**PATHOLOGY 1**

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**Lecture 3**

**CELL PHYSIOLOGY**

**Cell communication**

Cells communicate by sending and receiving signals. Signals may come from the environment, or they may come from other cells. In order to trigger a response, these signals must be transmitted across the cell membrane. Sometimes the signal itself can cross the membrane. Other times the signal works by interacting with receptor proteins that contact both the outside and inside of the cell. In this case, only cells that have the correct receptors on their surfaces will respond to the signal.

Cell membrane have receptors which function by binding the signals molecule (ligand) and causing the second signal/second messenger that thus causes cellular response.

Examples of membrane receptors include *Receptor Tyrosine Kinase & G Protein-Coupled Receptors.*

Intracellular receptors are found in the cell,either in cytoplasm or in the nucleus of target cell Signal transduction pathway often involve the addition or removal of phosphate groups which results In the activation of proteins.

Protein kinase are enzymes that transfer phosphate group from ATP to protein kinase pathway.

Protein phosphatases are enzymes that can rapidly remove phosphate groups from proteins (dephosphorylation) and thus inactivate protein kinase.

Cellular communication is a stepwise process that involves *1). Generation of extrinsic signal🡪 2). Signal detection by receptors🡪 3).transduction of signal 🡪 4). Cellular response*

Cell signaling leads to:-

* Regulation of genes
* Regulate proteins activity
* Cell division or apoptosis
* Metabolism such as catalyzing breakdown of glycogen

There are 4 major types of signaling:-

1. ***Paracrine*** – cell signal induce changes in nearby cells altering their behaviours. Examples in transfer of signals across synapses btwn nerve cells. Example of paracrine hormones are:-estrogens produced by ovaries to influence maturation of ovarian follicles before ovulation, testosterone produced by leydig cells of testes
2. ***Endocrine*** – cell targets a distance cell through the blood stream.e.g thyroid hormones, pancreatic hormones,testes & ovarian hormones
3. ***Autocrine*** – a cell secretes a hormone or chemical messenger that binds to autocrine receptors of same cell, leading to cell changes. Common in inflammation response, pains.
4. ***Direct signaling*** – involves cells on direct contact on each other

*CHOLERA TOXIN :- Once Cholera toxin binds to cell surface receptors/epithelial cells in the intestine, it interferes with cells signaling pathway. The toxin causes overactivation of the signaling pathway that controls the activity of chloride channel proteins. It stimulates enzyme adenylate cyclase which synthesize cyclic AMP which is a second messenger that regulates diverse physiological responses such as sugar, lipid metabolism,cell growth, differentiation..*

*The catalytic portion of the toxin seeks out G proteins used for cellular signaling and attaches an ADP making them permanently active*

**HORMONES**

***Hormones*** are chemical messengers that are secreted directly into blood and carried to organs or tissue to exert their functions.

Type of hormones;-

1. Protein hormones---made of chains of amino acids. Divided into proteins, peptides & amines. Example is ADH, insulin, fsh, growth hormone
2. Steroid hormones---derived from lipids. Example estrogen, testosterone,androgen,progestogens, glucocorticoids & mineralocorticoids

**Transport across the cell membrane:** The cell exchanges materials through the cell membrane using passive and active transport.

Three types of passive transport are ***osmosis, diffusion, and facilitated diffusion.***

*Osmosis* is the natural movement of water from a high concentration of water to a lower concentration of water.

*Diffusion* is the natural movement of molecules from a higher concentration to a lower concentration.

*Facilitated Diffusion* is the natural movement of molecules from a higher concentration to a lower concentration with the help of a transporter protein embedded on the cell membrane.          
  
Active transport requires energy to occur. Active transport is “forced” movement of molecules from a lower concentration to a higher concentration. The most common type of active transport is a pump. Pumps are proteins embedded in the cell membrane, which use ATP energy to work

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