Hormones

Hormones

- Hormones are the body's chemical messengers.
- A hormone is any member of a class of signalling molecules in multicellular organisms, that are transported to distant organs to regulate physiology and behaviour.
- They travel in the bloodstream to tissues or organs.

Radioimmunoassay (RIA)

Principle:

- Competitive binding of radiolabelled antigen and unlabelled antigen to a high affinity antibody.

Enzyme-Linked ImmunoSorbent Assay (ELISA)

- Enzyme immunoassay.
- Both qualitative and quantitative measurement of Ag-Ab binding can be performed.

Enzyme linked fluorescent assay (ELFA)

- It is based on one-step immunoassay sandwich method and a final fluorescent detection step.
- The intensity of the Fluorescence is inversely proportional to the concentration of antigen present in the sample.

Electrochemiluminescence (ECL)

"Electro" refers to electrical stimulation.

+

"Chem" indicates a chemical reaction.

+

"Luminescence" means "produces light."

=

Electrochemiluminescence (ECL)

Hormone receptor

- A hormone receptor is a receptor molecule that binds to a specific hormone.
- There are two main classes of hormone receptors.
  - Receptors for peptide hormones tend to be cell surface receptors built into the plasma membrane of cells and are thus referred to as trans membrane receptors.
  - Receptors for steroid hormones are usually found within the cytoplasm and are referred to as intracellular or nuclear receptors.

LIPID-SOLUBLE HORMONES

- Binding to specific cell receptor in the cell membrane and form hormone-cell receptor complex, which diffuses to nucleus.
- The receptor is eventually released for re-use.
- Steroid activates a specific gene to produce mRNA.
- mRNA pass out into the cytoplasm and initiates protein [enzyme] synthesis.
- The whole process is called mobile-receptor hypothesis in which a steroid hormone is not attached.

WATER-SOLUBLE HORMONES MECHANISM

1. A water-soluble hormone (the first messenger) diffuses from the blood and then binds to its receptor at the exterior surface of a target cell's plasma membrane. The hormone–receptor complex activates a membrane protein called a G protein. The activated G protein in turn activates adenylate cyclase.
2. Adenylate cyclase converts ATP into cyclic AMP (cAMP). The enzyme's active site is on the inner surface of the plasma membrane, this reaction occurs in the cytosol of the cell.
3. Cyclic AMP (the second messenger) activates one or more protein kinases, which may be free in the cytosol or bound to the plasma membrane.
   - A protein kinase is an enzyme that phosphorylates (adds a phosphate group to) other cellular proteins (such as enzymes). The donor of the phosphate group is ATP, which is converted to ADP.

Signal amplification

- Initial signal is in the form of hormone which acts as ligand whose concentration is just one/per receptor.
- The hormonal response has got multiple steps.
- Each step multiplies the signal (cascading effect) that finally lead to million fold amplification, i.e. one hormone molecule mediating its effect through million of molecules.
- This process is known as signal amplification.
- This usually occurs in secondary messenger pathway.

Melatonin

- Melatonin was first isolated from the bovine pineal gland in 1958.
- Melatonin is a hormone primarily released by the pineal gland at night.
- It is associated with control of the sleep–wake cycle.
- Melatonin is involved in synchronizing circadian rhythms, including sleep–wake timing, blood pressure regulation.
- Melatonin acts as a potent antioxidant and free radical scavenger.
- Melatonin occurs at high concentrations within mitochondrial fluid.
- It is produced from a pathway that includes both tryptophan and serotonin.

Eicosanoids

- Eicosanoids are signaling molecules made by the enzymatic or non-enzymatic oxidation of arachidonic acid or other polyunsaturated fatty acids (PUFAs).
- eicosa- in Greek for "twenty“. They are composed of 20 carbon units in length.

Inflammation

- Eicosanoid production is considerably increased during inflammation.
- Both COX and LOX pathways are of particular clinical relevance.

Anti-inflammation

- NSAIDs inhibit the cyclooxygenases (COX-1 and COX-2), but not the lipoxygenases.
- Glucocorticoids reduce availability of arachidonate for eicosanoid formation and they also reduce COX-2 activity.