

CELL AND MOLECULAR BIOLOGY

I M.Sc ZOOLOGY

BY

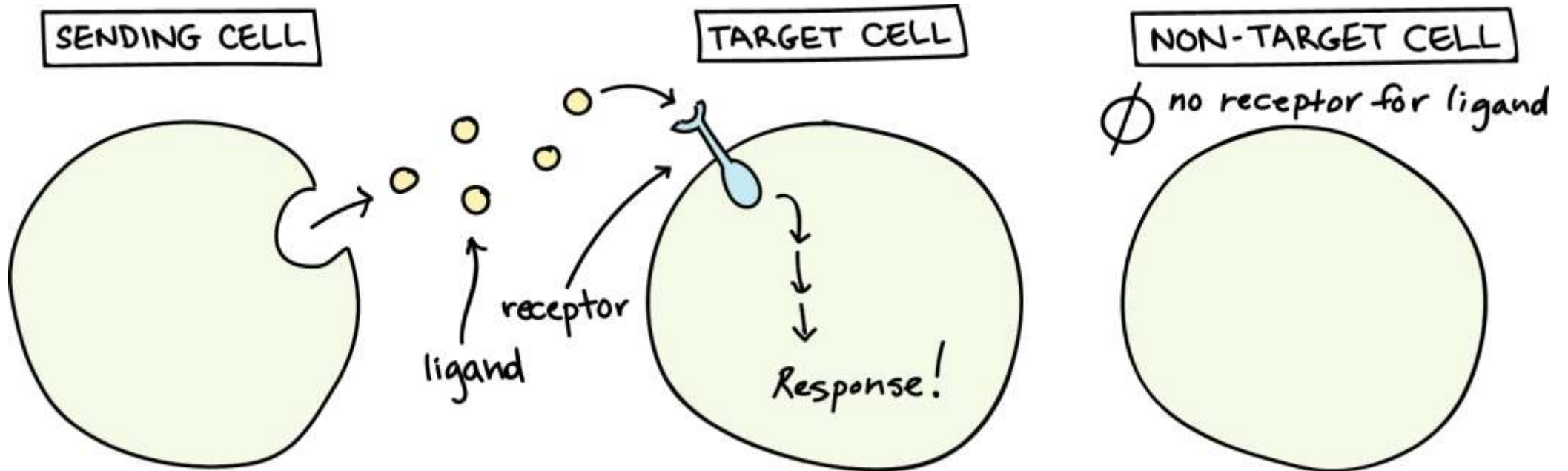
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CELL-CELL SIGNALING MECHANISMS

Cell-Cell Signaling Mechanisms

- Cell-cell signaling involves the transmission of a signal from a sending cell to a receiving cell
- However, not all sending and receiving cells are next door neighbours, nor do all cell pairs exchange signals in the same way
- There are five basic mechanisms of chemical signaling found in multicellular organisms:
 - ❖ Paracrine signaling
 - ❖ Synaptic signaling
 - ❖ Autocrine signaling
 - ❖ Endocrine signaling
 - ❖ Signaling by direct contact

- The main different between the different categories of signaling is the distance that the signal travels through the organism to reach the target cell



❖ Paracrine signaling

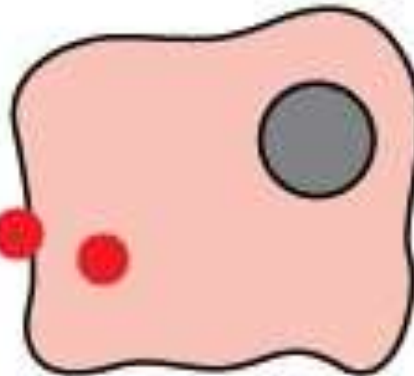
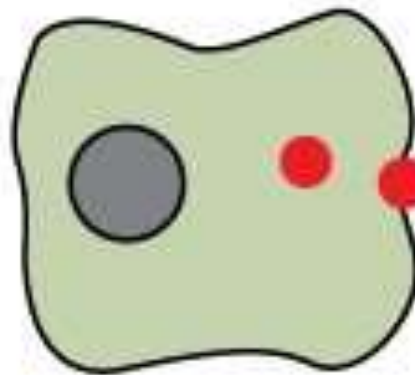
- Often, cells that are near one another communicate through the release of chemical messengers
- Ligands that can diffuse
- This type of signaling, in which cells communicate over relatively short distance, is known as paracrine signaling
- Paracrine signaling allows cells to locally co-ordinate activities with their neighbours
- Example:

Spinal cord development

Paracrine

A cell targets a nearby cell.

Signaling
cell

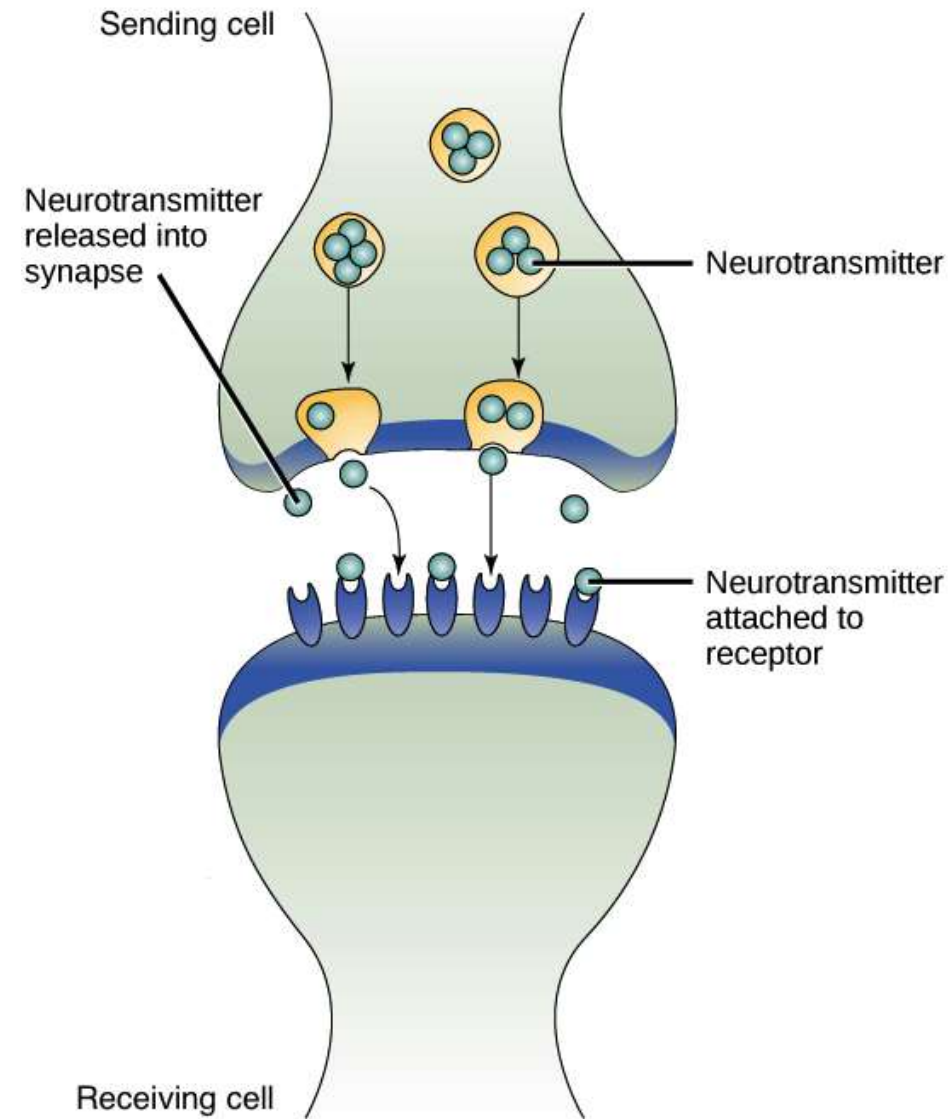


Target
cell

❖ **Synaptic signaling**

- One unique example of paracrine signaling is synaptic signaling, in which nerve cells transmit signals
- This process is named for the synapse, the junction between two nerve cells where signal transmission occurs
- When the impulse reaches the synapse, it triggers the release of ligands called neurotransmitters, which quickly cross the small gap between the nerve cells
- When the neurotransmitters arrive at the receiving cell, they bind to receptors and cause a chemical change inside of the cell

- The neurotransmitters that are released into the chemical synapse are quickly degraded or taken back up by the sending cell
- This resets the system so the synapse is prepared to respond quickly to the next signal

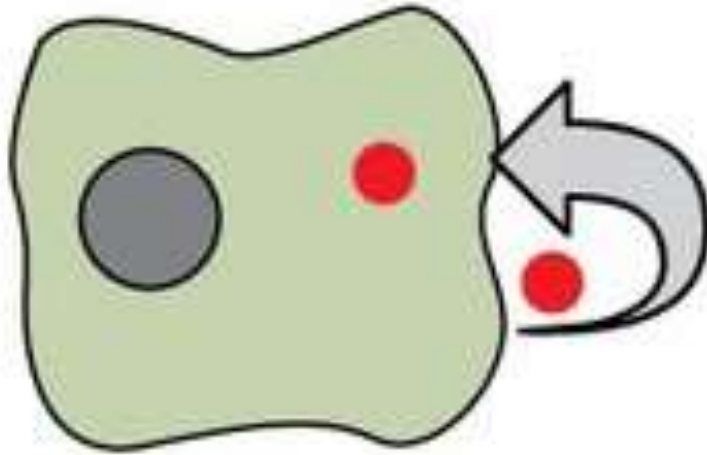


❖ **Autocrine signaling**

- In autocrine signaling, a cell signals to itself, releasing a ligand that binds to receptors on its own surface
- From a medical standpoint, autocrine signaling is important in cancer and is thought to play a key role in metastasis
- In many cases, a signal may have both autocrine and paracrine effects, binding to the sending cell as well as other similar cells in the area

Autocrine

A cell targets itself.

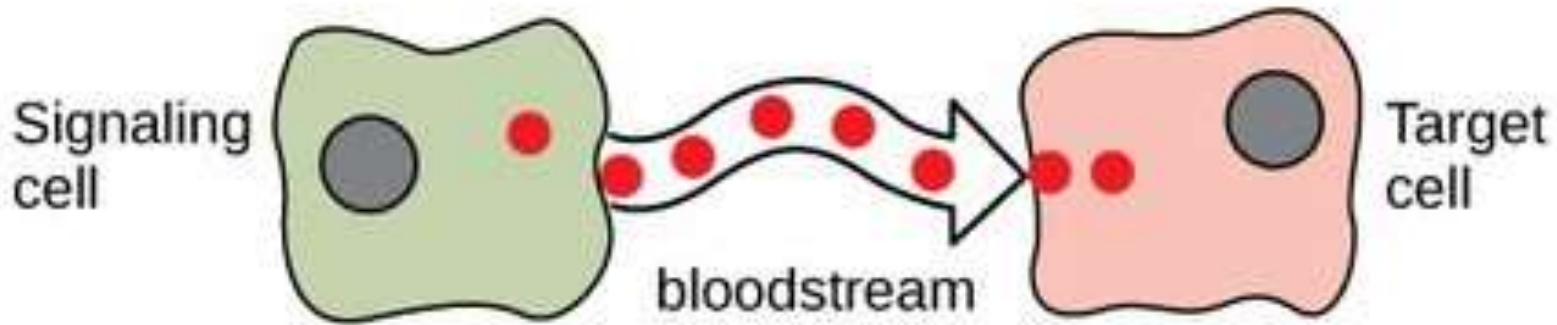


❖ Endocrine signaling

- In long distance endocrine signaling, signals are produced by specialized cells are released into the blood stream, which carries them to target cells in distant parts of the body
- Signals that are produced in one part of the body and travel through the circulation to reach far away targets are known as hormones

Endocrine

A cell targets a distant cell through the bloodstream.



❖ **Signaling by direct contact**

- Gap junctions in animals and plants are tiny channels that directly connect neighbouring cells
- These water-filled channels allow small signaling molecules called intra cellular mediators, to diffuse between the two cells
- Small molecules, such as calcium ions are able to move between cells, but large molecules like proteins and DNA cannot fit through the channels without special assistance
- This allows a group of cells to co ordinate their response to a signal that only one of them may have received

Signaling across gap junctions

A cell targets a cell connected by gap junctions.

