Hormone Signalling

Hormone signaling involves the following steps
1) Biosynthesis of a particular hormone in a particular tissue
2) Storage and secretion of the hormone.
3) Transport of the hormone to the target cells.
4) Recognition of the hormone by an associated cell membrane or intracellular receptor protein.

The 4 types of cell signaling or chemical signaling found in multicellular Organisms are
(1) Paracrine Signaling
(2) Endocrine Signaling
(3) Autocrine Signaling and
(4) direct signaling across gap Junctions

Paracrine signaling involves a form of cell signaling in which the target cell is near the signal releasing cell. Paracrine signals move by diffusion through the extracellular matrix. These types of signals usually elicit quick responses that lasts only a short amount of time. In order to keep the response localized, Paracrine ligand molecules are normally quickly degraded by enzymes or removed by neighboring cells. Removing the signals will re establish the concentration gradient for the signal, allowing them to quickly diffuse through the intracellular space if released again.

One example of paracrine signaling is transfer of signals across synapses between nerve cells. A synaptic signal

is a chemical signal that travel between nerve cells, Signals within the nerve cells are propagated by fast moving electrical impulses. When these impulses reach the end of the axon, the signal continues on to a dendrite of the next cell by the release of chemical ligands called neurotransmitters by the pre synaptic cell (the cell emitting the signal). The neurotransmitters are transported across the very small distances between nerve cells which are called chemical synapses. The small distances between nerve cells allow the signal to travel quickly. This enables an immediate response.

Endocrine Signaling - Signals from distant cells are called endocrine signals, they originate from endocrine cells. In the body many endocrine cells are located in endocrine glands, such as the thyroid gland, the hypothalamus and the pituitary gland. These types of signals usually produce a slower response, but have a longer lasting effect. The ligands released in endocrine signaling are called hormones. Signaling molecules that are produced in one part of the body, but affect other body regions some distance away.

Hormones travel the large distances between endocrine cells and their target cells via blood stream, which is a relatively slow way to move throughout the body. Because of their form of transport hormones get diluted and are present in low concentrations when they act on their target cells. This is different from paracrine signaling in which local concentration of ligands can be very high.

Autocrine Signaling – Autocrine signals are produced by signaling cells that can also bind to the ligand that is released. This means the signaling cells and the target cell can be the same or similar cells. This type of signaling often occurs during the early development of an organism to ensure that cells develop into the correct tissues and take on the proper function. Autocrine signaling also regulates pain sensation and inflammatory responses. Further if a cell is infected with a virus, the cell can signal itself to undergo programmed cell death killing the virus in the process. In some cases, neighboring cells of the same type are also influenced by the released ligand. In embryological development, this process of stimulating a group of neighboring cells may help to direct the differentiation of identical cells into the same cell type, thus ensuring the proper developmental outcome.

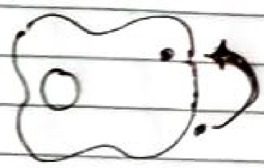
Direct Signaling Across Gap Junctions –

Gap junctions in animals and plasmodesmata in plants are connections between the plasma membrane of neighboring cells. These water filled channels allow small signaling molecules, called intracellular mediators, to diffuse between the two cells. Small molecules, such as calcium ions (Ca^{2+}) are able to move between cells, but large molecules, like proteins and DNA, cannot fit through the channels. The specificity of the channels ensures that the cells remain independent, but can quickly relay and

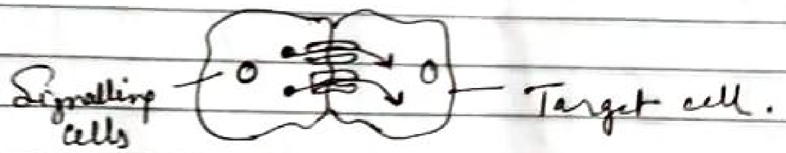
easily transmit signals. The transfer of signaling molecules communicates the current state of the cell that is directly next to the target cell, this allows a group of cells to co-ordinate their response to a signal that only one them may have recieved. In plants plasmodiamala are ubiquitous, making the entire plant into a giant communication network.

Forms of chemical Signaling

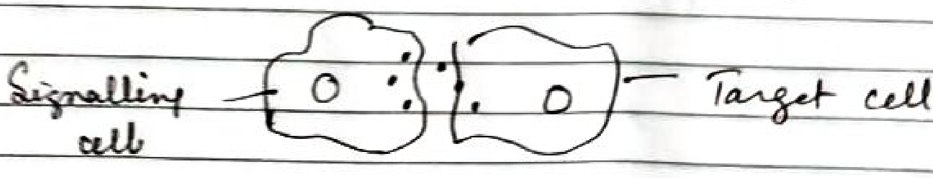
Autocrine | A cell targets itself



Signalling across gap Junction |



Paracrine | A cell targets a nearby cell



Endocrine | A cell targets a distant cell through the blood stream

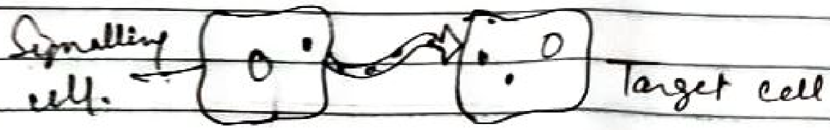


fig showing forms of chemical Signalling.

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