Chapter - 29
Chemical Co-ordination in Human

Various types of metabolic activities occurs in human body. The biochemical substances are produced by these reaction and physical changes of environment are to be faced by human. Homeostasis with environment is required by human to complete various biochemical activities. The nervous system and endocrine system of body work together to perform this function. The combined study of both these system is known as **Neuro endocrinology.**

Human body has following three types of glands-

1. Exocrine Glands– These glands deliver their secretion in various body parts through ducts. So these are also called duct glands i.e. salivary gland, liver etc.

2. Endocrine Glands– These glands are ductless. These deliver their secretion in various organs and tissues with blood. The chemical compounds which are secreted by endocrine glands are called **Hormones** i.e. Pituitary gland, Thyroid gland and Parathyroid glands etc.

3. Mixed Glands –These types of glands have both exocrine and endocrine function and these are ducted i.e. Pancreas.

Claude Bernard (1855) used first time the word internal secretion.

Thomas Addison is known as Father of Endocrinology.

Starling (1905) termed hormone as irritant substance.

Bayliss and **Starling** (1903) first time obtained hormone from secretory cell of mucous membrane of duodenum and named secretin.

Hormones – Hormone is such type of chemical messenger which is not present in our diet and naturally synthesized by endocrine glands. Its molecules are small and their molecular weight is less. They flow in whole body through blood. Maximum hormones are dissolvable in water. Chemically the hormones are mostly protein in nature (e.g. Insulin). Some are derivatives of protein (e.g. thyroxin) or in lipid (steroids) form (e.g. Progesterone). Cholesterol is basic substances of steroid hormones.

Structure of Endocrine Glands in Human, Function and Diseases related to Hormonal Imbalance

Endocrine glands are present at different places in human body. Following are main endocrine glands in human (Fig. 29.1)

1. Hypothalamus	2. Pituitary gland
3. Thyroid gland	4. Parathyroid gland
5. Thymus gland	6. Pineal body
7. Pancreas	8. Adrenal gland
9. Testes	10. Ovary

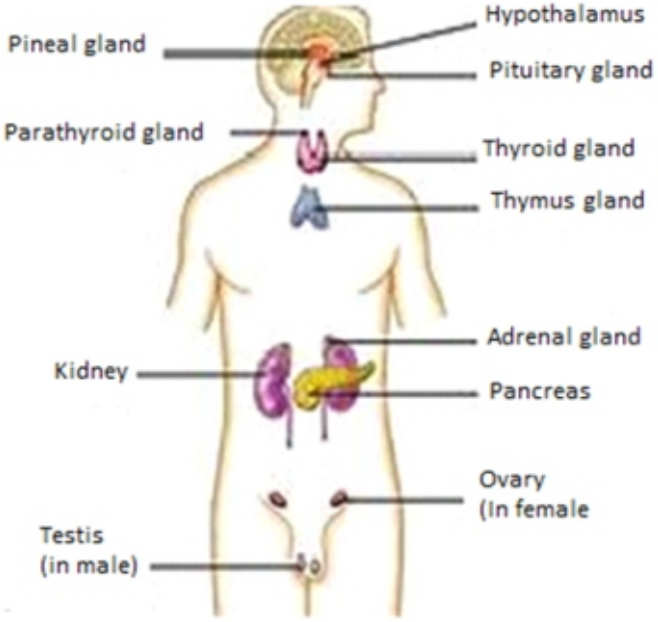


Fig. 29.1 Position of Endocrine glands in Human

Hypothalamus

Hypothalamus is a part of fore brain which forms the floor of cavity of diencephalon, diocoel or third ventricle. It has many areas of grey matter, which are called as hypothalamic nuclei. These areas synthesize specific releasing hormones. After releasing from this gland these hormones stimulate anterior lobe of pituitary gland to secrete various hormones.

Pituitary gland is attached with hypothalamus by a stalk like infundibulum. Regulating hormones flow by portal vein. Two types of hormones: **Releasing hormones** and **inhibiting** hormones are synthesized by hypothalamus which controls the production and secretion of hormone of pituitary gland. Hence hypothalamus is called as **supreme commander** of endocrine regulation or **Master** of **the master gland**.

By controlling on pituitary gland, hypothalamus regulates maximum activities of body.

Hormones secreted by Hypothalamus and their functions

Hypothalamus secretes about 10 types of Neuro-hormones, which control hormones secreted by pituitary gland (Table 29.2).

Table 29.1 : Releasing and inhibitory Neuro-hormones secreted by Hypothalamus

S. No.	Name and symbol of Neuro-hormone	function
1	Growth hormone releasing hormone (GHRH)	Stimulation of secretion of Growth hormone
2.	Growth hormone Inhibitory hormone (GHIH)	Inhibition of Growth hormone secretion
3.	Thyrotrophin Releasing hormone (TRH)	Stimulation of secretion of Thyrotropin
4.	Prolactin releasing Hormone (PRH)	Stimulation of releasing prolactin.
5.	Prolactin Inhibitory Hormone (PR-IH)	Inhibition of prolactin secretion
6.	Melanocyte stimulation releasing Hormone (MSH-RH)	Stimulate to release melanocyte stimulating hormone.
7.	Melanocyte stimulating Hormone Inhibitory Hormone (MSH-IH)	Inhibition of melanocyte stimulating hormone secretion
8.	Corticotropin Releasing Hormone (CRH)	Stimulation of corticotrophin Hormone secretion.
9.	Luteinizing Hormone Releasing Hormone (LH-RH)	Stimulation to release luteinizing hormone.
10.	follicle stimulating Hormone Releasing Hormone (FSHRH)	Stimulation of follicle stimulating hormone secretion.

Pituitary Gland

It is small, pea sized, pink coloured gland which is jointed with hypothalamus by a stalk (infundibulum). Pituitary gland is located in a shallow depression sella turcica of sphenoid bone of cranium. Its diameter is about 1.3 cm and weight is about 0.5 gm in human. It is somewhat bigger in size in female as compared to male. Pituitary gland

is originated from embryonic ectoderm. This gland is known as Master Gland.

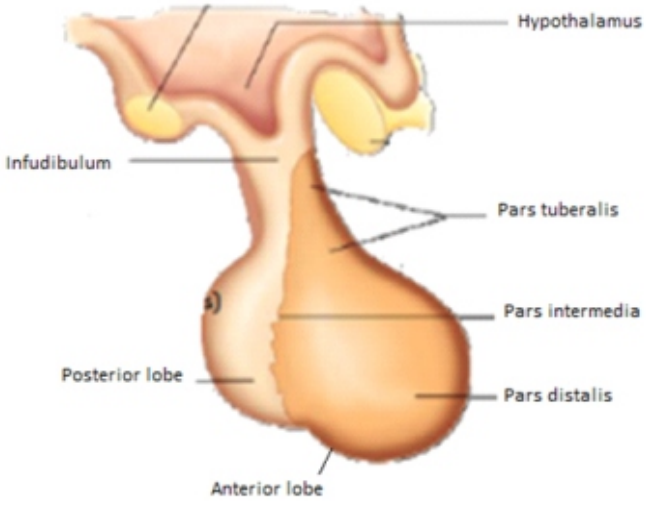


Fig. 29.2 Pituitary gland

On the basis of structure and function pituitary gland is made of two major lobes (Fig. 29.2).

I. Adenohypophysis or Anterior lobe

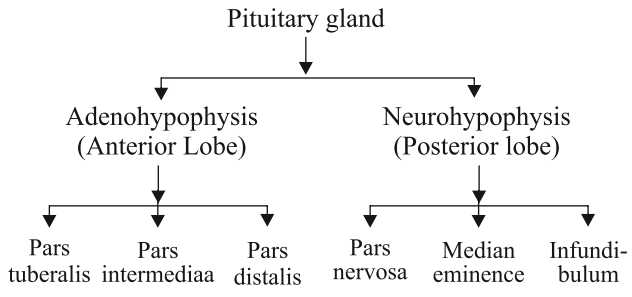
It is developed as ectodermal outgrowth from pharyngeal region of embryo. It forms 75% part of pituitary gland. It is made up of glandular epithelium cells.

Adenohypophysis has three parts –

(i) Pars tuberalis– It is collar like structure around stalk. It is unclear in human. There is no secretion of any type of hormone from it.

(ii) Pars intermedia– It is located between both lobes of pituitary gland. Only one hormone is secreted from it.

(iii) Pars distalis– It is the largest part of adenohypohysis. Six types of hormones are secreted from it.



II. Neurohypophysis or Posterior lobe –

It is developed from infundibulum of hypothalamus.It forms one fourth part of pituitary glandwhich is posterior part of pituitary gland. It is white and embossed.

Neurohypophysis has three parts –

(i) Pars nervosa – It stores hormones of neurohypophysis. It is large and swollen part situated at the corner of stalk.

(ii) Median eminence – It is situated at the base of hypothalamus.

(iii) Infundibulum – It is extended part below median out growth.

I. Hormones secreted by Adenophysis and Their Functions

1. Somatotropic hormone STH or Growth hormone or GH–

It is main stimulator for growth of body which promotes the development of bones and muscles and growth of connective tissues and cell division. It has more effects on long bones of body. It prevents damage of tissues. It stimulates breakdown of fats and their use, stimulates milk secretion. It increases excretion of urea and urination. It increases synthesis of glucose from amino acids (gluconeogenesis) and glycogen from glucose (glycogenesis) in liver.

The diseases caused by hyposecretion and hypersecretion of growth hormone

(i) Dwarfism – Person remains dwarf due to hyposecretion of growth hormone. Such persons are often impotent and infertile who are called **Midgets**. These persons have normal intellectual development. Due to this, weakness and suppression in reproductive capability causes in adults. This dwarfness is called **Ateliosis**.

(ii) Gigantism – Due to hypersecretion of growth hormone during childhood the person becomes longer or attains a height of 7-8 feet because length of limb bones increased.

(iii) Acromegaly – Long jaw bones, swollen cheek bones, bones wider than length is caused by hypersecretion in adolescence resulting disproportionate by structure and body becomes

deformed. This disease is called acromegaly. Sometime vertebral column bends by which kyphosis is caused.

(iv) Simmonds's Disease – If hypo secretion of growth hormone after completion the growth then degeneration of tissues in human starts, so human becomes old before time and weaker.

2. Gonadotropic Hormone – These hormones stimulate testes in males and ovaries in females. These are responsible for maturity and functionality of male and female reproductive organs. These hormones' are also play an important role in activeness of private parts, reproductive glands and other accessory reproductive organs.

These are mainly two types-

(i) Follicle Stimulating Hormone, FSH – It stimulates the growth of ovarian follicles, their maturation and secretion of female hormone estrogen. In males it stimulates growth of seminiferous tubules and formation of sperms. Due to its important role in formation of gametes and their development, this hormone is called gametokinetic factor.

(ii) Luteinizing Hormones LH or Interstitial cells stimulating Hormone ICSH –This hormone stimulates secretion of androgen or male hormone by stimulating interstitial cells or leydig cells of testes in men.

It stimulates maturation of Graafian follicle, ovulation and development of corpusluteum in women. It also stimulates secretion of progesterone from corpusluteum in female.

3. Thyroid Stimulating Hormone TSH – This hormone is glycoprotein hormone. This hormone works for growth and regulation of thyroid gland. The secretion of this hormone is stimulated by thyrotropin releasing hormone of hypothalamus.

4. Adrenocorticotropic Hormone ACTH - This hormone controls the growth of adrenal cortex and hormones secreted from it. This hormone is secreted by corticotroph cells of anterior part of pituitary gland. Its secretion is stimulated by corticotropin releasing hormone secreted by hypothalamus.

5. Lactogenic tropic or Prolactin or Mammotropic Hormone, LTH – This hormone is secreted by lactotroph cells of pituitary gland. This hormone increases the size of breasts in female during pregnancy and stimulates milk secretion after child birth. It is also called lactogenic hormone.

6. Melanocyte Stimulating Hormone, MSH– It is also called intermedin because this hormone is secreted by pars-intermedia. This hormone disperses melanin granules in pigmeted cells that cause dark colour. In human it stimulates the formation of moles and freckles on skin.

II Hormones Secreted by Neurohypophysis

1. Vasopressin of Antidiuretic Hormone, ADH – It increases reabsorption of water by nephrons, hence it is also called Antidiuretic Hormone.

Deficiency of it causes excess water loss in urine by which urine becomes dilute and blood concentrated. It is called Diuresis. Due to it a person excretes too much urine that is called Diabetes insipidus. This hormone also increases blood pressure. The secretion of vasopressin is controlled by osmoregulation centre of hypothalamus.

2. Oxytocin or Pitocin – During last period of gestation in women this hormone stimulates contraction of involuntary muscles of uterus lining to generate labor pain which is helpful in child birth. It helps to rebuild uterine wall normal after delivery. Lactation from mammary glands of women is also stimulated by this hormone after delivery.

Thyroid Gland

Position - Thyroid gland joins with ventral and lateral part of trachea in cervical region.

Structure – This bilobed gland looks like "H" shaped. Its colour is pink. It is the largest endocrine gland. It's both lobes are joined by a connecting bridge. In adult person isthmus is 5 cm long and 3 cm wide in size. Its weight is average 25 gm and is slightly larger in women as compared to men. It becomes smaller in old age (Fig. 29.3)

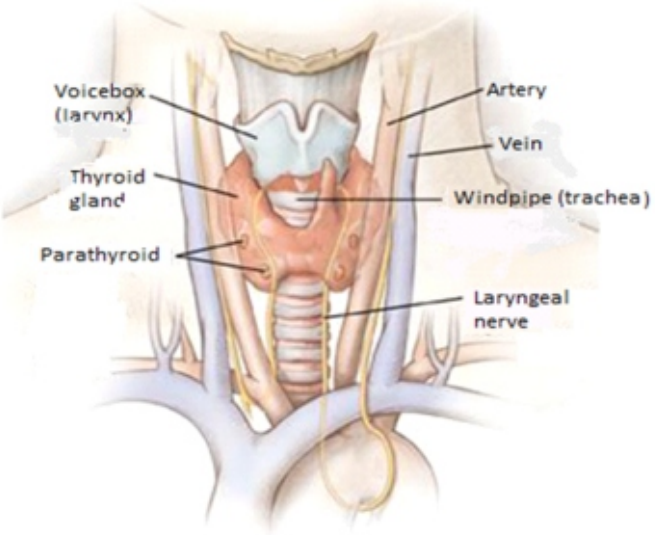


Fig. 29.3 Position of Thyroid and Parathyroid gland

This gland is made of many small spherical follicles. A yellowish, jelly like and transparent colloidal substance is filled in the cavity of these follicles. This iodine containing colloidal glycoprotein substance is called iodothyroglobulin. The wall of each follicle is made of single layered cuboidal glandular cells. In between follicles connective tissue stroma is present. Parafollicular or 'C' cells are presentat some places in stroma.

Hormones Secreted by Thyroid Gland

Three hormones are secreted from thyroid gland.

1. Thyroxine or Tetraiodothyronine, T_4 – In the presence of thyroid stimulating hormone (TSH) follicular cells synthesize this hormone. Its total quantity is 65 to 90%. It is formed by iodine and tyrosine. It is comparatively less active.

2. Tri – iodothyronine, T_3 - It is iodine containing hormone and more active and powerful as compare to T_4. It forms 10% part of total hormone. T_3 and T_4 are collectively called **Thyroid Hormone.**

3. Calcitonin – "C" cells of thyroid gland synthesize this hormone. This hormone stimulates excretion of Ca^{++} in urine and reduces breakdown of bones. Thus this hormone is opposing parathormone of parathyroid gland.

Functions of Thyroxine –

1. It increases the rate of energy production in cells or speed of life by increasing oxidative metabolism. So it is helpful in body growth.
2. This hormone increases glucose absorption by intestine, oxygen consumption and basic metabolic rate (BMR). It increases heart rate.
3. It increases the function of enzyme, protein synthesis, gluconeogenesis, body temperature and nerve activity.
4. It plays a significant role in metamorphosis of tadpole (larva) into frog.
5. It performs function of osmoregulation and moulting in cold blooded vertebrates.
6. It increases activity of neuro-secrtory chemicals adrenalin and nor- adrenalin.

Diseases related with Thyroid –

Hyposecretion of thyroxin hormone causes following diseases in human.

1. Cretinism – This disease is caused by deficiency of thyroxin in childhood. Physical and mental development becomes slow in this disease. Hands – legs become deformed. Children remain cretins (dwarf), their basal metabolic rate decreases. Such types of children are called cretins. Their gonads are not developed. These are infertile.

2. Myxoedema – This disease occurs due to hypo secretion of thyroxin in adults. Including cretinism, symptoms such as hair fall, lack of memory, skin becomes yellowish, thick and reproductive ability decreases in this disease. Such persons get benefit by using thyroxin.

3. Goiter – In this disease thyroid gland enlarges and neck also becomes thick by swelling. This disease is due to deficiency of iodine in diet. Generally this disease is more prevalent in people living at hilly areas because there is lack of iodine in water.

4. Hashimoto's disease – This disease is caused by the formation of antibodies against the given medicine to cure hypo secretion which is identified as antigen. These antibodies destroy thyroid gland. It is also called as suicide of thyroid. Hence it is an autoimmune disease.

More secretion of thyroxin hormone from

thyroid gland causes symptoms like increase metabolic rate, increasing heartbeat, irritating behavior, more sweating from body, shivering in hands- feet.

Following diseases are caused by hyper secretion-

1. Exophthalmic Goiter – In this disease mucous is deposited below eye ball and bulging of eye ball in a person. Such persons have horror vision, seems like staring.

2. Plummer's disease – If nodes (tumours) are formed at various places in thyroid gland then it is called Plummer's disease.

3. Grave's disease – Swollen condition of thyroid gland is called Grave's disease.

All diseases of hypo secretion may be cured by increasing quantity of iodine in diet.

Parathyroid Gland

Position- In human this gland is embedded in dorsal surface of each lobe of thyroid gland. 2 parathyroid glands are present in each lobe of thyroid gland. It is red in colour. Its weight is o.01 to 0.03 gm and each gland is 6-7 mm long and 3.4 mm wide in human. Their numbers are four in human. In this gland blood capillaries are found between lobes of glandular cells.

Parathormone is secreted by parathyroid gland which is also called **Collip's hormone**.

Functions of Parathormone - This hormone increases excretion of phosphate and reabsorption of calcium by kidney and intestine. It regulates calcium and phosphate ions in blood. It helps in muscle contraction, nerve impulse conduction and blood clothing. It promotes synthesis of vitamin "D" which is helpful in bone formation.

Disease related with hypo secretion of parathormone - Lack of parathormone in early childhood leads to decrease in ca^{+2} levels and increase phosphate level in blood by which stiffness and spasms in muscles start due to sudden increasing the activity of nerves and muscles. It is called **Hypocalcemictetany.**

Desease related with hypersecretion of Parathormone- Its hypersecretion leads to dissociation of calcium from bones as a result calcium level in blood is increased. It is called hyper calcimia. By this bone becomes breakable, soft and porous. This disease in called osteoporosis.

The increased level of calcium in plasma causes calcification in soft tissues of body. By increasing amount of urine thirst increases and stones are formed in kidney. This disease is called **Osteitis fibrosa cystica.** For treatment of hyper secretion, enlarged part of the gland is removed.

Thymus Gland

This gland is located just in front of heart near the trachea (Fig. 29.4). After puberty its size decreases continuously in human. It remains just like a cord in old age. This gland is known as main organ of immunity and training centre of T-lymphocytes. The hormone secreted by thymus gland is called **Thymosin**. This hormone helps in formation of complete immune system. It stimulates lymphocytes to destroy bacteria or their antigens. In old age and with growing age the production of thymosin decreases and completely stopped.

Functions of Thymosin hormone-

1. It is responsible for immunity in animal

2. It is helpful in maturation of reproductive glands.

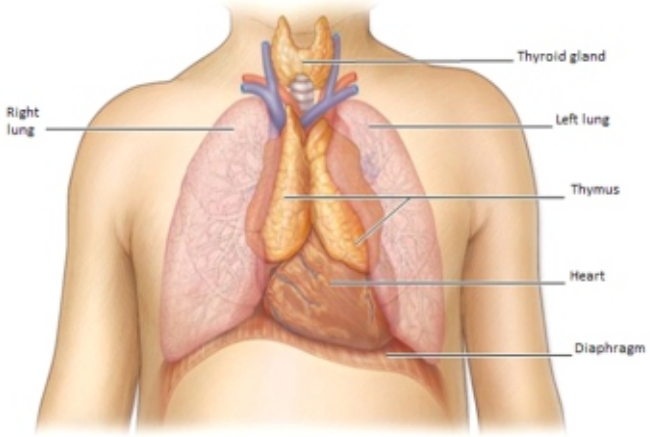


Fig. 29.4 Physical relationship between thymus and nearest organs in child

Pineal Body

This gland is located on a hollow stalk arising from hypothalamus in middle the posterior region of hind brain. It is whitish and flattened small gland which is covered by thin membrane of Piamater. It is developed from embryonic ectoderm. It is about 150 milligram in weight. **Melatonin** hormone is secreted by this gland. Its secretion decreases in high light and increases in mild light or darkness. This gland is acts as **Sexual Biological clock.** Blind children of human attain puberty before time and the children live in high sun light area also attains puberty soon. It is due to less secretion of melatonin.

It has two types of cells –

(i) Pinealocytes and (ii) Neuroglial cells

Pancreas

Structure – It is a major digestive gland which secretes pancreatic juice for digestion of food. This gland is located behind stomach in between "U" shaped duodenum. It is a light yellowish or pink coloured flat, irregular shaped mixed gland which is 15 cm long and 85 gm in weight in human. The groups of endocrine cells are found in connective tissues which are present between the lobes of this gland. These are called **Islets of Langerhans**. It was discovered by Langerhans (1869).

There are three types of cells in Islets of Langerhans-

1. Alpha Cells (ą- cells)
2. Beta cells (β - cells)
3. Delta cells (δ- cells)

1. Alpha Cells (ą- cells) – These cells are of medium sized and about 25% in numbers. These cells secrete glucagon hormone. Kimbel and Murlin (1923) discovered them.

2. Beta cells (β - cells) - These cells are large in size and highest in number 60%. These cells secrete insulin. Insulin was obtained first of all by Banting and Best (1921) from Canada and Abel obtained its crystals. Scientist Sanger (1953) discovered its protein structure and was given the Nobel Prize in 1958 for this work.

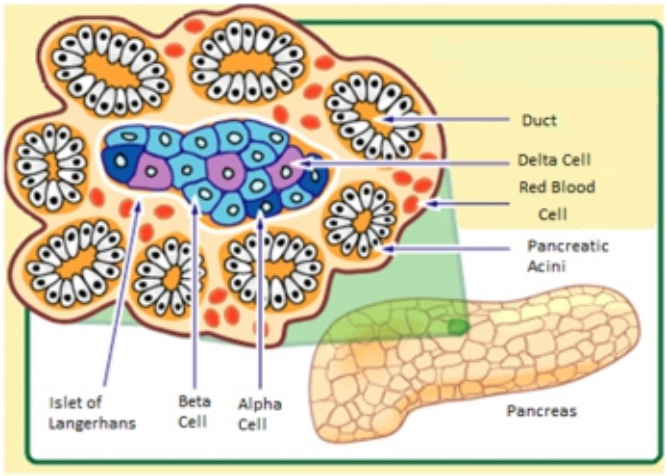


Fig. 29.5 An Islets of Langerhans

3. Delta cells (δ- cells) - These are less in number 10%. These are small in size. somatostanin hormone is secreted by them.

Hormones secreted by pancreatic glands and their functions

1. Glucagon – This hormone is secreted by alpha cells. Glycogen is converted into glucose by this hormone. It promotes synthesis of glucose from fatty acids and amino acids by gluconeogenesis and increases glucose level in blood.

2. Insulin – This hormone is secreted by beta cells. It has opposite function of glucagon. It maintains normal level of glucose in blood. It stimulates the synthesis of glycogen from glucose in liver. It increases Basal metabolic rate (BMR) in cells and protein from RNA and synthesis of glycogen in liver and muscles.

3. Somatostanin – This hormone is secreted by delta cells. It acts as inhibitor for insulin and glucagon and increases the duration for assimilation of digested food.

The diseases related with hypo secretion of Insulin hormone

1. Diabetes mellitus – The level of glucose is increased in blood by deficiency of insulin which is called **hyper glycaemia** resulting into excretion of glucose that is called **glycosuria.** Diabetes is also genetic in human.

2. Poly urea – The amount of water increases in urine so patient frequently faces the problem of urination by increasing volume of urine.

3. Polydypsia – The amount of urine discharge also increases in this disease and dehydration occurs by this patient feels thirsty.

4. Ketosis – Incomplete degradation of fat occurs in it. This increases acetone level in blood leads to coma.

Diseases related with hyper secretion of Insulin

Glucose level in blood decreases slowly by hyper secretion of insulin. This condition is called **hypoglycaemia.** In such condition body cell sreceive more glucose from blood. Patient feels tiredness, poor vision and cramps in body are its main symptoms.

Adrenal Gland

A cap like, brown coloured adrenal gland is located at anterior end of each kidney. These glands are derived from embryonic mesoderm and ectoderm. Each gland is about 4 to 6 gm in weight. Its outer part is called cortex and inner part is medulla. A thin cover made of connective tissue is present around this gland. This gland is also known as intelligence of life in adult person.

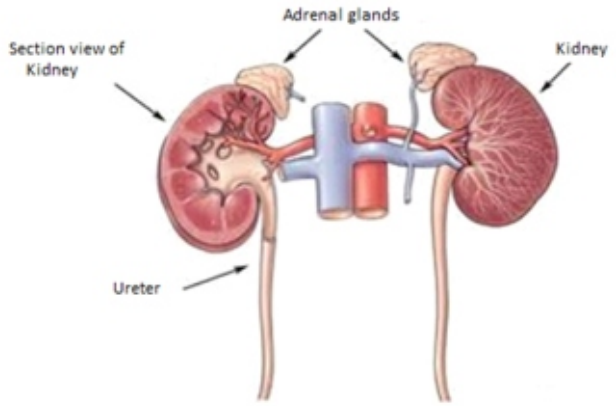
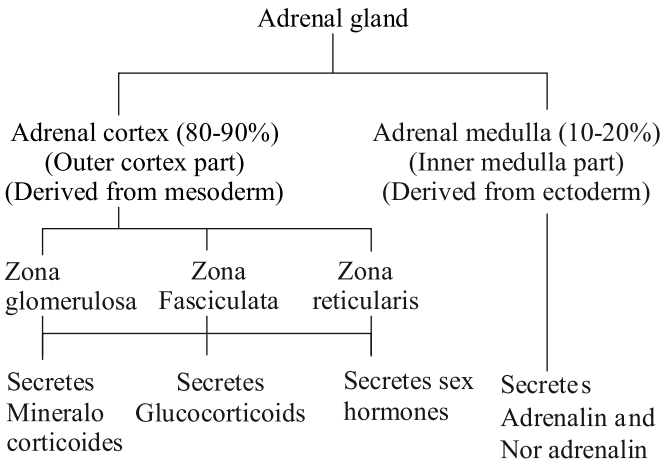


Fig. 29.6 Adrenal gland
(Position and diagramatic structure)

Hormones secreted by Adrenal cortex

1. Mineralocorticoids– These hormones regulate concentration of mineral ions in blood and kidney. Aldosterone is main hormone among them. This hormone increases absorption of Na^+ and Cl^- ions from nephrons and excretion of K^+ ions.



2. Glucocorticoids – Cortisol and cortisone are its main hormones. Metabolism of carbohydrates, fats and proteins is controlled by these hormones. These increase level of glucose, fatty acids and amino acids in blood. They induce glycogenesis, gluconeogenesis and ureogenesis in liver. These inhibit formation of antibodies against infection in any tissue. So these are **immune-suppressive.** In addition of it these are useful for water and mineral balance and for success of organ implantation. These are anti-inflammatory in nature. These are used to cure arthritis, Asthma etc.

3. Sex hormone - Three types of sex hormones **androgen, estrogen** and **progesterone** are secreted in small amount by adrenal cortex. These hormones affect external sex organs and reproductive behavior. Hairs appear on the face of women by hyper secretion of this hormone. This disease is called Hirsutism. These hormones develop muscles and sex organs in male and female.

Hormones secreted by Adrenal medulla

1. Adrenalin – This hormone helps to regulate activities of sympathetic nervous system. This hormone stimulates unstriped muscles by which wall of blood vessels is shrinked, increasing blood pressure, increasing heartbeat, broad eyes and dilationof pupil, erecting of hairs on body, more sweating, accumulated glycogen in liver converts in glucose then passing in blood etc.

Adrenalin hormone prepares human body to face emergency situations. Secretion of this hormon

increased during mental tension, anger and fear so that- extra energy produced, which helps to face emergency conditions.

2. Nor-Adrenalin – This hormone stimulates all similar activities performed by adrenalin. Blood vessels are relaxed by this hormone. It does not increase heart rate and blood pressure.

Three types of responses can be created by it during adverse and emergency period. It includes behavior off ear, fight and flight. Hence adrenal medulla is also known as '3F' gland. Adrenal gland controls stress, sugar, salt metabolism and sex related processes, so it is also called 4S gland.

Diseases related with Hypo secretion of Adrenal gland –

1. Addison's Disease – Due to hypo secretion of adrenal cortex hormones maximum quantity of sodium and water excretes with urine causes dehydration of body. Blood pressure becomes very low. Skin becomes bronzing. Muscles and brain of patient become weak and body temperature becomes low. Loss of appetite, nausea and nervousness in a person. At last patient may die. The hormones of adrenal cortex act as life-saving hormone.

Disease related with hyper secretion of Adrenal gland –

1. Conn's Disease - This disease is caused by excess of mineralo-corticoids. It disturbs balance of sodium and potassium which causes stiffness in muscles by nerves disorder.

2. Cushing's disease – Deposition of water and sodium in body and glycogen in liver is seemed to be more in this disease. Protein catabolism is increased in this disease. Irregular growth seems to be in skin and bones.

3. Hirsutism or Adrenal virilism – Excess amount of adrenalin hormone produces male characters in female like beard – moustaches on face, heavy voice, growing dense hairs on body. Its excess amount leads infertility in women.

4. Gynaecomastia – Due to hyper secretion of adrenal hormone seems to be developed male sex organs in female. It is called **female pseudo-bisexuality**. Such girls are sterile. Breasts develop in boys.

5. Oedema – Blood pressure increases in this disease by increasing amount of water along with sodium in blood. It leads to swelling in body. Due to excessive loss of potassium the function of nerves and muscles is blocked and paralysis may occur.

Gonad Glands

Testes– Testes is a male sexual gland. Interstitial cells or leydig's cells in testes are endocrine in nature. One pair of testes is located in scrotal sac, outside abdominal cavity in human. Interstitial cells secrete male hormones testosterone and androsterone, which are steroid hormones. Secretions of these hormones are controlled by LH or ICSH hormones of pituitary gland.

Androgen hormone is responsible for development of secondary sexual characters in male. Testes sac in male, moustache, deeping voice, to develop hairs on body and sexual desire etc. functions are done by it in males.

Before attaining puberty, the removal of testes by surgery is called **orchiectomy** or **castration**, which decreases secretion of male hormones and person become neuter. Primary and secondary sexual characters can't develop in him.

This technique is used in livestock for development of castrated steer, castrated capons and castrated Gelding. Such animals become polite in nature, thereby their management becomes easy.

Ovaries – Ovary is female reproductive gland. It is an endocrine gland. It secretes three types of horomes -

1. Estrogen – This hormone is secreted by Graafian follicles. Secondary sexual characters (Uterus, oviduct, vagina, clitoris, breasts etc.) are developed by this hormone. Soft voices, menstrual cycle starts, buttock become heavy, complacency, sex desire is also developed.

2. Progesterone – This hormone is secreted by a yellow coloured gland corpus luteum developed in ovary after ovulation. Corpus luteum is controlled by luteinizing hormone of pituitary gland. Secretion of this hormone leads to development of breast,

growth and activation of mammary glands, necessary structural and physiological changes required for pregnancy, increasing blood circulation in uterus wall and accumulation of fat and glycogen etc.

3. Relaxin – This hormone is secreted by corpus luteum. Its function is to relax pubis symphysis joint at time of parturition. So this hormone is helpful in child birth.

Hypo secretion of estrogen hormone leads to decrease in development of secondary sexual characters of female and irregularity in menstrual cycle.

Hyper secretion of estrogen hormone leads to irregular menstrual cycle and continuous increasing the level of estrogen may lead to danger of cancer.

Important Points

1. Thomas Addison is known as father of endocrinology.
2. Claude Bernard used first time the word internal secretion.
3. Bayliss and starling first of all discovered secretin hormone.
4. Hormone is such type of chemical messenger which is not found in our food and is synthesized by endocrine glands naturally.
5. Endocrine glands are ductless glands. Their secretion is called hormone, which are directly secreted in blood.
6. Releasing and inhibitory hormones are secreted by hypothalamus gland.
7. Pituitary gland controls on activities of other endocrine glands of the body. Pituitary itself is under control of hypothalamus. Hypothalamus is called supreme commander of endocrine system.
8. Thyroxin hormone is secreted by thyroid gland. Hypo secretion of thyroxin hormone causes Goiter disease in human.
9. Parathormoneis secreted by parathyroid gland, which is also known as Collip's hormone.
10. The hormone secreted by thymus gland is called thymosine.
11. Pineal gland controls Sexual Biological Clock.
12. Pancreas is endocrine and exocrine both type of gland.
13. In hypo secretion of insulin human suffers from diabetes.
14. Adrenal gland secretes mainly steroid type hormones e.g. mineralocorticoids, glucocorticoids and sex hormones.
15. Testosterone and Androsteron hormones are secreted by testes, which develops secondary sexual characters and formation of sperms at the age of puberty in male.
16. Estrogen and progesterone hormones are secreted by ovaries, which develops secondary sexual characters and formation of ova in adult female.

Practice Questions

Multiple choice Questions-

1. Secretion of endocrine glands are called-
   (a) Pheromone (b) Enzyme
   (c) Hormone (d) Mucous
2. Father of Endocrinology is –
   (a) Claude Bernard (b) Thomas Addison
   (c) Bayllis and starling (d) Bunting and Best
3. Endocrine glands are-
   (a) Glands with duct (b) Acidic glands
   (c) Alkaline glands (d) Ductless glands
4. Hypo secretion of which hormone develops diuresis –
   (a) Thyroxin (b) Vasopressin
   (c) Oxytocin (d) Calcitonin
5. The hormone controls calcium and phosphorus metabolism is secreted from where-
   (a) Pancreas (b) Thymus
   (c) Thyroid (d) Parathyroid

6. The hormone secreted by alpha cells of Islets of Langerhans is –
   (a) Insulin (b) Glucagon
   (c) Melatonin (d) Somatostanin
7. The gland which motivates human for fear, fight and flight during emergency is
   (a) Adrenal (b) Thyroid
   (c) Pituitary (d) Thymus
8. Name of the hormone released by corpus luteum is-
   (a) Adrogen (b) Progesteron
   (c) Estrogen (d) Testosterone
9. The disease caused by deficiency of iodine in human is –
   (a) Diabetes (b) Goiter
   (c) Sterility (d) Addison's disease
10. Androgen hormone is secreted by-
   (a) Ovaries (b) Pituitary
   (c) Thyroid (d) Testes

Very short Answe Questions-

1. Who is known as father of Endocrinology?
2. Where is pituitary glandlocated?
3. What will be effect, if there is deficiency of ADH in body?
4. Who is known as supreme commander of endocrine system?
5. Which hormone is secreted by parathyroid?
6. Life-saving hormone is secreted by which endocrine gland?
7. Write the name of hormone secreted by thymus gland?
8. Write the name of gland which acts as sexual biological clock?
9. Where Islets of Langerhans are located in body?
10. Write name of any one hormone secreted by Adrenal cortex.
11. Who discovered secretin hormone at first?
12. Which hormone is secreted by thyroid gland?
13. Which hormone is secreted by Beta cells of Islets of Langerhans?
14. Which disease is caused by deficiency of Insulin hormone?
15. Write name of hormones secreted by Graafian follicles?

Short Answer Questions -

1. Differentiate endocrine and exocrine glands with examples.
2. Explain the functions of thyroxin hormone?
3. Write the functions of hormones secreted by Islets of Langerhans.
4. Mention the source of thyroxin hormone.
5. Write the name of releasing and inhibiting hormones secreted by hypothalamus.
6. Explain in brief the diseases caused by irregular secretion of Adrenal gland.
7. Goiter disease is frequently occurrs in persons living on hilly areas. Explain with reasons.
8. Write name of hormones secreted by Adenohypophysis.
9. What will happen if thyroid of human is removed?
10. Write symptoms of Myxedema disease.

Essay Type Questions -

1. Describe the hormones secreted by neurohypophysis by drawing labelled diagram of pituitary gland.
2. Describe in brief the hormones and diseases caused by irregular secretions by thyroid gland
3. Describe in brief the various hormones secreted by Adrenal gland.
4. Which hormones are secreted by ovaries? Describe any two.

Answer Key-

1. (c) 2. (b) 3. (d) 4. (b) 5. (d)
6. (b) 7. (a) 8. (b) 9. (b) 10. (d)