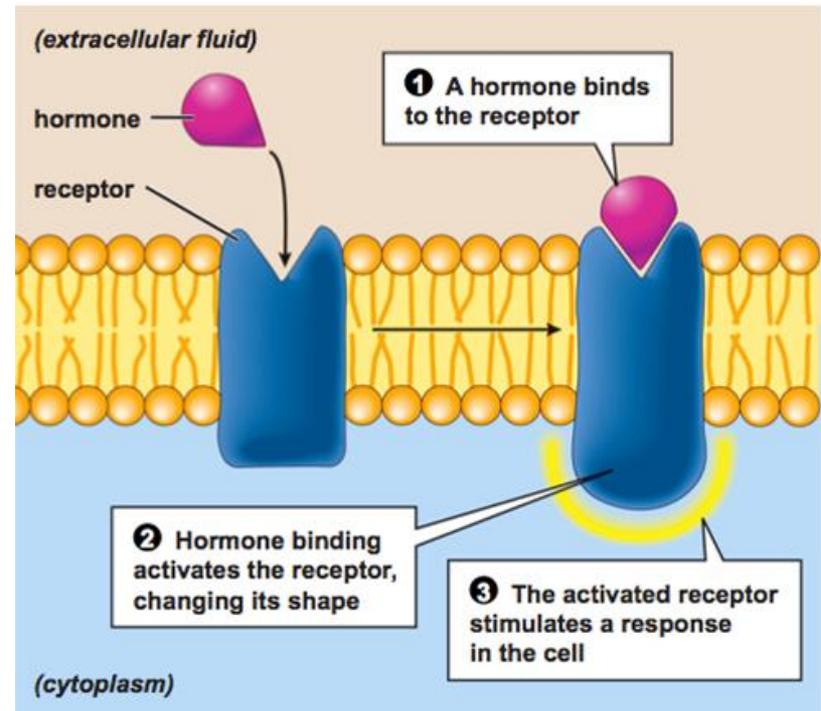
Molecules Used As Signals

- * Proteins
- * Peptides
- * Amino Acids
- * Nucleotides
- * Steroids
- * Fatty Acid Derivatives
- * Dissolved Gases



Target Cell

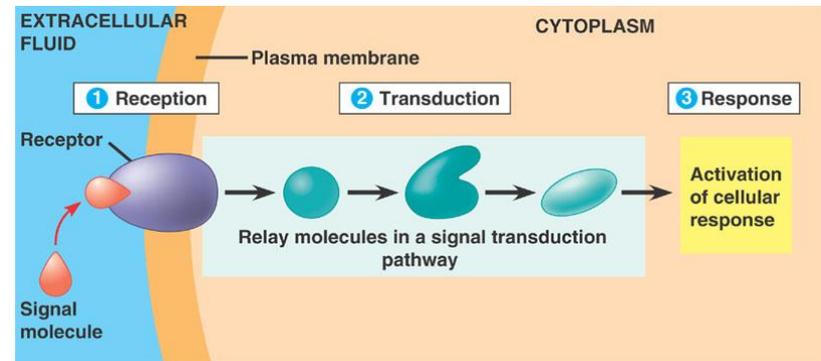
- * Contain receptor proteins in the cell membrane
- * Recognizes and responds specifically to the signal molecule
- * Performs the first step in a series of **transduction processes** at the receiving end



General Steps of Cell Signaling

Three Steps

- * Three Steps
 - * Signal reception
 - * Transduction
 - * Response

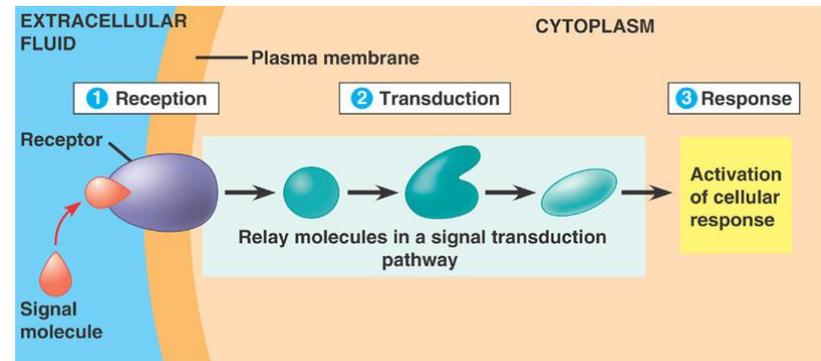


Signal Reception & Types of Receptors

Step One

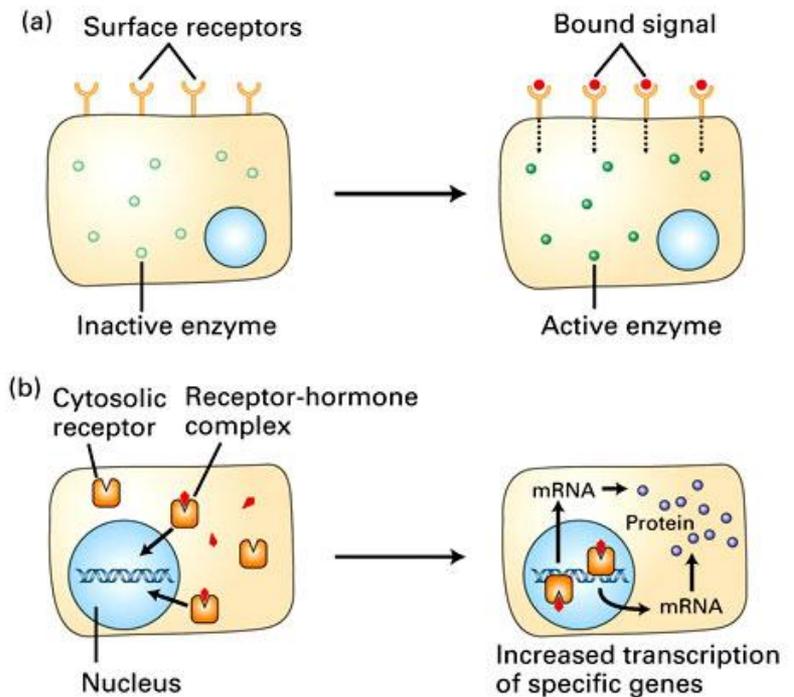
Signal Reception

- * Cells are stimulated by an extracellular signal
- * Signal binds to, and activates, a receptor protein
- * Each receptor protein recognizes a specific signal molecule
 - * Once signal is recognized, a new intracellular signal is generated.
 - * This is the first step of transduction



Types of Receptors I

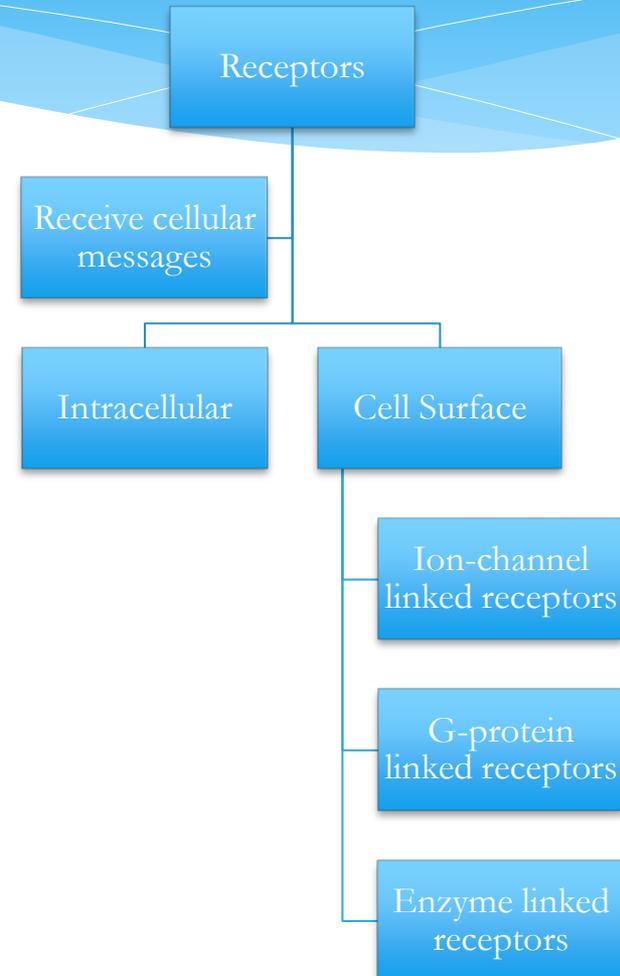
- * There are two basic mechanisms by which chemical signals cause a biologic effect within the cell
- * Hence there are two types of receptors
 - * **Intracellular receptors**
 - * Inside the cell
 - * **Cell surface receptors**
 - * Found on the surface of the cell



Types of Receptors II

Classes of Cell-Surface Receptors

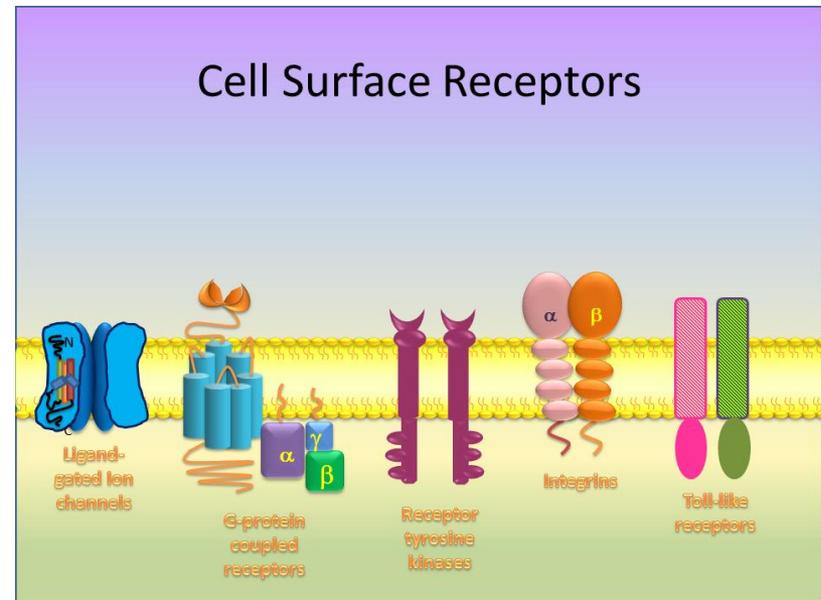
- * Three classes
 - * Ion-channel linked receptor
 - * **G-protein linked receptor**
 - * Enzyme-linked receptor



Types of Receptors III

Cell Surface Receptors

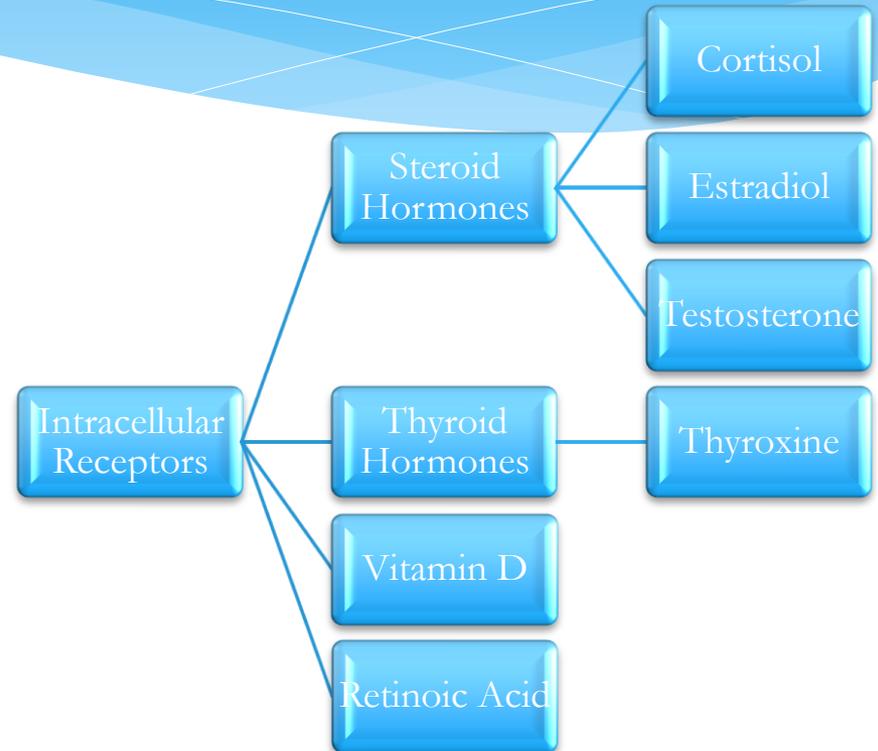
- * Largest class of receptors
- * Used for signals that **are too large or too hydrophilic to cross the plasma membrane**
- * Lie in the plasma membrane of the cell
- * Relays message across the membrane



Types of Receptors IV

Intracellular Receptors I

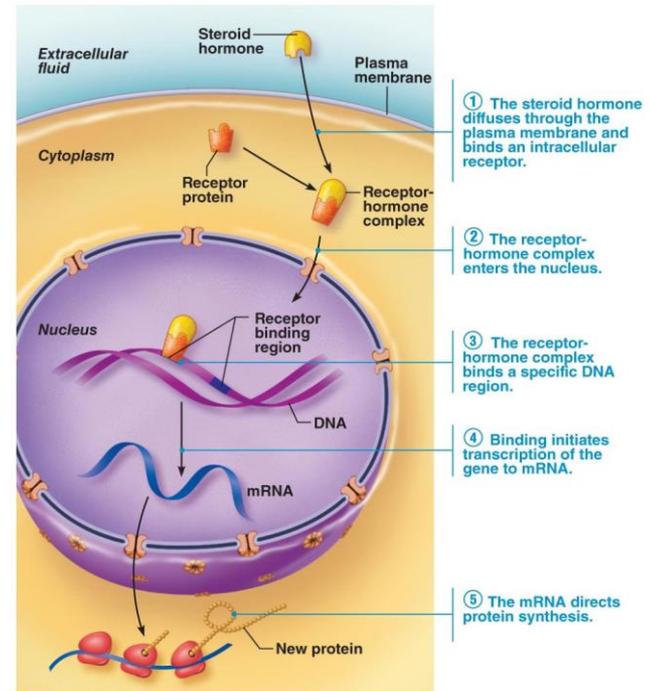
- ◆ Used for molecules that are sufficiently **small and hydrophobic** to **diffuse across the cell membrane**
 - ◆ Best known hydrophobic signal molecules
 - ◆ **Steroid hormones**
 - ◆ Cortisol
 - ◆ Estradiol
 - ◆ Testosterone
 - ◆ **Thyroid hormones**
 - ◆ Thyroxine
 - ◆ **Vitamin D**
 - ◆ **Retinoic Acid**



Types of Receptors V

Intracellular Receptors II

- * Receptors lie in the interior of the target cell either within the cytosol or nucleus.
- * More details to come later.

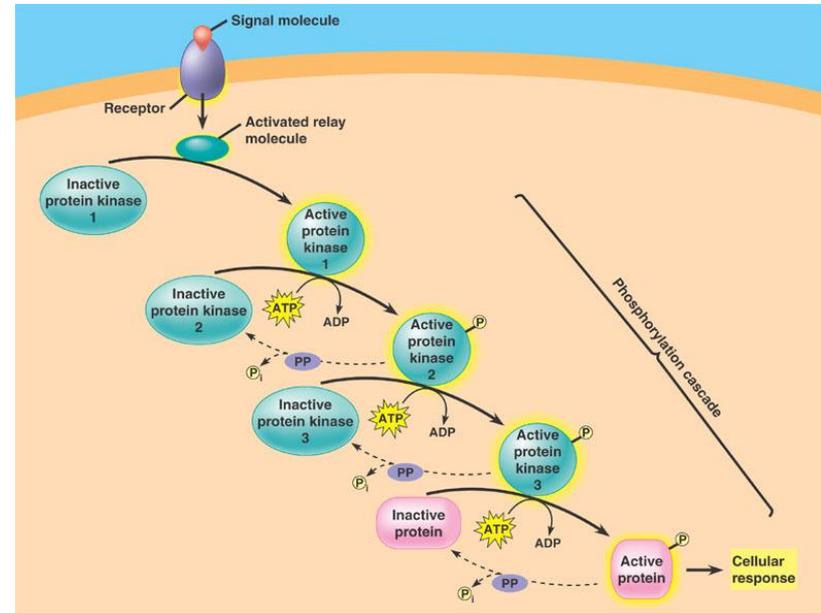


Signal Transduction & Transduction Pathways

Step Two

Signal Transduction

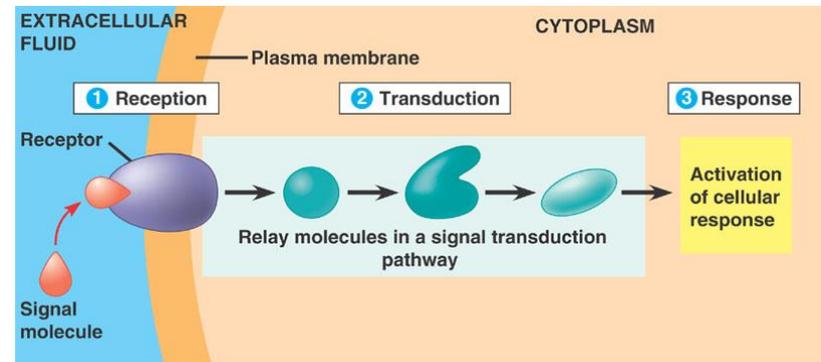
- * Signal transduction is the continuation and/or conversion of signals from one form to the next.
- * The signals, although sometimes in different forms, represent the same information.
- * **Unique when utilizing steroids and hormones.**



Response

Step Three Response

- * The ultimate response to the signal that started the process.



Review