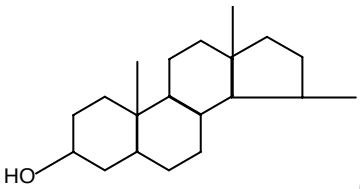
15. BIOMOLECULES

vi) HORMONES

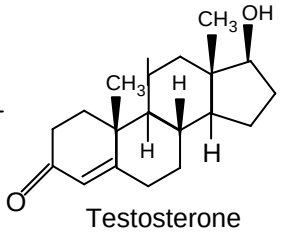
- Hormones are molecules of carbon compounds that transfer biological information from one group of cells to distant tissue (or) organs.
- Hormones are produced in ductless glands and they are called **endocrine glands**.
- **Hormones** are also called **chemical messengers** because of the action of hormones as communication among cells.
- Hormones are required in trace amounts but are highly specific in their functions.
- Deficiency of any hormone leads to particular disease.
- Hormones are continuously produce but not stored in the body.
- Hormones are of Animal (or human) origin and plant origin.
- Hormones are carried to different parts of the body by the blood stream where they control the various body functions.
- Plant hormones are called **growth hormones.**
- The term hormone was first introduced by **Baylers** and **Starling** in 1902 for secretion produced by **intestinal mucosa.**
- The site of action of hormone is away from their origin.
- Hormones are generally proteins but not all of them are proteins.
- Hormones not only control different aspects of metabolism but also perform many other functions such as cell and tissue growth, heart rate, blood pressure, kidney function, secretion of digestive enzymes, the reproductive system etc.
- In mammals the secretion of hormones is controlled by the anterior lobe of the pituitary gland present at the base of the brain. **Classification of Hormones**
- Based on the structures of hormones these are classified into three main types.

  1) Steroid hormones 2) Protein hormones

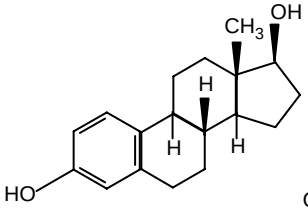
  3) Amine hormones.
- **Steroid hormones** are mostly secreted by testis, adrenal cortex of males and ovary.
- The common examples of steroid hormones are testosterone, dihydrotestosterone, and androgens.
- During puberty these stimulate the male sex characteristics.
- In females estrogens are female sex hormones which are produced in ovaries and are responsible for development of female sex characteristics during puberty.
- **Protein hormones** are produced by pancreas, parathyroid, pituitary and gastro intestinal mucosa.
- The common examples of protein hormones are oxytoxin, vasopressin and Insulin.
- **Amino hormones** are produced by thyroid and adrenal medulla.
- Steroid hormones contain a steroid nucleus which is based on a four ring network consisting of three cyclohexane rings and one cyclopentane ring.



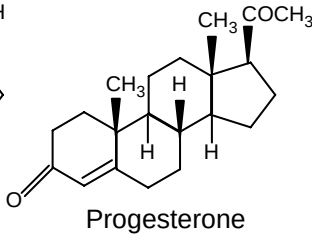
Steroid nucleus



Testosterone



Estradiol



Progesterone

Functions of Hormones

I. Steroid hormones

Steroid hormones are two types.

- 1) Adrenal cortical hormones (cartico steroids

  2) Sex hormones.
- Cartico steroids are mainly two types.

  1) Mineralo corticoids 2) Gluco corticoids.
- **Mineralo corticoids** are produced by different cells in the adrenal cortex.
- Mineralo corticoids useful for water–salt balance in the body. These cause excretion of potassium in urine.
- **Glucocorticoids** are made by cortex. These are useful to modify certain metabolic reactions.
- Gluco corticoids have anti–inflammatory effect.
- **Sex hormones** are three types. 1) Male sex hormones (or) androgens 2) Female sex hormones (or) estrogens 3) pregnancy hormones (or) progenstines.
- Testosterone is the major male sex hormone produced by testes and responsible for the development of male secondary sexual characteristics such as deep voice, facial hair, sturdy physical structure.
- Synthetic testosterone analogs are used in medicine to promote muscle and tissue growth. These are also used by atheletes illegally to promote their muscle and tissue growth.
- **Estradial** is the main female sex hormone responsible for development of secondary female characteristics such as breast development, shrill voice, and long hair and participates in control of the menstrual cycle.
- **Progesterone** is responsible for preparing the uterus for implantation of the fertilized egg. These are also useful as birth control agents.

Non steroid hormones :

- Non-steroid hormones are mainly two types.

  1) Peptide hormones

  2) Amino acid derivative hormones.
- Peptide hormones are peptide compounds.

Ex. Insulin, oxytocin.

- Insulin is responsible for controlling the glucose level in our blood and its deficiency leads to the disease **diabetes**.
- Insulin is secreted by pancreas.
- Insulin is a dipeptide consisting of two peptide chains bound by three S-S bonds. One chain contained 21 amino acids and the other chain contained 30 amino acids.
- Sulphur bridges connect cysteine amino acids in the two chains.
- **Oxytocin** is produced by the pituitary gland.
- Oxytocin induces lactation in breasts and helps in the contraction of uterus after child birth.
- Amine hormones are amino acids and organic amine compounds.

  Ex. Thyroxine, Adrenaline, & nor adrenaline.
- Thyraxine is secreted by thyroid gland and it is responsible for the control of metabolism of some proteins, lipids and carbohydrates
- Deficiency of thyroxine leads to the disease **goitre**.
- Addition of KI to table salt do not lead to the thyroxine deficiency.
- Adrenaline is responsible for maintenance of pulse rate and blood pressure.
- Non Adrenaline is secreted by adrenal glands and secretion of excess of non adrenaline in our body, when we are in anger causes hypertensions.
- **Amino acid derivatives:**
- Amino acid derivatives are thyroidal hormones.

  e.g.: Thyroxin, Tri iodo thyronine
- Thyroidal hormones effect the general metabolism regardless of the specific activity. For this reason thyroid gland is called pace setter of the endocrine systems.

Site of Activity :

- On the basis of site of activity hormones are divided into two categories.
- The first category effects the properties of plasma membrane.

  Ex. All peptide hormones (Insulin, hormones of pituitary gland).
- The hormones of other category are taken into the cell and carried to the cell nucleus and influence the gene expression.

Plant hormones :

- Plant hormones regulate growth and physiological function at a site remote from the place of secretion.
- Plant hormones are produced by higher plants.
- The plant hormones are

  1) Auxins 2) Gibberlins

  3) Cytokinins 4) Ethylene

  5) Traumatic acid 6) Abscicic and

  7) Morphactin.
- Auxins are cyclic carbon compounds and pentene derivatives.

- Auxine promote growth along the longitudinal axis.
- Gibberlinus are the derivatives of cyclic compound gibbane.
- Gibberlinus cause bolting (shoot elongations) and flowering.
- Cytokinins stimulate cell division, promote cell elongation and induces flowering in short day plants.
- Ethylene accelerates the colouring of harvested fruits like lemons, induces rooting and flowering.
- **Transmatic acid** is an open chain dicarboxylic acid with one double bond and induces cell division.
- Absicic acid is a sesquiterpene and induces prototropism.
- Morphactin inhibits mitosis, formation of branches is promoted. These are derivatives of fluorine-9- carboxylic acid.

General Biological functions of animal hormones :

- Maintaining constant internal environment of organs.
  Ex. Insulin maintains constant sugar level in blood.
- Sex hormones develops secondary sexual characters.
- Adrenaline is responsible for some emergency reaction.
- Some metamolic reaction are controlled by hormones.