CELL AND MOLECULAR BIOLOGY

Cell signaling

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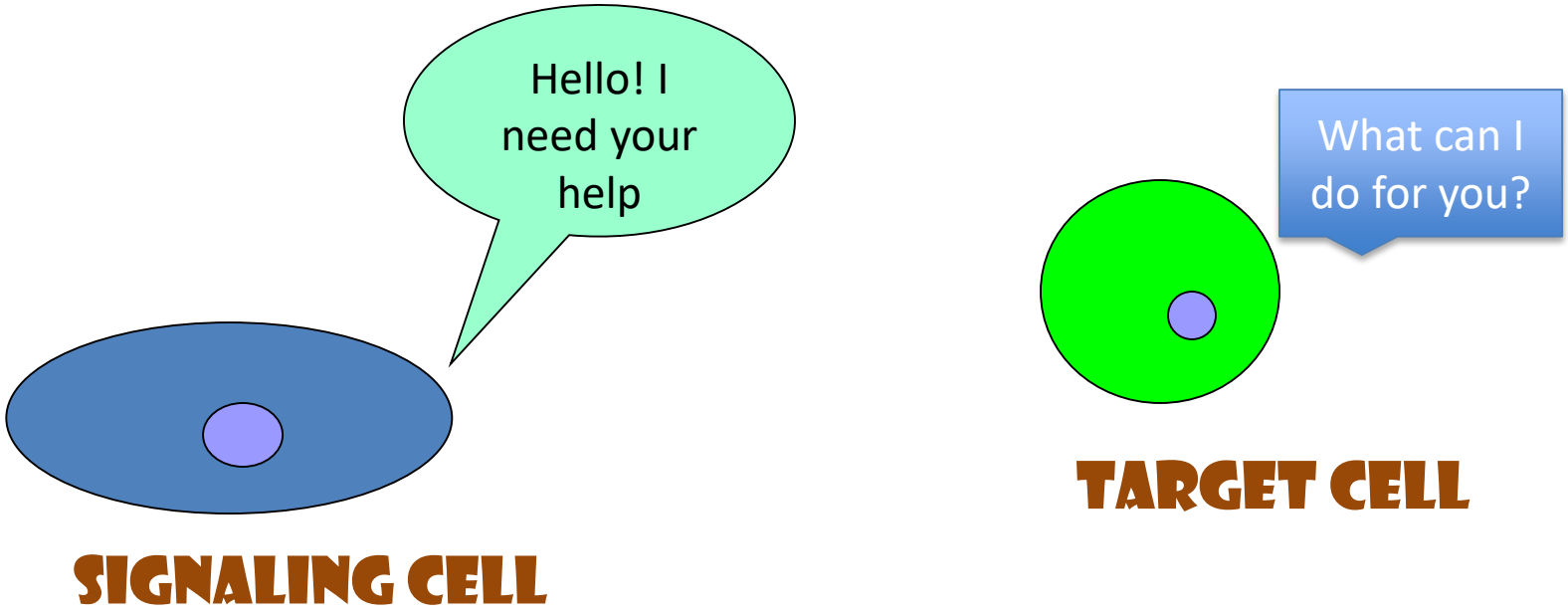
Cells communicate with each other through signaling molecules



Cells that produce the signaling molecule are referred to as signaling cells

Cells that receive the signal are target cells

keywords

- Signal transduction
- Signaling cell
- Extracellular signal molecule
- Target cell
- Intracellular signaling molecules
- Receptors and ligand

Signaling Overview

- ***Signaling:*** Cell-cell communication via signals.
- ***Signal transduction****:* Process of converting extracellular signals into intra-cellular responses.
- ***Ligand:*** The signaling molecule.
- ***Receptors****:* Bind specific ligands. Transmit signals to intracellular targets. Different receptors can respond differently to the same ligand.

Types of signaling

1. **Contact-dependent** - via proteins on the membrane
2. **Secreted Signals:**

- Autocrine - via growth factors, cell that releases the signal is also the target.
- Paracrine - via neurotransmitters and cytokines, action on adjacent target cells.
- Endocrine - via hormones, action on distant target cells.
- Synaptic - via neurotransmitters, action on post-synaptic cell in response to electrical stimuli

Autocrine signalling

In some cases, cells can respond to the local mediators that they themselves produce.

Cancer cells sometimes promote their own survival and proliferation in this way.

For example, an endocrine gland in the pancreas that produces insulin regulates glucose uptake in cells all over the body.

Paracrine Signaling

Paracrine signals are released by cells into the extracellular fluid in their neighborhood and act locally.

For example; inflammation at the site of an infection

Synaptic signaling

Neuronal signals are transmitted electrically along a nerve cell axon. When this electrical signal reaches the nerve terminal, it causes the release of neurotransmitters onto adjacent target cells.

Extracellular signal molecules bind either to cell through:

i) surface receptors
ii) intracellular enzymes or receptors.

Receptors

- Receptors are generally transmembrane proteins, which bind to signaling molecules outside the cell and subsequently transmit the signal through a sequence of molecular switches to internal signaling pathways.

Cell-Surface Receptors

Cell-Surface Receptors Relay Extracellular Signals via Intracellular Signaling Pathways

Cell-Surface Receptors

1. Ion-channel-coupled
2. G-protein-coupled receptors
3. Enzyme-coupled receptors

Enzyme-coupled cell-surface receptors

1. Receptor tyrosine kinases
2. Tyrosine-kinase-associated receptors
3. Receptor serine/threonine kinases
4. Histidine-kinase-associated receptors
5. Receptor guanylyl cyclases
6. Receptor-like tyrosine phosphatases