

Mechanism of Action of hormones

Receptors

- Hormones bind with specific receptors to exert their actions
- Receptors may be present :
 1. On the cell membrane
 2. In the cytoplasm
 3. In the nucleus
- **Earl. W. Sutherland** received Nobel prize for his discoveries on mechanism of hormone action in 1971.

Receptors

- Hormone-receptor complex binds activates a series of signal generating mechanisms via cascade of enzymatic reactions
- Signal molecules increase in each step leading to manifold increase in the action – **Signal amplification**
- Peptide and amine hormones bind to cell surface receptors
- Steroid and thyroid hormones bind to intracellular receptor

- Mutation of receptors causes diseases
 1. Familial hypothyroidism due to mutation of TSH receptors
 2. Color blindness due to mutation of receptors for cone pigment
 3. Nephrogenic diabetes insipidus due to mutation of V2 vasopressin receptors

Quantity and sensitivity of receptors

- Regulated by the hormone concentrations
- 1. Up-regulation
- 2. Down – regulation
- 3. Desensitization

Types of receptors

- Ion channel linked receptors
- G-protein coupled receptors
- Enzyme linked receptors

G-proteins

- Small G –Proteins:
 1. Rab family
 2. Rac Family
 3. Ras Family
- Large G-proteins:
- Gs, Gi, Gq, Gt and G13

| S.NO. | Hormones using receptor tyrosine kinase signaling |
|-------|---|
| 1 | Fibroblast growth factor |
| 2 | Growth hormone |
| 3 | Hepatocyte growth factor |
| 4 | Insulin |
| 5 | Insulin like growth factor |
| 6 | Leptin |
| 7 | Prolactin |
| 8 | Vascular endothelial growth factor |

| S.NO. | Hormones using adenylyl cyclase –Camp messenger system |
|-------|--|
| 1 | ACTH |
| 2 | Angiotensin II |
| 3 | Calcitonin |
| 4 | Catecholamines (β receptors) |
| 5 | CRH |
| 6 | FSH, LH |
| 7 | Glucagon |
| 8 | HCG |
| 9 | PTH |
| 10 | Secretin |
| 11 | Somatostatin |
| 12 | TSH |
| 13 | Vasopressin (V2 receptor) |

| S.NO. | Hormones using Phospholipase - C second messenger system |
|-------|--|
| 1 | Angiotensin II |
| 2 | Catecholamines (α receptors) |
| 3 | GnRH |
| 4 | GHRH |
| 5 | Oxytocin |
| 6 | TRH |
| 7 | Vasopressin (V1 receptor) |