

• COORDINATION AND CONTROL :-

The association and working together of various parts of an organism in a systematic manner to produce appropriate response to a stimulus is called 'Coordination'.

↳ STIMULUS :-

A factor or agent that causes a response.

↳ RESPONSE :-

Reaction or answer to a stimulus.

↳ RECEPTOR :-

A specific substance / molecule that detects the stimulus.

↳ EFFECTOR :-

A cell, organ or system that response to a stimulus.

TYPES OF COORDINATION SYSTEM

NERVOUS COORDINATION

CHEMICAL COORDINATION

OR

ENDOCRINE SYSTEM

→ NERVOUS SYSTEM:-

A complex system that coordinates and controls various functions of the body.

Three interconnected functions :-

- i. Sensory Input
- ii. Integration
- iii. Motor Output

i. SENSORY INPUT :-

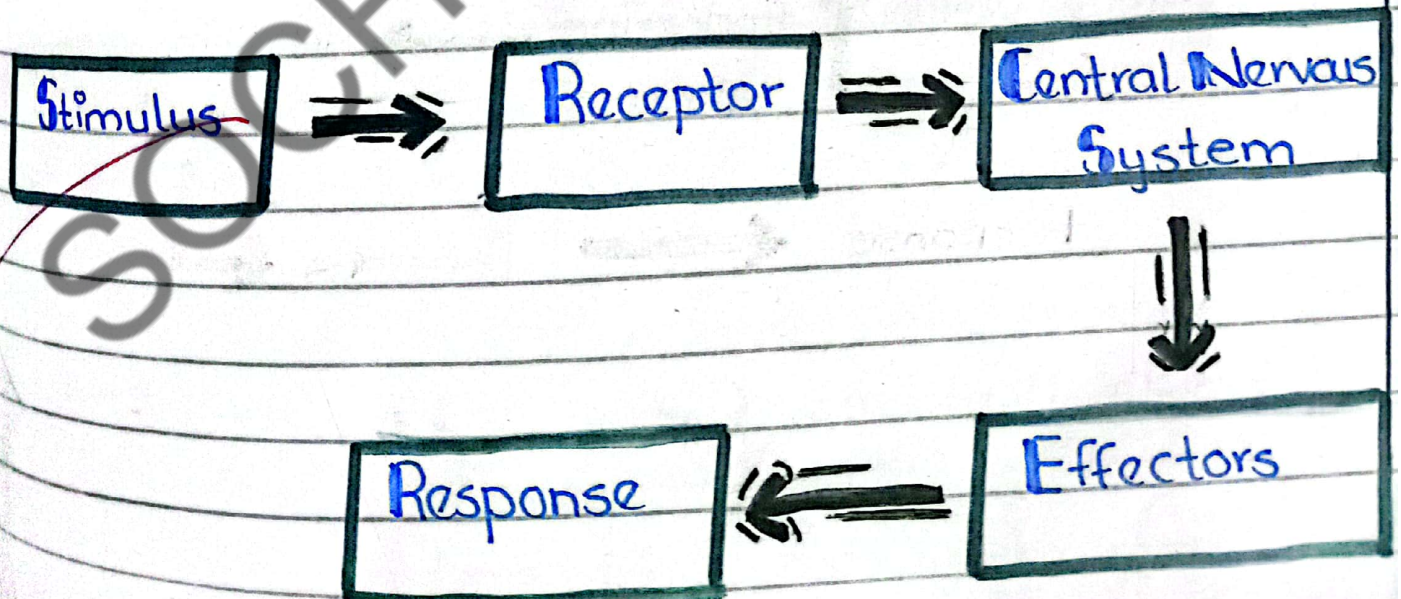
Conduction of signals from receptors to processing centres { brain, spinal cord and central nervous system }.

ii. INTEGRATION :-

Interpretation of information and formulation of response within processing centre.

iii. MOTOR OUTPUT :-

Conduction of signals from processing centre to effector to produce a response.



• CHEMICAL CO-ORDINATION:-

Types of co-ordination system that uses chemical signals to regulate body activities.

→ HORMONES :-

Chemical messengers produced by glands in the body.

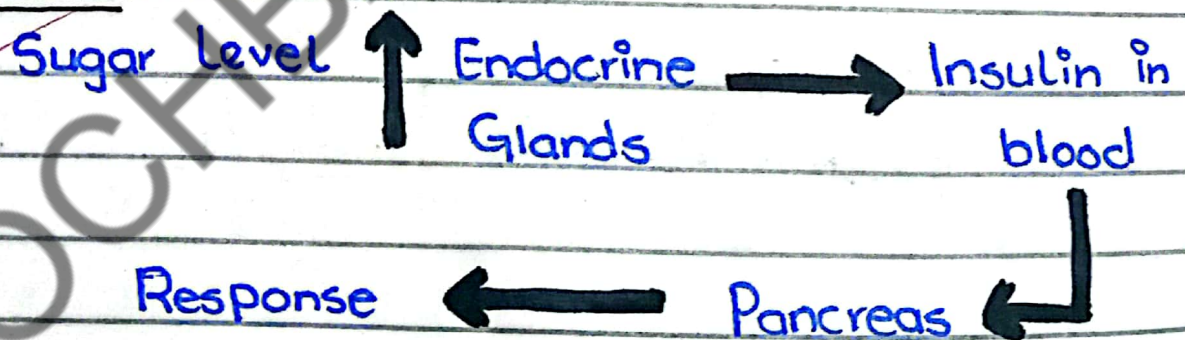
- Production site → where they are produced.
- Effector site → where they produce effect.

→ ENDOCRINE GLANDS :-

A Gland that produces and secretes hormones directly into blood stream.

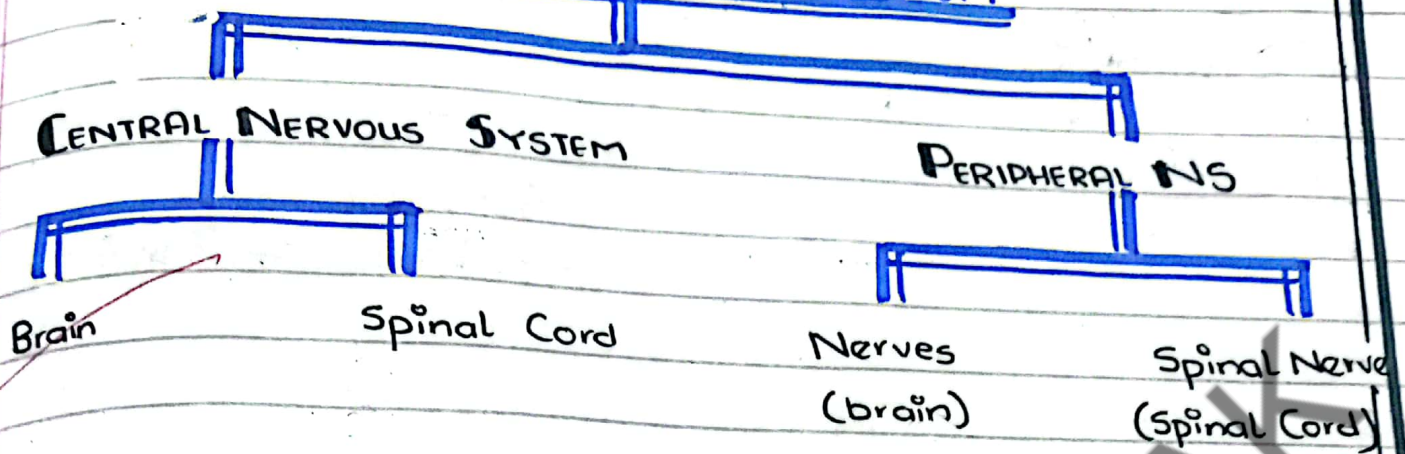
- Travel via blood to target cells / organs.
- Slow and long lasting.

• EXAMPLE :-



- Growth Hormones (GH)
- Adrenaline (Stress Response)
- Estrogen (Female Reproductive)

HUMAN NERVOUS SYSTEM



NEURON:-

The structural and functional unit of Nervous System.

→ STRUCTURE OF NEURON:-

Long, thin and delicate.

- Extends from spinal cord → foot.
- Bundle of Nervous (nerves).

i. CELL BODY / SOMA:-

Main part of Nerve Cells.

ii. AXONS:-

Long slender extension of nerve cells.

- Lead away from cell body.
- Transmission of information over long distance.

iii. DENDRITES:-

Highly branched extension of nerve cells.

- Transfer of impulses towards cell body and then to axon.

iv. MYELIN SHEATH:-

It is fatty, insulating layer that surrounds and protects the neuron.

- Cells in myelin sheath → Schwann Cells
- Gaps between Schwann Cells → Nodes of Ranvier

↳ Determines the speed of conduction of impulses.

↳ Impulses jumps → node to node
Saltatory impulses.

• TYPES OF NEURON:-

i. SENSORY NEURON:-

Carry sensory information from receptors to brain and spinal cord.

→ Have one dendrite and one axon.

ii. MOTOR NEURON:-

Carry information from brain and spinal cord to effectors.

→ One axon and multiple dendrites.

iii. INTERNEURONS:-

Carry impulses from sensory neurons to motor neurons.

→ One axon and multiple dendrites.

• COMPONENTS OF CNS:-

(i) Brain

(ii) Spinal Cord

i. BRAIN:-

→ Structure and Function:-

• Enclosed within cranium (skull).

• Covered with 3 protective layer / membrane called meninges.

- Cerebrospinal fluid = The fluid present between inner and middle membrane.
- Cushions the brain from shock.
- Hollow spaces (ventricles) are present along with the central canal of the spinal cord.

• BRAIN:-

PARTS OF BRAIN



→ FOREBRAIN:-

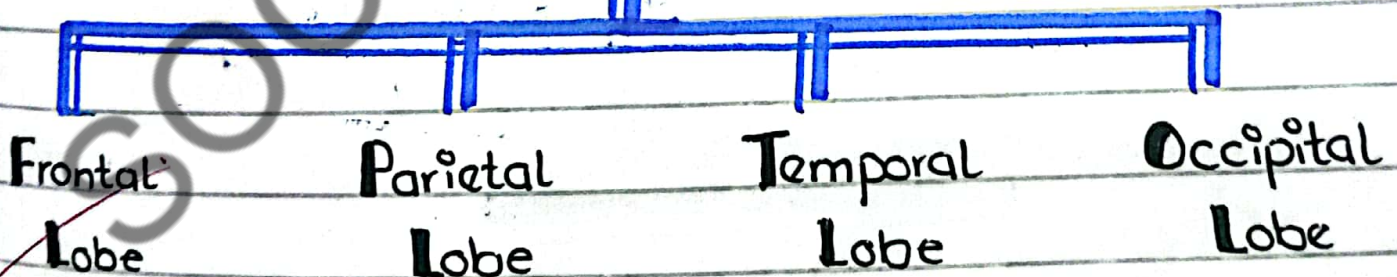
Consist of :-

- Cerebrum
- Thalamus
- Hypothalamus

i. CEREBRUM:-

- ↳ Cerebrum is the largest part of brain.
- ↳ Cerebrum is divided into left or right cerebral hemispheres.

CEREBRAL HEMISPHERE



- Occipital lobe → Vision
- Temporal lobe → Hearing and smelling
- Frontal lobe → Movement of Skeletal Muscles
- Parietal lobe → Awareness of Body position

↳ Right hemisphere is connected to left hemisphere via bundle of nerve (Fattosum) fibres called "Corpus Callosum".

ii. THALAMUS:-

Present below Cerebrum.

- Receives impulses → Pass them to Cerebrum
- Involves in pain and consciousness.

iii. HYPOTHALAMUS:-

Present below thalamus.

- Regulate body temperature, appetite, thirst, blood pressure, mood etc ...
- Link NS to endocrine system.
- Below thalamus → Pitutary gland is present
{ very small, Pea }

BRAIN :-

MIDBRAIN :-

- Mass of tract (bunch of nerve fibre)
- ↳ Present below Cerebrum

FUNCTION :-

- ↳ Receives sensory information



- ↳ Send it to appropriate part of forebrain

- Also controls auditory reflexes and postures.

HINDBRAIN :-

Consists of :-

- i. Cerebellum
- ii. Pons
- iii. Medulla

i. CEREBELLUM :-

Second largest part of brain.

→ Function :-

- Balance and muscle coordination.

ii. PONS :-

Small lobe like structure

- Present above medulla

→ Function:-

- Assist medulla in controlling breathing process.
- Serves as a connection between Cerebellum and Spinal Cord.

iii. MEDULLA OBLONGATA:-

Last part of the brain.

Present above Spinal Cord.

→ Function:-

- Controls involuntary process.

E.g; Heartbeat, BP, respiration

- Also controls reflex action.

E.g; Coughing, Sneezing

• SPINAL CORD :-

→ STRUCTURE :-

- Oval shaped hollow cylinder.
- Runs from base of the brain to lower back.
- 31 pairs of nerves originate from Spinal Cord.

Each Nerve

• Dorsal / Backroot
of Sensory Neurons

• Ventral / Lower
root of Motor Neuron

Mixed Neurons / Nerves

- They serve as a bridge between brain and body parts.

TWO DISTINCT AREAS

White Matter
(Myelinated Fibres)

Grey Matter
(cell bodies + Non-
myelinated fibres)

↳ IN SPINAL CORD:-

Butterfly shaped grey matter is present in centre.

→ White matter is outer to grey matter.

↳ FUNCTION OF SPINAL CORD:-

- Receives sensory information from receptors and sends out motor commands to the effectors.
- Carries out reflex action.
- Better functioning of brain.

• PERIPHERAL NERVOUS SYSTEM:-

- Consist of nerves.
- Links CNS → different parts of body

CRANIAL NERVES

- Nerves which arise from brain.
- 12 pair of nerves.
- Sensory neuron, Motor neuron, interneurons and mixed neurons.

SPINAL NERVES

- Nerves which arise from spinal cord.
- 31 pairs of nerves.
- Mixed Neurons.

• REFLEX ACTION AND REFLEX ARC:-

→ VOLUNTARY ACTIONS:-

International movement or actions that are an individuals conscious control.

→ EXAMPLE:-

Jumping, Speaking etc....

→ INVOLUNTARY ACTIONS:-

Automatic responses that are not under conscious control.

↳ EXAMPLE:-

Heartbeat, Swallowing etc....

→ REFLEX ACTION / REFLEXES:-

Intermediate and automatic responses that occur without conscious intention.

• EXAMPLE:-

Withdrawal of hand on (touch) touching hot objects:-

- i. Heat of object, stimulates receptors in the skin.
- ii. Impulses are produced → travel to sensory neuron to spinal cord.
- iii. Impulses transmit → interneuron → Motor neuron.
- iv. Motor neuron to effector.
- v. Effector → arm muscle which contract.

→ REFLEX ARC:-

Neural pathway responsible for the processing and also executing the reflex actions.

- i. Sense organs
- ii. Sensory neurons
- iii. Interneurons
- iv. Motor neurons
- v. Effector (Muscle / Gland)

• RECEPTORS IN MAN:-

Specialized proteins or molecules that detect and respond to specific signals.

→ Five main types of receptors in Man :-

- i. Sight → Eyes
- ii. Hearing → Ears
- iii. Smelling → Nose
- iv. Tasting → Tongue
- v. Touching → Skin

i. EYE:-

The sense organ that enables to see the shape, (colour) color and movement of the object.

Located in the skull cavity which is known as Orbit.

(Ob) Orbit contains → nerves, blood vessels and six muscles.

Upper and lower eyelids are present above eye that cover and protect the eye.

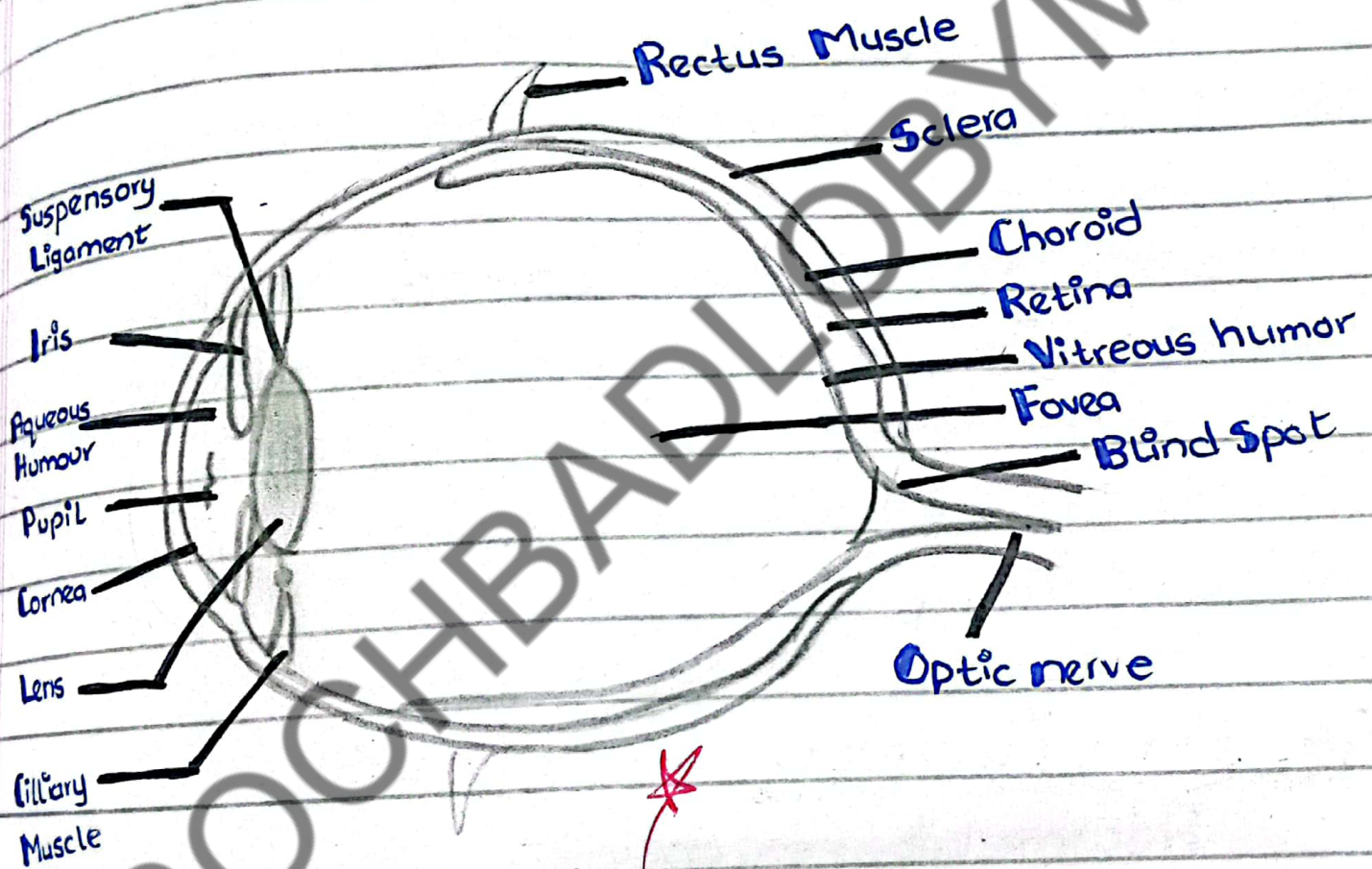
→ INTERNAL STRUCTURE OF EYES:-

i. SCLERA:-

First and the outermost layer.

ii. CHOROID:-

Second layer (Blood capillaries modified to form Iris).



INTERNAL STRUCTURE OF EYE

→ Eyes:-

• IMAGE FORMATION :-

- i. Light enters the eyes through the cornea and aqueous humor.
- ii. It then falls into the lens and vitreous humour.
- iii. The light is refracted (bent) by the cornea and falls into the retina.
- iv. Real image is formed (upside, inverted and smaller).
- v. The photoreceptor cells convert the light into electrical signals and transmit to optic nerves and carry to brain.
- vi. The brain interprets these signals as visual information.

• THE PUPIL REFLEX :-

Automatic response of eyes to change light intensity.

- Regulate the amount of light that enters eye.
- Radial muscles or circular muscles
- These muscles in iris can contract and relax (can change diameter of pupil).

i. IN BRIGHT LIGHT:-

- Circular muscles contract
 - Radial muscles relax
- Pupil Narrow

↓
Less Light enters
the eye.

ii. IN POOR LIGHT:-

- Radial muscles contract
 - Circular muscles relax
- Pupil dilates

↓
More Light enters
the eye

• EAR:-

- Organ of Hearing
- Sensitive to sound vibrations
- Three distinct parts :-

- i. External ear
- ii. Middle Ear
- iii. Inner Ear

i. EXTERNAL EAR:-

- Outer funnel like structure called pinna,
- external / auditory canal.
- Ear drum

ii. MIDDLE EAR:-

- Consist of three auditory, ossicles (bone) :-
 - i. Malleus
 - ii. Incus
 - iii. Stapes
- These bones connect eardrum to inner ear.
- Transmit vibrations from eardrum to inner ear.
- Stapes → attached to oval window (small oval-shaped opening).
- Way to inner ear.

- EUSTACHIAN TUBE:- Small tube that connects middle ear to throat.

- Maintains air pressure on both sides of the ear drum (normal hearing).

iii. INNER EAR :-

Cochlea

i. COCHLEA :-

Coiled like snail shell

- Contains sound receptors.

ii. 3 - SEMICIRCULAR CANALS :-

Loop shaped canals.

iii. VESTIBULE :-

Small central chamber

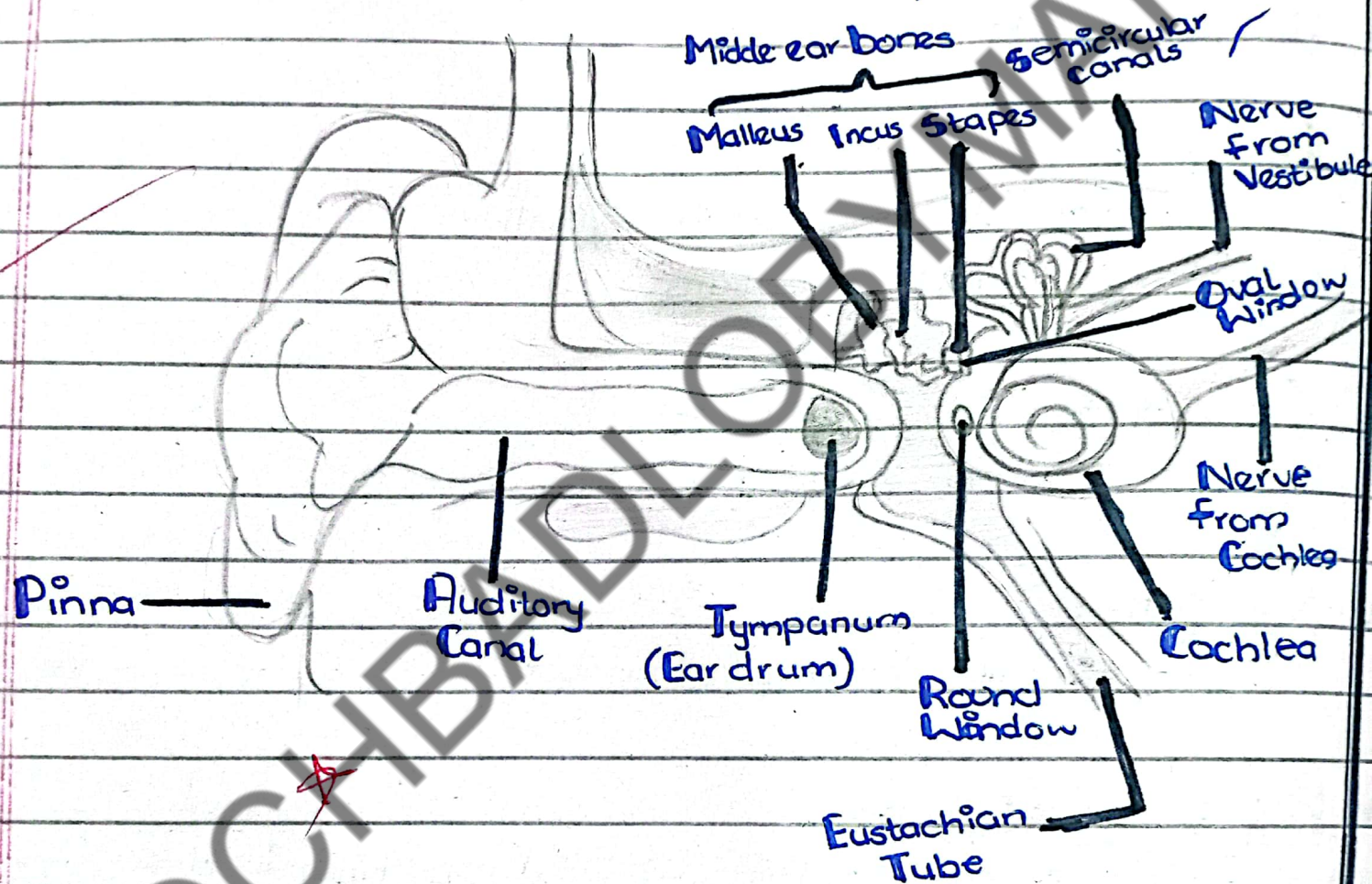
iv. ROUND WINDOW :-

Small membrane - covered opening in the inner ear.

→ PROCESS OF HEARING :-

- Pinna collects sound waves and directs them to auditory canal.
- Sound waves vibrate eardrums.
- Vibrations are then passed to malleus, incus and stapes.
- These bones amplify the vibrations and transfer to oval window.

- v. The vibrations then strike the cochlea.
- vi. Sensory cells in the cochlea send the impulses to brain and interpret as sound.



• EAR:-

→ EAR MAINTAINS BALANCE OF BODY:-

Balancing structure in ear are ;

- Three semi-circular canals and vestibules
- i. Vestibules → detects change in position of body
- ii. Semi-circular canal → detects rotational acceleration of head.

→ ENDOCRINE SYSTEM:-

Network of glands and organ that produce and regulates hormones in the body.

- Chemical messengers
- Controls various functions.
E.g: growth, reproduction

→ HORMONES:-

- Chemical messengers
- Carried around the body in the blood.

→ TARGET ORGAN:-

The organ on which a particular hormone etc....

- They speed up / slows down / alter activities

of these organs.

- Slow processing (days or months) produce long-term response.

• TYPES OF ENDOCRINE GLANDS:-

- i. Pituitary glands
- ii. Thyroid glands
- iii. Parathyroid glands
- iv. Pancreas
- v. Adrenal glands
- vi. Gonads

i. PITUITARY GLANDS:-

Small, pea sized, below Hypothalamus

- Two distinct lobes (anterior and posterior)
- It is called 'master gland' because it regulates the functions of other endocrine glands.

• ANTERIOR GLANDS:-

Larger lobe

- Regulates and maintains development and functions of endocrine glands.
- Secrete many hormones.

- i. Thyroid Stimulating Hormone
- ii. Growth Hormone / Somatotrophic Hormone

- THYROID STIMULATING HORMONE :-

Control development and maintenance of Thyroid glands (thyroid hormone).

- GROWTH HORMONE :-

Control height of an individual.

- PITUITARY DWARF :-

If less than required growth hormone is produced during childhood.

→ Short stature.

- PITUITARY GIANT :-

If more than required growth hormone is produced.

→ Giant stature.

- ACROMEGALY :-

Too much GH in the adulthood.

→ Feet, hands and face becomes overly large.

- Other hormones of Anterior lobe influences gonads and adrenal glands.

• POSTERIOR GLAND / LOBE :-

Secretes two hormones.

i. OXYTOXIN :-

- Powerful contraction of uterus during the child birth.
- Ejection of milk

ii. ANTI-DIURETIC HORMONE :-

- Reabsorption of water from nephron.
- If less anti-diuretic hormone is released



diluted urine



diabetes insipidus.

• ENDOCRINE SYSTEM:-

ii. THYROID GLAND:-

- Located in neck
- Around sides of trachea, below larynx
- Have two lobes and secretes two types of hormones.

• THYROXIN:-

- Regulate metabolism
- Regulate growth, mental and skeletal development in children.
- Goitre:- Enlargement of thyroid gland due to deficiency of iodine in diet.

• CALCITONIN:-

- When blood calcium (Ca) level increases
- Calcitonin is released.
- Deposition of extra Ca in bones.

iii. PARATHYROID GLAND:-

- Present in form of pairs.
- Located on thyroid gland.
- They release Parathormone;
- Parathormone:- Control and balance of Cations and phosphate in body.

iv. PANCREAS:-

- Present in abdominal cavity → near stomach
- Specialised cells are present called "Islets of Langerhans."

ISLETS OF LANGERHANS

ALPHA CELLS

- Secrete glycogen
- Increase glucose concentration
- Liver converts glycogen into glucose.

BETA CELLS

- Secrete Insulin
- When blood sugar level increases
- Maintain glucose level
- Convert glucose to glycogen

→ DIABETES MELLITUS:-

- Beta cells do not produce enough insulin.
- Glucose accumulates in the blood.

→ ENDOCRINE SYSTEM:-

v. ADRENAL GLANDS:-

- Pairs of glands one on top of each kidney.
- Two distinct parts;

a. ADRENAL CORTEX:-

- Secrete several hormones collectively called Corticosteroids.
- Metabolic regulation, inflammation, reduction stress, response etc

b. ADRENAL MEDULLA:-

- Produce adrenaline and Non-adrenaline ...

• ADRENALINE:-

- Produced in emergency situations
e.g: fight and flight fear and anxiety
- Increase heart beat, BP
- Prepare body to face emergency

• Non-ADRENALINE:-

- Raise BP
- Constriction of blood vessels.
- Attention and arousal

vi. GONADS:-

• TESTES:-

- Secretes testosterone
- Develop secondary sexual characteristics at puberty.

↳ EXAMPLE:-

- Beard appearance
- Thick voice etc...

• OVARIES:-

- Secretes oestrogen
- Develop secondary sexual characteristics

↳ EXAMPLE:-

- Enlargement of breasts
- Menstrual cycle

→ NERVOUS DISORDER :-

Two common types :-

i. VASCULAR DISORDER :-

E.g;

PARALYSIS :-

- Loss of muscle function, leading to numbness, weakness or inability to move specific part of a body.

- SYMPTOMS :-

- Partial / complete loss of power of motion.

- CAUSES :-

- Stroke (damage)
- Haemorrhage or clotting of blood vessels.

- TREATMENT :-

- Physiotherapy
- Rehabilitation

ii. FUNCTIONAL NERVOUS DISORDER :-

E.g;

EPILEPSY :-

- Abnormal or excessive discharge of nerve impulses in brain

- SYMPTOMS :-

- Seizures
- Genetics, defects, infection disease, head injury etc...

- TREATMENT :-

- Antiseizure drugs