LECTURE NO-3

PATTERN OF HORMONE SECRETION

- Fluctuations of frequency and amplitude of hormone secretion is described as hormone peaks, pulses, spikes or bursts.

The rhythm of hormone secretion may be one the following

1. Ultradian – Many **short pulses occurring every few minutes to few hours each day** (Adrenaline and noradrenaline)
2. Circadian – peaks occur approximately **once in 24 h** (cortisol peaks in early morning)
3. Infradian – pulses take more than a day but less than a year to occur (preovulatory surge of LH in dogs once in 6 months)

HORMONE TRANSPORT IN THE BLOOD

1. **Most water soluble hormone molecules circulate in the blood in the free from** (not attached to a protein) **Most lipid soluble hormones bind to transport proteins**. Binding of hormones to proteins are loose and reversible.
    a. **Transport proteins are albumin and globulins** synthesized by the liver they **prolong the half-life of hormone** and they protect circulating hormones from being broken down by enzymes in the blood plasma and liver - free hormones may be broken down or cleared from the blood in minutes, whereas bound hormones may circulate for hours or weeks.
2. **Bound hormones are hormones attached to a transport protein and unbounded (free) hormone is one that is not attached to a transport protein**.
3. Only free hormones (unbound) can leave a blood capillary to influence the target. **Therefore only free hormones are physiologically active**..
4. Example of transport proteins

a. Thyroid hormone binds to three transport proteins
    i. albumin
    ii. albumin-like protein called thyrectin
    iii. an alpha globulin named thyroxine binding globulin (TBG)
b. **Transcortin** is the corticosteriod-binding globulin (CBG), which has high affinity for cortisol and corticosterone,
c. **Sex hormone-binding globulin (SHBG)** aids transport of estradiol, progesterone and testosterone.

TARGET ORGANS AND RECEPTOR TYPES

- ***Target Cell*** : The cells that contain specific receptors for a hormone
- **Tropic hormone** – A hormone that stimulates functions of another organ / tissue. *Tropic*:a nourishing relationship.
- Although all cells are exposed to all hormones, only few cells or organs can respond to all specific hormone, termed as ***target cells or target organ***. This is because of ***highly specific receptor sites*** **in** the target organ.
- The receptors are **large protein molecules**.
- Hormone exerts its physiological actions only after binding to specific receptors.
- Despite the diversity of hormones, all hormone receptors can be categorized into one of two types, based on their location
- Membrane-bound receptors called as *cell-surface* (membrane) *receptors*
- Receptors located within the cell called as *intracellular receptors*

Location of Receptor	**Classes of Hormones**	**Principle Mechanism of Action**
Cell surface receptors	Proteins and peptides,	Generation of *second*

	catecholamines and eicosanoids	*messengers* which alter the activity of other molecules - usually enzymes - within the cell
Intracellular receptors –proteins, floating in cytoplasm and/or nucleus	Steroids and thyroid hormones	Alter transcriptional activity of responsive genes and thereby alter the cell's protein (enzyme) content

RECEPTOR PROPERTIES

All receptors are proteins

The properties of the receptors are

Each cell may have receptors for more than one hormone and therefore is a target for several hormones

1. **Specificity spill over** – hormones with similar structure may bind to one another's receptors usually with lower affinity and ability to activate the receptors.
2. Once a hormone binds to its receptor the message is delivered and the hormone plays no further role

Hormone receptor combination initiates a cascade of reactions

Specificity: The binding site of the receptor is highly specific for each signaling molecule (hormone, neurotransmitter); molecules that bind specifically to receptor are called ligands.

However, some molecules having structural similarity to ligands can also

bind with receptors and produce a physiological response and such molecules are called as agonists.

Some molecules having structural similarity with hormone may bind with receptors without producing a response and inhibit the hormone effect are called as antagonists.

High affinity: Usually the concentration of the hormone in the blood is very low(in pmol/l to μmol/l). Because the receptors have high affinity to hormones, binding occurs rapidly

The concentration of receptors is quite variable

When a target cell is exposed to high level of hormone for a period of time,the number of active receptors will be reduced (by receptor degradation) known as **down regulation**.

During deficiency of a hormone, there is an increase in the number of active receptors known as up regulation.

When a receptor becomes bound to a hormone, the receptor undergoes a conformational change (known as **receptor activation**), which allows it to interact productively with other components of the cells, leading ultimately to an alteration in the physiologic state of the cell.