PHARMACOLOGY-II

UNIT 4 NOTES

ENDOCRINE SYSTEM

- Basic Concepts
- Anterior Pituitary Hormones
- Thyroid Hormones
- Hormones Regulation
- Insulin, Oral Hypoglycemic Agents
- ACTH and Corticosteroids

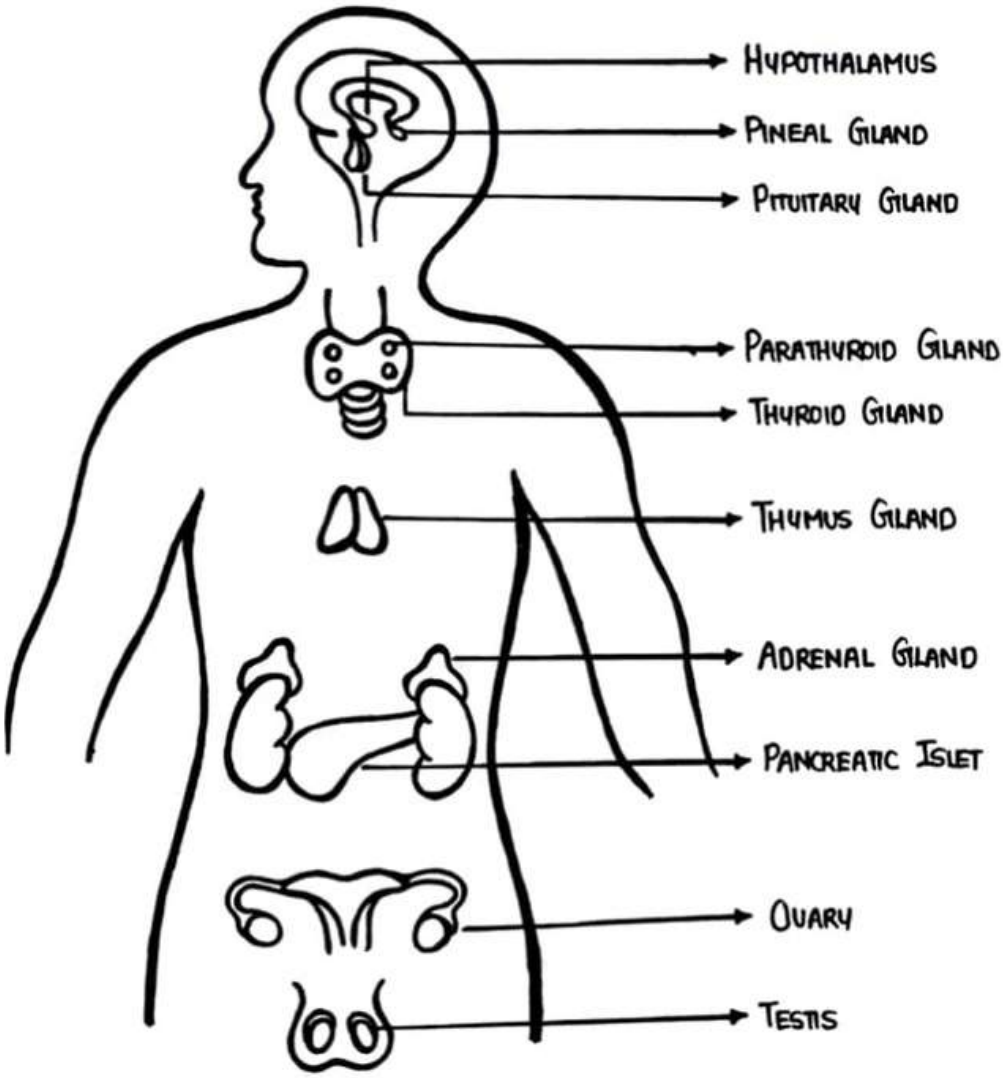
ENDOCRINE SYSTEM

- The Human Endocrine System is consist of group of ductless glands (Endocrine Glands) that regulates the body processes by secreting chemical substances (chemical messengers) known as **Hormones**.
- Endocrine Glands are Ductless.
- They secretes hormones directly into the Bloodstream.
- The Nervous System & Endocrine System together controls & coordinates all the functions of our body.
- The branch of science deals with the study of Endocrine system is known as **Endocrinology**.

ENDOCRINE GLANDS

- Endocrine Glands are ductless glands that secretes hormones into the extracellular spaces that further diffused into blood capillaries & carried throughout the body by circulatory system.
- The Endocrine system consist of number of endocrine glands as follows :

① Pituitary Gland
② Pineal Gland
③ Thyroid Gland
④ Parathyroid Gland
⑤ Thymus Gland
⑥ Adrenal Gland
⑦ Pancreatic Islets
⑧ Ovaries (Females)
⑨ Testes (Males)



ENDOCRINE SYSTEM

HORMONES

- Hormones are nothing but type of chemical messengers primarily produced by Endocrine Glands.
- Hormones regulates & controls a wide range of Physiological Functions.
- They are responsible for various cellular activities specially Growth & Metabolism.

Types Of Hormones

Hormones can be classified into two types :

① Steroidal Hormones
② Non - steroidal Hormones

Steroidal Hormones

- They are generally synthesised / derived from Cholesterol based lipids.
- They are mainly water insoluble / lipid soluble.
- These hormones can easily cross the Plasma Membrane.
- Example : Testosterone, Progesterone, Glucocorticoids etc.

Non- Steroidal Hormones

- They are also known as Protein Hormones.
- They are synthesised from Amino Acids (Amines, Polypeptides, Proteins etc).
- They are generally Water Soluble.
- Protein Hormones cannot cross the Plasma Membrane.
- Example : Insulin , Adrenaline, Glucagon etc.

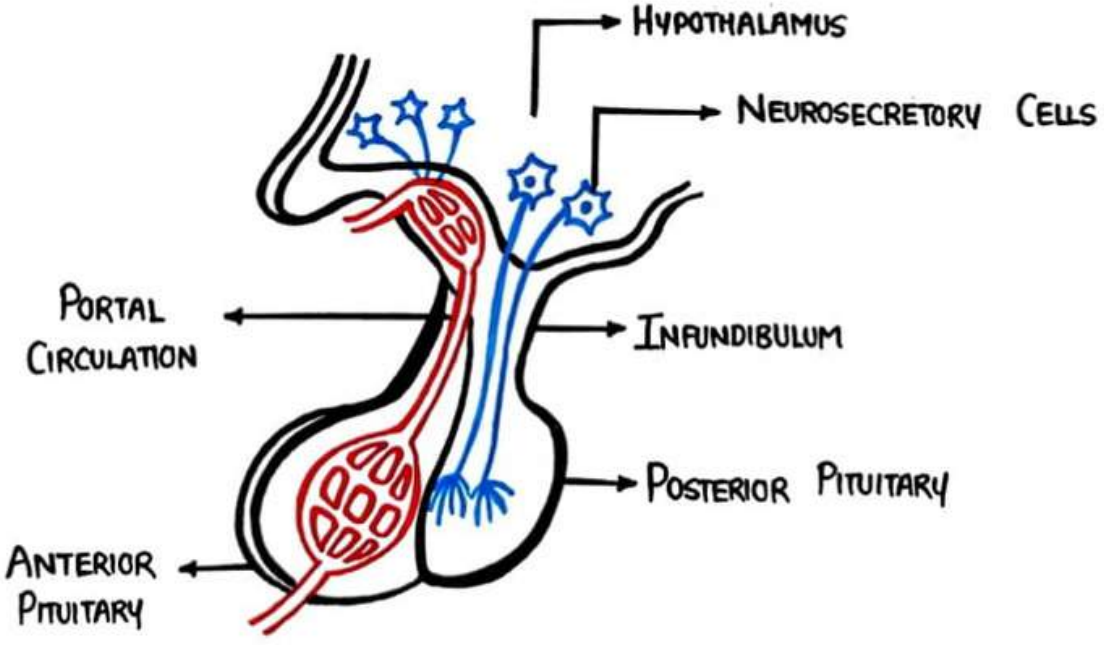
PITUITARY GLAND

- Pituitary Gland is a very small gland & also known as **Hypophysis**.
- It is located in '**Sella Turcica**' a depression in sphenoid bone.
- It is almost a pea size gland & its weight is about 500 mg.
- It joints with Hypothalamus through **Infundibulum**.
- The Pituitary Gland is also known as '**Master Gland**' of our body as it controls the activity & functions of various other Endocrine Glands.

PARTS OF PITUITARY GLAND

Pituitary Gland can be subdivided into two parts :

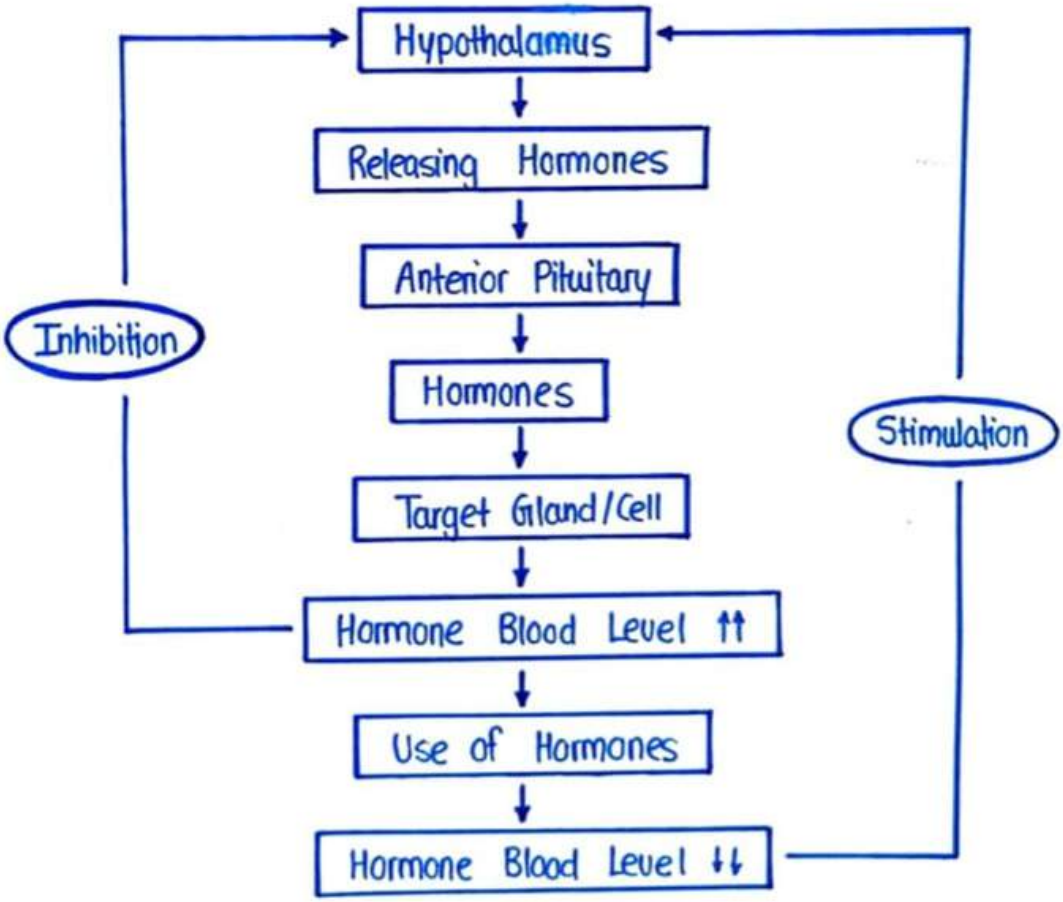
① Anterior Pituitary
② Posterior Pituitary



HYPOTHALAMUS

- Although Hypothalamus is not purely considered as part of Endocrine Glands yet along with Pituitary Gland it plays major role in Endocrine System.
- It is known as Master of 'Master Gland'.
- It releases various 'Releasing' and 'Inhibiting' Hormones to the Anterior Pituitary through 'Portal Circulation'
- It also produces & stores hormones (ADH & Oxytocin) in the posterior pituitary through 'Neurosecretory / Neuroendocrine cells'.

It controls the release or inhibit of hormones from Pituitary Gland as follows:



ANTERIOR PITUITARY

- Anterior Pituitary is also known as Adenohypophysis.
- It can be further divided into two parts :

① Pars Distalis
② Pars Intermedia.

- Hypothalamus controls the release & inhibition of hormones released from anterior pituitary by sending hormones through 'Hypophaseal Portal Vein'.
- Anterior Pituitary secretes various hormones that controls & coordinates the functions of other endocrine glands.
- The Hormones releases by Anterior Pituitary are as follows :

(i) Growth Hormone (GH)
(ii) Thyroid Stimulating Hormone (TSH)
(iii) Adrenocorticotrophic Hormone (ACTH)
(iv) Prolactin
(v) Gonadotrophins

GROWTH HORMONE

- It releases from Anterior Pituitary in most abundant amount.
- It is responsible for growth & development of body by increasing cell division, Protein Synthesis, Blood-Glucose Level & Lipid breakdown.
- It targets various tissues & organs i.e. Liver, Connective Tissue, Bones, Muscles etc.
- Hypothalamus stimulate the release of growth hormone by secreting 'Growth Hormone Releasing Hormone' & suppresses / inhibited it by secreting 'Growth Hormone Release Inhibiting Hormone' (GHRIH).
- Secretion of GH is greatre at night during sleep.
- Hypersecretion of GH leads to Gigantism.
- Hyposecretion of GH leads to Dwarfism.

Thyroid Stimulating Hormone (TSH)

- It is also known as Thyrotrophin.
- It stimulates growth & activity of Thyroid Gland
- The blood levels of TSH is stimulated by 'Thyrotrophin Releasing Hormone' secreted by Hypothalamus.
- Its inhibition is regulated by Negative Feedback Mechanism.
- Its release is lower in early evening & highest during night.

Adrenocorticotrophin Hormone (ACTH)

- It acts on Adrenal Cortex
- Its secretion is stimulated by 'Corticotrophin Releasing Hormone' from Hypothalamus.
- It promotes the release of steroid hormones (especially cortisol) from Adrenal Cortex.
- Its inhibition is regulated by Negative Feedback Mechanism.

Prolactin

- This hormone is responsible for Lactation (Milk Production) & has a direct effect on breast after Childbirth.
- The release of Prolactin is stimulated by 'Prolactin Releasing Hormone' & further lowered by 'Prolactin Inhibiting Hormone'.
- Its secretion is Increased during sleep & emotional stress.

GONADOTROPHINS

- After Puberty two Gonadotrophins (Sex Hormones) are secreted by Anterior Pituitary in response to 'Gonadotrophin Releasing Hormone' via Hypothalamus.
- These Hormones are :

① FSH (Follicle Stimulating Hormone)
② LH (Luteinizing Hormone)

In Males :
- In Males FSH stimulates Spermatogenesis.
- LH also known as Interstitial Cell Stimulating Hormone (ICSH) stimulates interstitial cell of testes to secrete Testosterone.

In Females :
- In Females FSH stimulates Oogenesis.
- LH & FSH are involved in secretion of hormones Oestrogen & Progesterone during menstrual cycle.

Analogue & Inhibitors Of Anterior Pituitary Hormones

① Growth Hormone

- Analogue : Somatropin (recombinant form of GH)
- Inhibitors : Somatostatin Analogues (eg. Octreotide, lanreotide)
  Dopamine Agonists (eg. bromocriptine, cabergoline)
  GH Receptor Antagonists (eg. pegvisomant)

② Thyroid Stimulating Hormone

- Analogue : Thyrotrophin Alfa (recombinant TSH)
- Inhibitors : Somatostatin analogues, dopamine agonist, Glucocorticoids.

③ Adrenocorticotrophic Hormone

- Analog : Cosyntropin (synthetic ACTH)
- Inhibitors : Glucocorticoids (negative feedback)
  Somatostatin Analogue

④ Prolactin (PRL)

- Analog : No clinical analog till now
- Inhibitors : Dopamine Agonists (Bromocriptine, cabergoline)

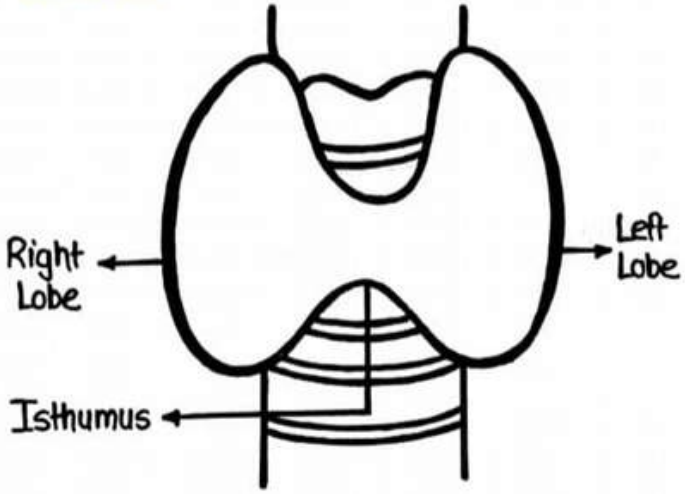
⑤ LH & FSH

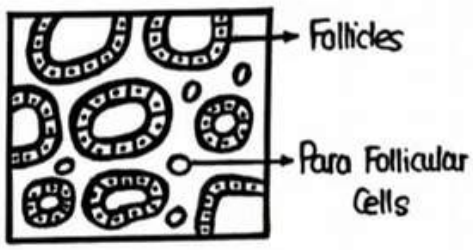
- Analogs : LH : Lutropin Alfa
  FSH : Follitropin α, β , Urofollitropin
- Inhibitors : LH : GnRH agonists (leuprolide , goserelin)
  FSH : "

THYROID GLAND

- It is the largest endocrine gland in our body.
- It present around trachea at level of 5th, 6th & 7th cervical & 1st thoracic vertebrae.
- It resembles the shape of butterfly.
- It consist of two lobes connected with Isthumus.
- It composed of hollow structures known as 'Follicles'.
- It secretes two hormones :

① Thyroid Hormone
② Calcitonin





CALCITONIN

- It is secreted by Parafollicular cells.
- It acts on bone & kidneys to reduce blood calcium level when increased.
- It basically decreases Blood Calcium level.
- Release of calcitonin is stimulated by increase in Blood Calcium level.

Thyroid Hormones

- There are mainly two types of Thyroid Hormones.

① Triiodothyronine (T_3)

② Thyroxine (T_4)

- Iodine is most essential for formation of thyroid hormones.
- The release of T_3 & T_4 is stimulated by Thyroid Stimulating Hormone (TSH).
- They are known as 'Master Hormones'
- It increases the BMR & Heat Production
- It regulates metabolism of Carbohydrates, Proteins & Fats.
- T_3 & T_4 are essential for normal growth & development especially Skeleton & Nervous System.
- T_3 is more potent while T_4 is more abundant.
- It also regulates Menstrual Cycle & Water - Electrolyte Balance.
- They also play a role in maintaining Healthy skin, hair & nail.
- Thyroid Hormones can also affect mood & their imbalance leads to Mood swings, anxiety & depression.

THYROID HORMONES

- Thyroid hormones are essential chemical messenger produced by thyroid gland, a small butterfly-shaped gland located in front of the neck.
- Thyroid Gland is the source of two fundamentally different type of hormones.

① Thyroxine (T_4)
② Triiodothyronine (T_3)

- Both hormones are vital for normal growth & development and control essential functions, such as energy metabolism and protein synthesis.
- Thyroid Gland is divided into lobules which consist of mainly two types of cells

(1) Follicular Cells
(2) Parafollicular Cells

SYNTHESIS OF THYROID HORMONES

Thyroid Hormone synthesis is a complex process involving multiple steps that occur primarily in thyroid gland.

- Iodide Uptake
- Oxidation of Iodide
- Thyroglobulin Synthesis
- Iodination of Tyrosine
- Coupling Reaction
- Release of T_3, T_4

THYROID DRUGS

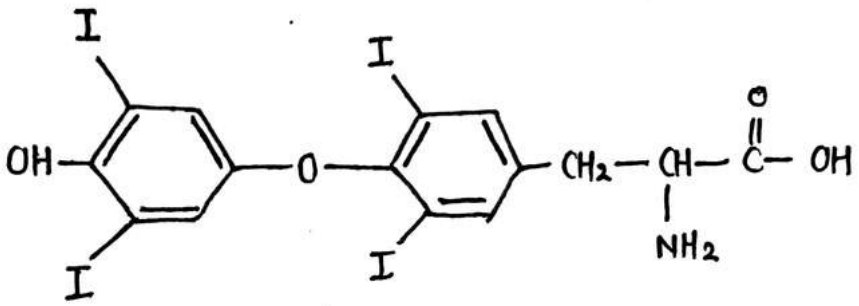
- L- Thyroxine
- L- Thyronine

ANTITHYROID DRUGS

- Propylthiouracil
- Methimazol

① L- THYROXINE

- L- Thyroxine (also known as Levothyroxine) is a synthetic form of thyroid hormone Thyroxine (T_4), which is normally produced by Thyroid Gland.
- It is a treatment of choice for hypothyroidism.



MOA

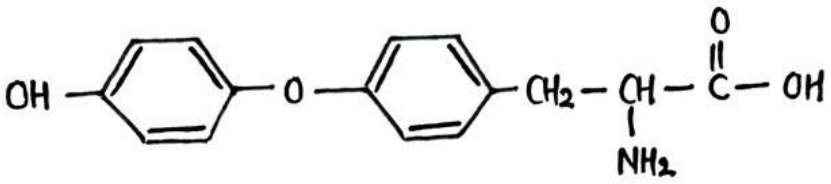
L- Thyroxine is a synthetic T_4, first it is converted to to its active form Triiodothyronine (T_3) in peripheral tissues, binds to nuclear thyroid ~~ho~~ receptors, where it regulate gene expressions to perform various physiological functions.

Uses

- Hypothyroidism
- Thyroid Hormone Replacement Therapy.

② L- THYRONINE

L- Thyronine is a synthetic Triiodothyronine that plays a crucial role in various physiological process.



MOA

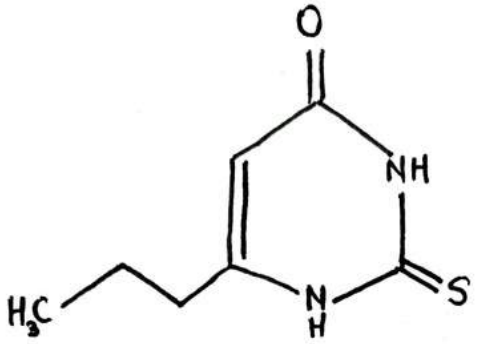
L- thyronine is a synthetic T3 , that binds to thyroid hormone receptors in nucleus of the cells & regulates various physiological process.

Uses

Severe Hypothyroidism

③ PROPYLTHIOURACIL

Propylthiouracil is an antithyroid drug, primarily used in treatment of hyperthyroidism, including conditions like ~~Hyperthyroi~~ Graves' Disease.



MOA

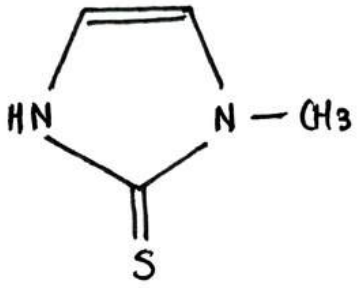
It inhibits Thyroid Peroxidase enzyme, preventing iodination of Tyrosine residues, synthesis of Thyroid hormones and also inhibits T_4 to T_3 conversion.

Uses

- Hyperthyroidism
- Graves' Disease

④ METHIMAZOLE

Methimazole is an antithyroid medication primarily used to treat hyperthyroidism.



MOA

Same as Propylthiouracil

Uses

- Hyperthyroidism
- Graves' Disease
- Toxic Multinodular Goitre.

PLASMA CALCIUM LEVEL REGULATION

Plasma calcium levels are tightly regulated within a narrow range to ensure proper physiological functioning, including nerve transmission, muscle contraction, blood clotting, and enzyme activity.

Hormones Regulating Plasma Calcium Level

Plasma Calcium level is regulated by mainly 3 hormones:

- Parathormone
- Calcitonin
- Vitamin D (Calcitriol)

Vitamin D

- Vitamin D, plays a critical role in the regulation of plasma calcium levels, primarily through its effect on calcium absorption, bone resorption & kidney function.
- Vitamin D in its active form (calcitriol), increases absorption of calcium from digestive tract
- It also works synergistically with PTH to promote release of calcium from bones & reduce calcium loss through kidneys.

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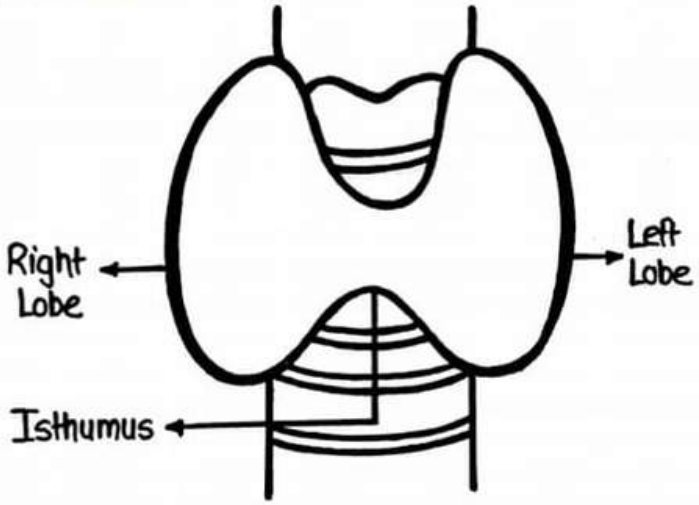

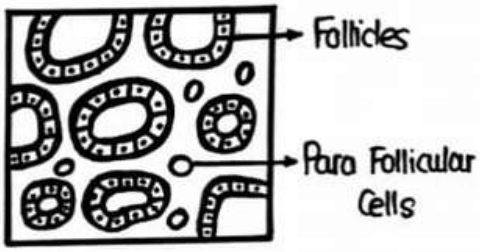

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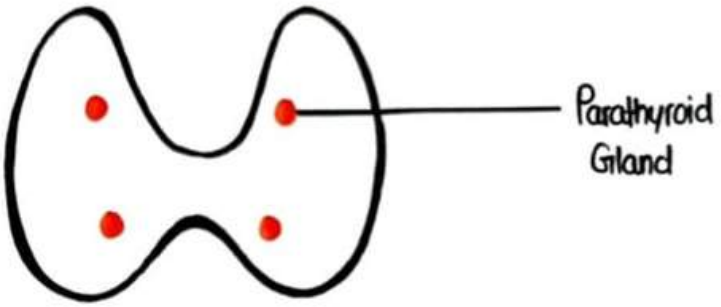
PARATHYROID GLAND

- There are 4 small Parathyroid Glands, located within Thyroid Gland.
- Parathyroid Gland secretes Parathyroid Hormone



PARATHORMONE

- The Parathyroid hormone (Parathormone, PTH) regulates or increased Blood Calcium Level, when it is low.
- It maintains proper calcium balance in body. by stimulating release of calcium from bones enhancing calcium absorbtion from intestine & reducing calcium excretion from kidneys
- Parathormone & Calcitonin from Thyroid Gland act in complementary manner to maintain Blood Calcium Level within normal range.

DIABETES MELLITUS

- Diabetes Mellitus is a chronic metabolic disorder characterized by high levels of Glucose in Blood.
- It occurs either due to inadequate production of Insulin by Pancreas or body's inability to effectively use Insulin.
- Insulin is a Hormone produced by Pancreas that helps to regulate Blood Sugar Level by facilitating absorbtion of Glucose into cells to be used for Energy.

TYPES OF DIABETES MELLITUS

Diabetes Mellitus can be mainly classified into 3 types

① Type 1 Diabetes Mellitus
② Type 2 Diabetes Mellitus
③ Gestational Diabetes

TYPE 1 DM

- Earlier it was known as Insulin Dependent Diabetes Mellitus.
- It constitutes about 10% cases of Diabetes Mellitus.
- It occurs because of destruction of β cells of pancreas due to Autoimmune Disorders.
- It leads to deficiency of Insulin that leads to increase in Blood Glucose Level.
- Type 1 Diabetes often develops during Childhood or Adult Age.

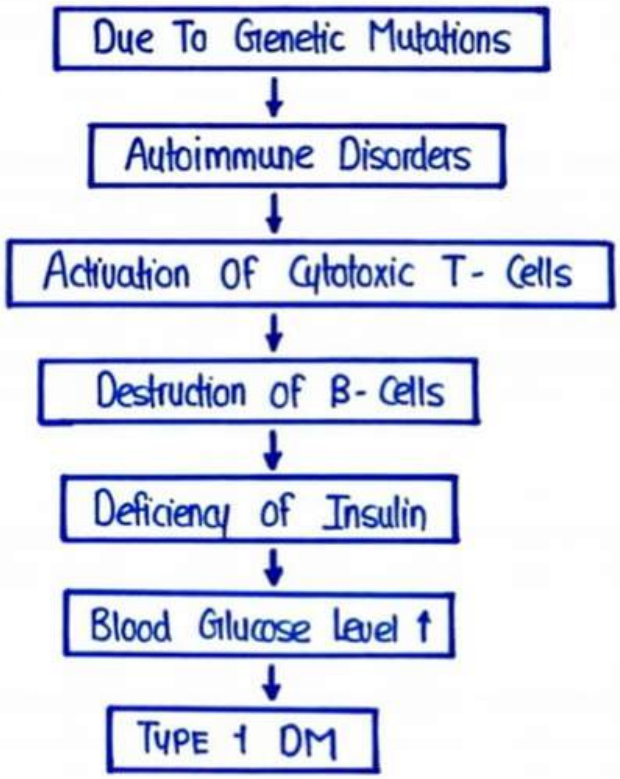
CAUSES

- Type 1 Diabetes Mellitus primarily occurs due to an Autoimmune Disorder, where body's immune system mistakenly attacks & destroys insulin producing β cells in pancreas.
- The exact cause of this autoimmune response is not fully understood, it is beleived to involve a combination of Genetic & Environmental factors.
- There are following factors that can be responsible for this AIR.

① Genetic Mutations
② Viral Infections
③ Early Childhood Exposures
④ Geographical & Seasonal Patterns

PATHOGENESIS

The pathogenesis of Type 1 Diabetes can be explained as follows :



Symptoms

- Increased Thirst
- Frequent Urination
- Extreme Hunger
- Weight Loss
- Fatigue
- Weakness

Complications

- Diabetic ketoacidosis
- Diabetic Neuropathy
- Diabetic Nephropathy
- Diabetic Retinopathy
- Depression & Anxiety

Treatment & Management

- Insulin Therapy
- Blood Sugar Monitoring
- Physical Activity
- Management of Other Health Conditions
- Carbohydrate Counting

TYPE 2 DM

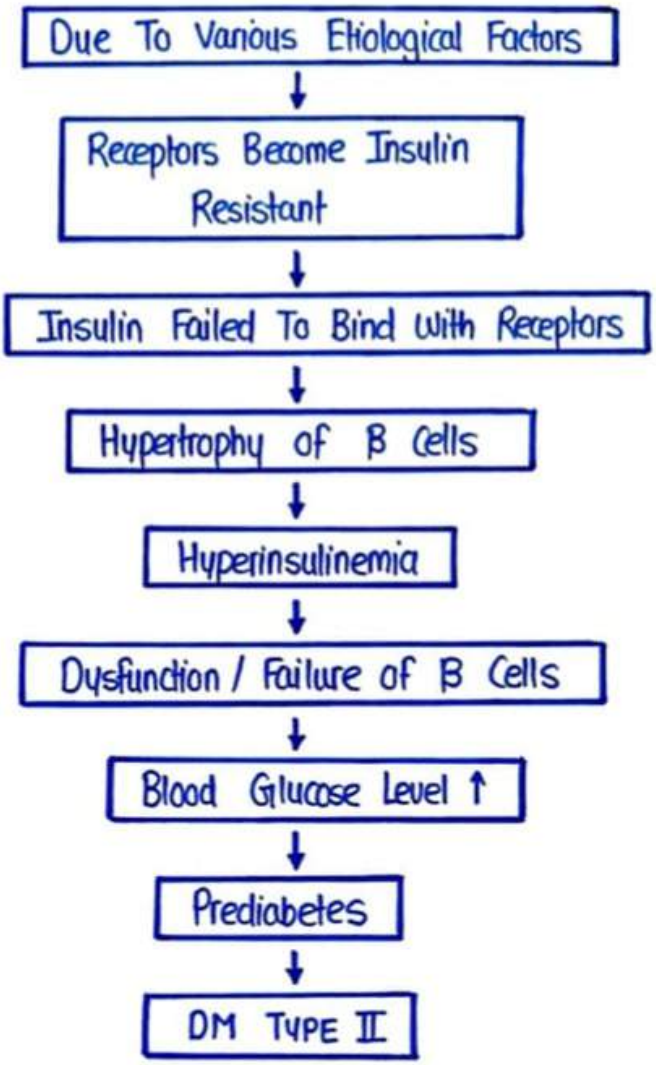
- Earlier it was known as Non Insulin Dependent Diabetes Mellitus.
- It constitutes about 90% cases of Diabetes.
- It generally occurs when cell doesn't respond to properly.
- In Type 2 Diabetes receptor on cells becomes Insulin Resistance.
- Type 2 DM, if maintained for a long period of time can also leads to Insulin Deficiency
- It generally occurs later (mostly after 30) due to physical inactivity, obesity & poor dietary habits.

CAUSES

Type 2 diabetes is mainly a lifestyle disorder in which body becomes resistant to the effect of Insulin. Several factors contribute to the development of Type 2 DM as follows:

- Genetic Factors
- Obesity
- Physical Inactivity
- Unhealthy Diet
- Age
- Gestational Diabetes
- Polycystic Ovary Syndrome (PCOS)

Pathogenesis



Symptoms

- Excessive Thirst
- Frequent Urination
- Increased Hunger
- Weight Loss
- Fatigue
- Slow Healing

Complications

- Diabetic Neuropathy
- Diabetic Nephropathy
- Diabetic Retinopathy
- Cardiovascular Diseases
- Depression / Anxiety

Treatment / Management

- Healthy Diet
- Regular Exercise
- Weight Management
- Certain Medications :
  - Sufonyl Urea
  - Metformin
- Blood Sugar Monitoring

ANTIDIABETIC AGENTS

- Antidiabetic Agents are used for treating Diabetes Mellitus by decreasing blood glucose levels.
- Some of these drugs are administered orally and termed Oral Hypoglycaemic or Oral Antihyperglycaemic Agents
- Different classes of anti-diabetic drugs exist and they are selected based on nature of diabetes, individual's age, situation and other factors

INSULIN

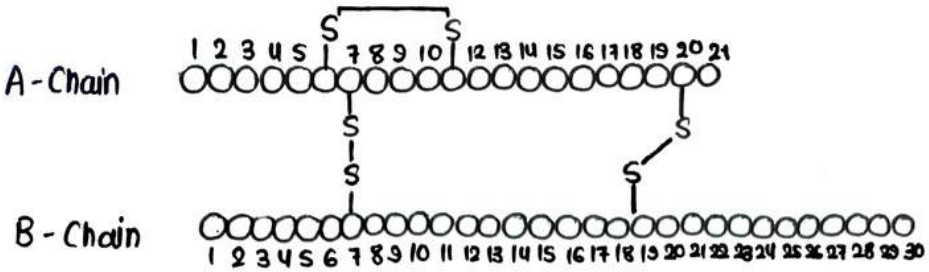
- Insulin is a peptide hormone that plays a central role in regulating various metabolic processes, particularly the regulation of blood glucose levels.
- It is produced & secreted by beta cells of islets of Langerhans in pancreas.
- Insulin is essential for proper utilization, storage and regulation of glucose and other nutrients in the body.

Structure of Insulin

- Insulin is a protein hormone composed of 51 amino acid arranged in two polypeptide chains:

① A Chain (21 amino acids)
② B Chain (30 amino acids)

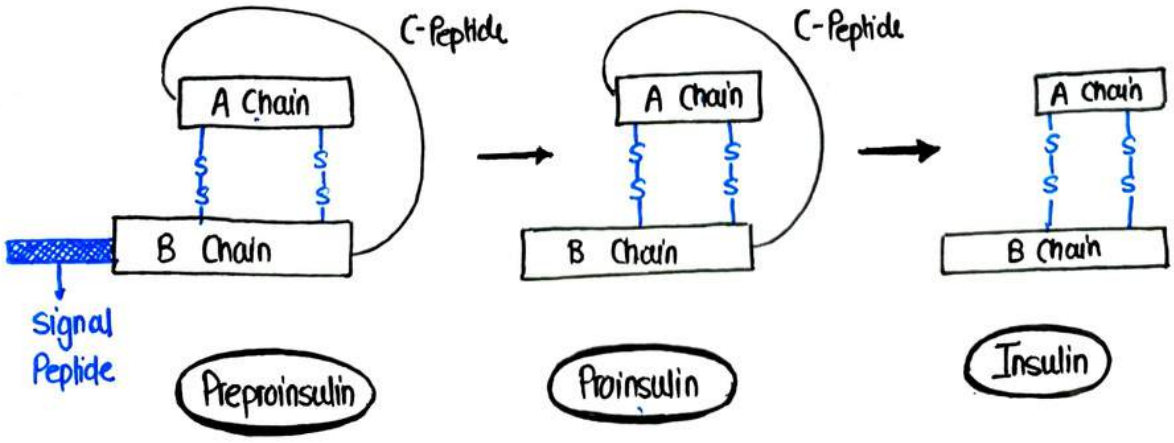
- These chains are connected by disulfide bonds, crucial for maintaining its functional 3 dimensional structure.



INSULIN

SYNTHESIS

- Synthesis of Insulin refers to process by which Insulin, a peptide hormone, is produced in pancreas, specifically by the beta cells of islets of Langerhans.
- The insulin mRNA is translated as a single chain precursor, known as pre-pro-insulin.
- The signal peptide is removed from Pre-pro-insulin, forming proinsulin
- In Golgi Apparatus, proinsulin is processed into Mature Insulin. by removing C peptide.



Insulin Preparation

Types	Onset	Peak	Duration
Short Acting Insulin			
(i) Crystalline Soluble Insulin	0·30-1	2	5-8
(ii) Amorphous Insulin Zinc Suspension (Semilente)	0·30-1	8	12-16
Intermediate Acting			
(i) Globin Zinc Insulin	1-4	6-10	16-24
(ii) Insulin Zinc Preparation (Lente)	1-4	6-8	24-30
(iii) Isophane Insulin Suspension	1-2	10-12	24-30
Long Acting Insulin			
(i) Protamine Zinc Suspension	8	14-16	30-36
(ii) Extended Insulin Zinc Crystalline (Ultralente)	7	14-16	34-36

CLASSIFICATION OF ORAL HYPOGLAECEMIC AGENT

Oral Hypoglaecemic agents can be classified as follows :

① Sulfonyl Ureas

- Tolbutamide *
- Chlorpropamide
- Glipizide
- Glimepiride

② Biguanides

- Metformin

③ Thiazolidinediones

- Pioglitazone
- Rosiglitazone

④ Meglitinides

- Repaglinide
- Nateglinide

⑤ Glucosidase Inhibitors

- Acrabose
- Voglibose

① SULFONYL UREAS

- Sulfonylureas are a class of oral hypoglycemic agents primarily used to treat Type 2 Diabetes Mellitus
- They stimulate insulin secretion from pancreatic β cells, thereby lowering blood glucose levels.

MOA

- Sulfonylureas binds to and inhibit the ATP-sensitive potassium channels on β cell membrane of pancreas.
- This inhibition causes membrane depolarization, leading to opening of voltage gated calcium channels.
- The resulting influx of calcium triggers the exocytosis of insulin granules, increasing insulin secretion.

PHARMACOKINETICS

- Absorption : They rapidly absorbed from GIT.
- Distribution : They are highly protein-bounded.
- Metabolism : Metabolized in liver via CYP2C9 enzymes.
- Excretion : Excreted primarily in urine.

② BIGUANIDES

- Biguanides are class of oral antihyperglycemic agents primarily used in treatment of Type-2 diabetes mellitus.
- Metformin is most commonly used Biguanides.

MOA

- Biguanides inhibit gluconeogenesis and glycogenolysis in liver by suppressing complex-I in ETC, leading to decreased ATP & activation of AMP dependent protein kinase AMP_K
- AMP_K activation reduces glucose production & increases Insulin sensitivity.
- It also slows down intestinal glucose absorption.

PHARMACOKINETICS

- Absorption : Well absorbed from GIT
- Distribution : Widely distributed in body tissues.
- Metabolism : It is not metabolized by liver
- Excretion : Excreted unchanged in urine

Adverse Effect

- Nausea
- Vomiting
- Diarrhoea
- Lactic Acidosis

③ THIAZOLIDINEDIONES

- Thiazolidinediones, also known as glitazones, are a class of medications primarily used to manage Type 2 DM.
- They function as insulin sensitizers, enhancing body's response to insulin, thereby improving glucose control.

MOA

- Thiazolidinediones exert their effect by activating PPAR-γ (Proliferator-activated receptor gamma), a nuclear receptor found primarily in adipose tissue, muscle, and liver.
- When activated, PPAR-γ modulates the expression of genes involved in glucose & lipid metabolism.
- By activating PPAR-γ, TZDs increase the sensitivity of peripheral tissue (muscle & adipose tissue) to insulin, facilitating glucose uptake & reducing blood glucose levels.
- In liver, PPAR-γ activation leads to reduced hepatic glucose production, further lowering blood sugar levels.

PHARMACOKINETICS

- Absorption : They are well absorbed from GIT.
- Distribution : They are widely distributed in body.
- Metabolism : They are primarily metabolized in liver by CYTP450 enzyme.
- Excretion : They are excreted via kidneys.

④ MEGLITINIDES

- Meglitinides are class of oral antidiabetic agents used to manage Type II Diabetes Mellitus by stimulating insulin secretion.
- They are generally short acting and primarily used to manage postprandial blood glucose levels.

MOA

- Meglitinides binds to specific sites on ATP-sensitive potassium channels on pancreatic beta cells.
- This binding causes closure of potassium channels, leading to cell depolarization.
- Depolarization opens voltage-gated calcium channels, allowing calcium influx, which triggers exocytosis of insulin.

PHARMACOKINETICS

- Absorption : Rapidly absorbed from GIT.
- Distribution : Highly protein bounded.
- Metabolism : Metabolised in liver by CYP3A4 & CYP2C8 enzymes.
- Excretion : Mainly excreted via feces & urine.

Adverse Effects

- Hypoglycemia
- Weight Gain
- GIT Disturbances.

(5) α- Glucosidase Inhibitors

Alpha- Glucosidase Inhibitors are oral antidiabetic drugs that work by delaying carbohydrate digestion and glucose absorption, thereby reducing postprandial blood glucose levels.

MOA

- These drugs inhibit alpha- glucosidase enzymes located in brush border of small intestine
- These enzymes are responsible for breaking down complex carbohydrates (starch, oligosaccharides and disaccharides) into monosaccharides like glucose.
- By inhibiting these enzymes., AGIs slow the conversion of carbohydrates into glucose resulting in:

- A slower rise in blood glucose levels after meals.
- Lower postprandial blood glucose spikes.

Pharmacokinetics

- Absorption : Acarbose poorly absorbed, Miglitol well absorbed
- Distribution : Generally low to moderate volume of distribution
- Metabolism : Partially or excreted unchanged
- Excretion : Excreted mainly in feces or unchanged in urine.

Adverse Effect

- Abdominal bloating & pain
- Diarrhea

GLUCAGON

- Glucagon is a hormone produced by the alpha cells of the pancreas in response to low blood glucose levels.
- Its primary role is to increase blood glucose levels by promoting the release of glucose stored in liver.

Function

- Glycogenolysis
- Gluconeogenesis
- Lipolysis

Regulation

- It is stimulated by low blood glucose, high amino acid levels, and sympathetic nervous system activation.
- Inhibited by: High blood glucose, insulin & somatostatin.

ADRENOCORTICOTROPHIN HORMONE (ACTH)

- It acts on Adrenal Cortex
- Its secretion is stimulated by 'Corticotrophin Releasing Hormone' from Hypothalamus.
- It promotes the release of steroid hormones (especially cortisol) from Adrenal Cortex.
- Its inhibition is regulated by Negative Feedback Mechanism.

CORTICOSTEROIDS

- Corticosteroids are class of steroid hormones that are produced naturally in the Adrenal Cortex, the outer part of adrenal gland
- The release of these hormones is controlled by pituitary adrenocorticotrophic hormone which is further regulated by
- hypothalamic corticotrophin releasing hormone.
- As drug they lowers inflammation in body also reduce the activity of immune system.

CLASSIFICATION OF CORTICOSTEROIDS

The major corticosteroids produced by adrenal cortex are as follows:

① Mineralocorticoids
② Glucocorticoids

① Mineralocorticoids

- They regulate water & electrolyte balance by affecting ion transport in renal tubules
- Aldosterone is the major mineralocorticoids.

② Glucocorticoids

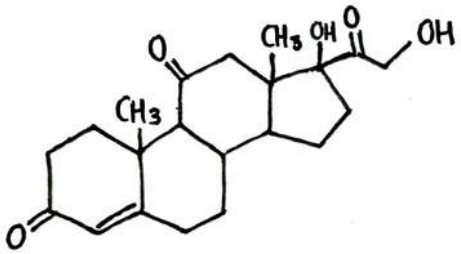
- It involved in metabolism & have immunosuppressive, anti-inflammatory & vasoconstrictive effects.
- Cortisol is the major Glucocorticoid hormone.

Drugs In Our Syllabus

- Cortisone
- Hydrocortisone
- Prednisolone
- Betamethasone
- Dexamethasone

① CORTISONE

- Cortisol is a pregnane (21-C) steroid hormone.
- It is naturally occuring corticosteroid used as a prodrug.



MOA

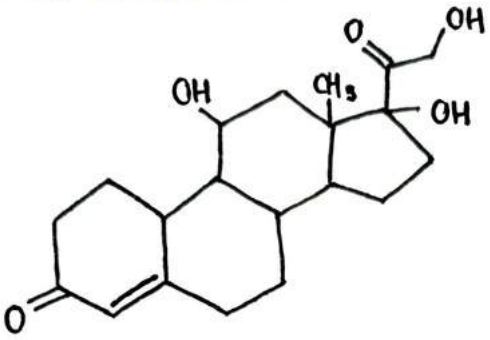
- Cortisone is an inactive prodrug which is first converted to its active form Hydrocortisone in liver by enzyme 11β-hydroxysteroid dehydrogenase type 1 (11β-HSD1).
- Once activated it binds to glucocorticoid receptors to show its anti-inflammatory effect.

Uses

- Inflammation
- Short-term pain relief

② HYDROCORTISONE

- Hydrocortisone is naturally occurring glucocorticoid steroid hormone produced naturally by adrenal glands.
- As a drug it is a synthetic or semisynthetic analogue of natural hydrocortisone.



MOA

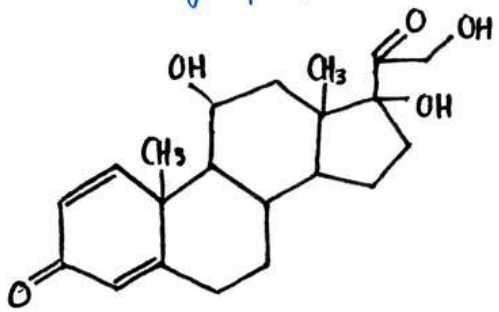
Hydrocortisone binds to glucocorticoid receptor located in cytoplasm of target cells & shows its anti-inflammatory and immunosuppressive effects.

Uses

- Inflammation
- Allergic Conditions
- Ulcerative Colitis

③ PREDNISOLONE

Prednisolone is a synthetic glucocorticoid with anti-inflammatory & immunomodulating properties.



MOA

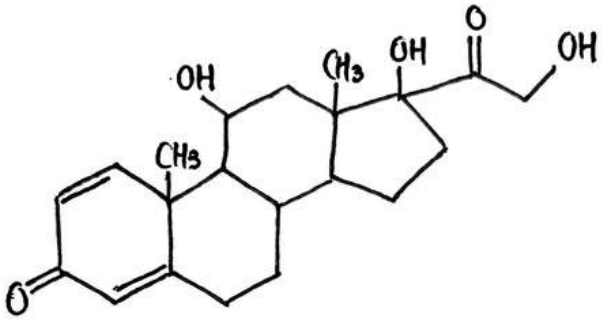
Prednisolone binds to glucocorticoid receptors located in cytoplasm of target cells & shows its antiinflammatory and immunosuppressive effects.

Uses

- Severe Allergies
- Autoimmune Disorders
- Asthama

④ BETAMETHASONE

Betamethasone is a potent synthetic glucocorticoid steroid widely used for its anti-inflammatory, immunosuppressive and antiallergic properties.



MOA

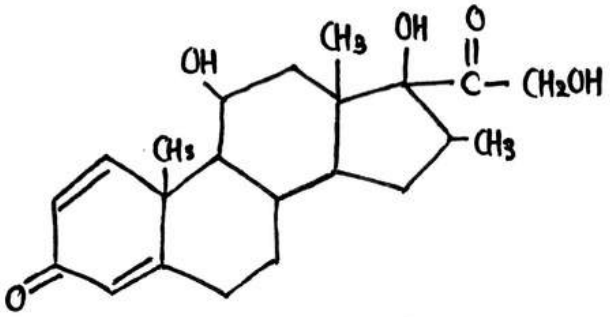
Betamethasone binds to glucocorticoid receptors & shows its antiinflammatory & immunosuppressive effects.

Uses

- Skin Irritation
- Inflammation

(S) DEXAMETHASONE

Dexamethasone is a potent synthetic glucocorticoid widely used for its anti-inflammatory, immunosuppressive and antiallergic effects.



MOA

It works through binding to glucocorticoid receptors in cytoplasm of target cells & shows its anti-inflammatory & immunosuppressive effect.

Uses

- inflammation
- Autoimmune Disease
- Allergic Reactions.

THANK YOU

FOR CHOOSING IMPERFECT PHARMACY AS YOUR STUDY PARTNER

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