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# NERVOUS SYSTEM

→ controlling and co-ordinating all parts of body

## Nuerone / Nuerone cell:

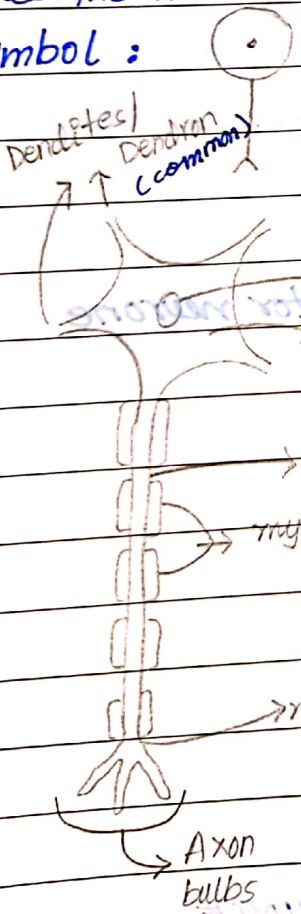
- 3 types of nuerons which have been divided on base of structure and function

i. Sensory nuerone
ii. Motor nuerone
iii. Relay / Intermediate Nuerone

bundle of nuerons ⇒ nerve

## MOTOR NUERONE:

→ has a number of dendrites
→ long axon
→ takes the nerve impulse from CNS to responsive organ or the effector. (-muscles -glands)
→ symbol :




- so that original strength is maintain and the axon has no obstacles
- so that no other tissue transfers its stimulus to axon and disturbs the opening / closing of Na and K gates.

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## SENSORY NUERONE

→ single
→ long dendrites
→ short axon
→ takes the nerve impulse from receptor to any organ
→ symbol : 


## RELAY NUERONE:

→ number of dendrites
→ short axon
→ basically making up the CNS
→ passes the nerve impulse from ~~sen~~ sensory to CNS to motor neurone
→ limited to the CNS
→ symbol : 

RECEPTORS → CNS → Effectors
e.g/sense organs — S.N — R.N — M.N — e.g/muscles/glands

STIMULUS → RECEPTOR → COORDINATOR → EFFECTOR → RESPONSE



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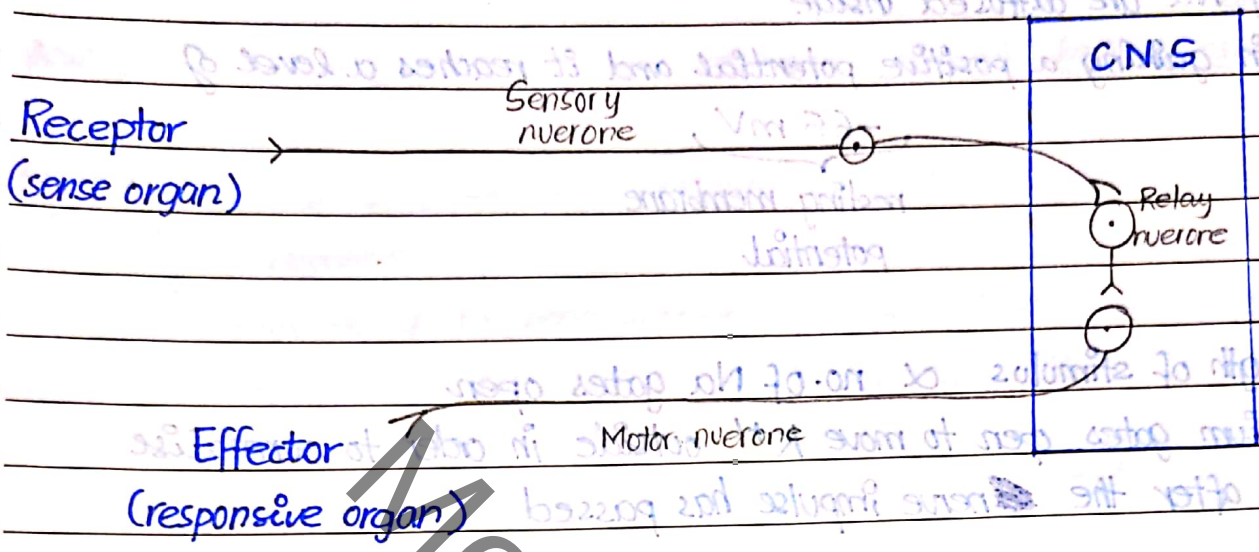
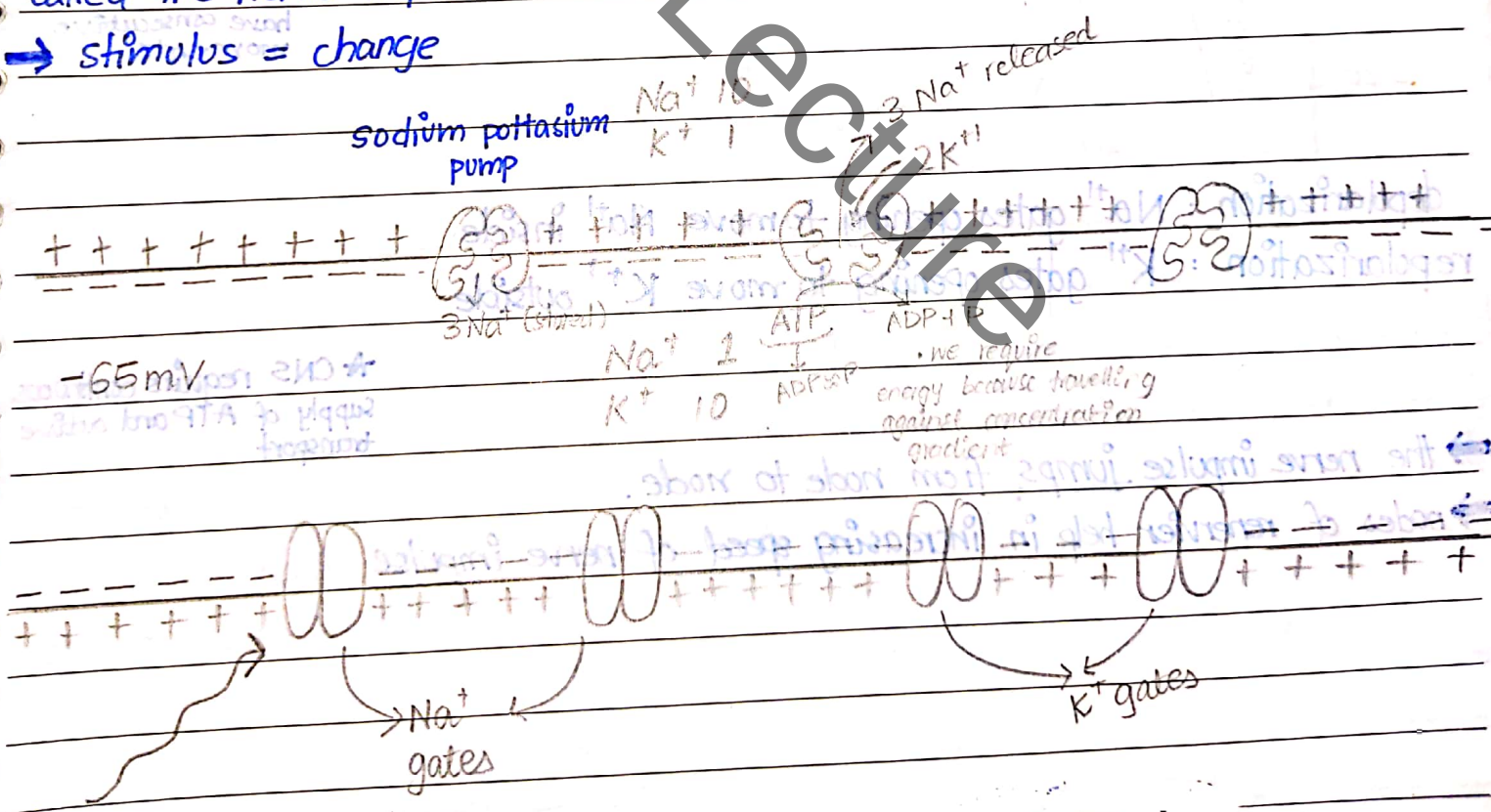
## BASIC PASSAGE OF NERVE IMPULSE




➡ the inside is lesser positive / there is major concentration gradient

➡ the 'message' moves in the form of electrochemical change which is called the nerve impulse

➡ stimulus = change



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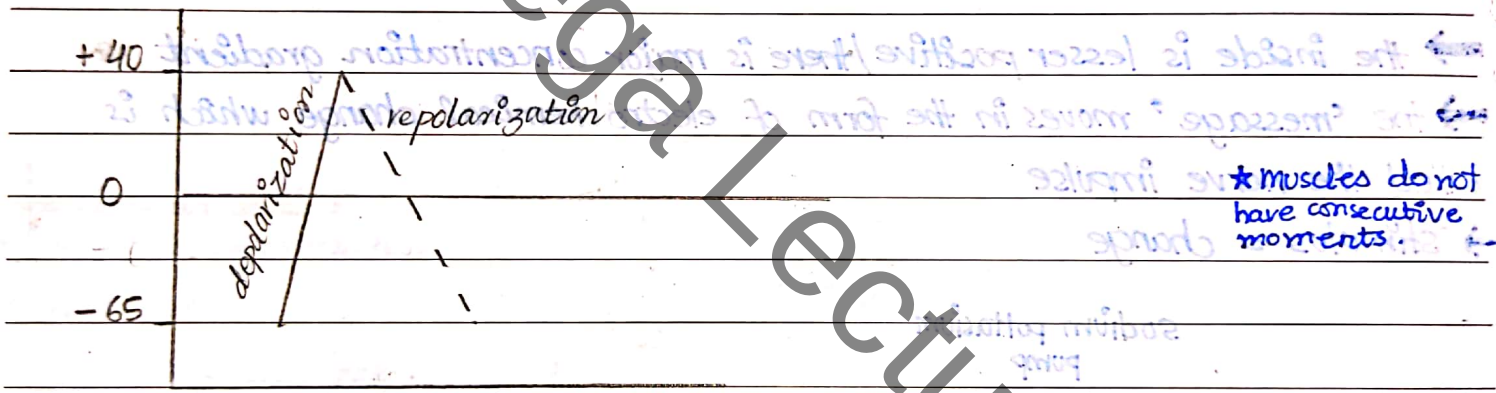
- whenever a stimulus arrises the sodium gates open
- the ions of Na are diffused inside
- it results in gaining a positive potential and it reaches a level of +45mV (initiation of nerve impulse) -65 mV (resting membrane potential)

Strength of stimulus $\propto$ no. of Na gates open

- the pottassium gates open to move $K^{+1}$ outside in order to normalise the charge after the nerve impulse has passed




* muscles do not have consecutive moments.

depolarization : $Na^{+1}$ gates opening to move $Na^{+1}$ inside
repolarization : $K^{+1}$ gates opening to move $K^{+1}$ outside

* CNS requirs continuas supply of ATP and active transport

➡ the nerve impulse jumps from node to node.
➡ nodes of renervier help in increasing speed of nerve impulse

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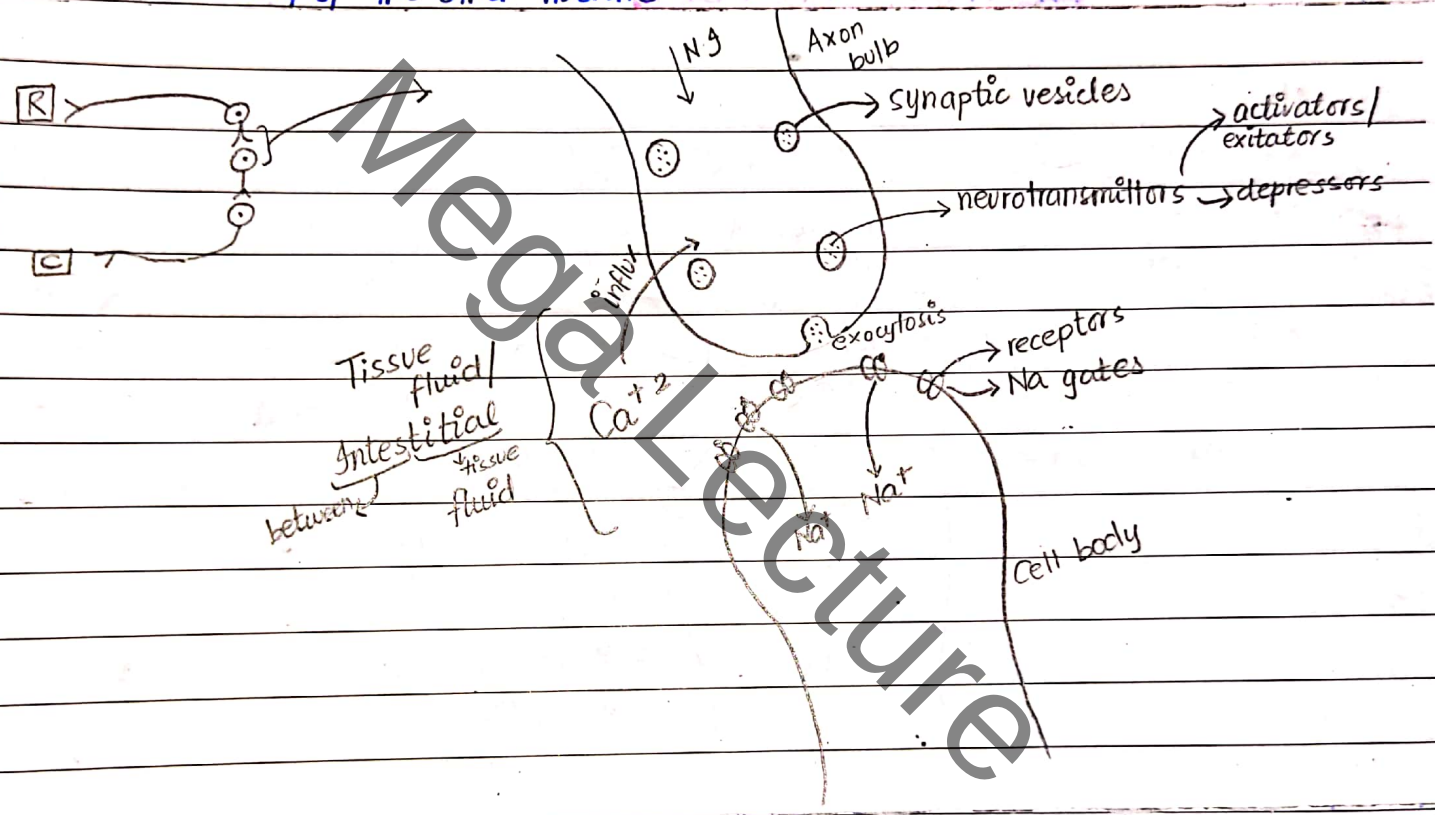
**Dendrites/Dendron** :- moving nerve impulse towards the cell body

**Axon** :- moving nerve impulse away from the cell body

} general (for all types of neurones)

**Synapse** :- transfer of the nerve impulse from one nuerone to the other nuerone

* - transfer of the nerve impulse from axon of one nuerone to cell body of the other nuerone




- as the nerve impulse arrives
- the tissue fluid influxes calcium to the axon bulb
- the Ca concentration increases
- (if activator ⇒ allows $Na^+$ gates to open) (if depressor ⇒ suppresses $Na^+$ gates).
- bursting of one type of synaptic vesicle because of ↑ Ca concentration
- releases the nuerotransmitters
- neurotransmitters recognized by Na gates (detects) and generating the N.I
- Na gates open



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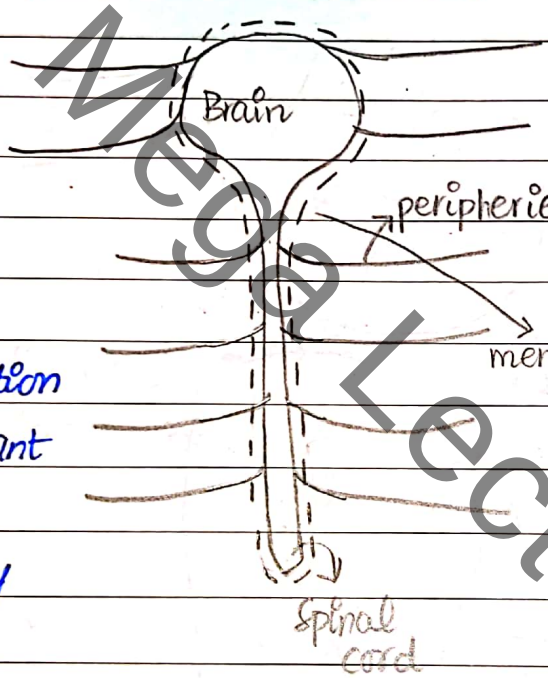
★. pain killer act at the level of synapse ⇒ there is pain but can not be felt
★. same for anesthesia before surgery
★. however for paralysis the synapse is blocked at 2nd level, they can feel pain but can't respond to it.
★. caffeine acts at level of CNS, activates exitators
★. abusive drugs activate depressors and so they keep sleeping

## NERVOUS SYSTEM




### Central Nervous System (CNS)

1. Brain
2. Spinal Cord

→ integrates information & carries out important tasks
→ comprising of relay nuerons

### Peripheral Nervous System (PNS)

1. Nerves:
   (i). cranial nerves (12 pairs)
   (ii). spinal nerves (31 pairs)

→ meant for connecting peripheries with the central command
→ axon and dendrons of S.N and M.N
→ the milenated parts

### BRAIN:

→ enclosed by skull (cranium)
→ enclosed by a double membrane (also the spinal cord) : Meninges with Cerebral Spinal Fluid {when doubled they have a cavity}
- reduction of friction
- providing nourishment to (nutrients + $O_2$) nervous tissue
- infection gives us Meningitis and it is fatal (fever)

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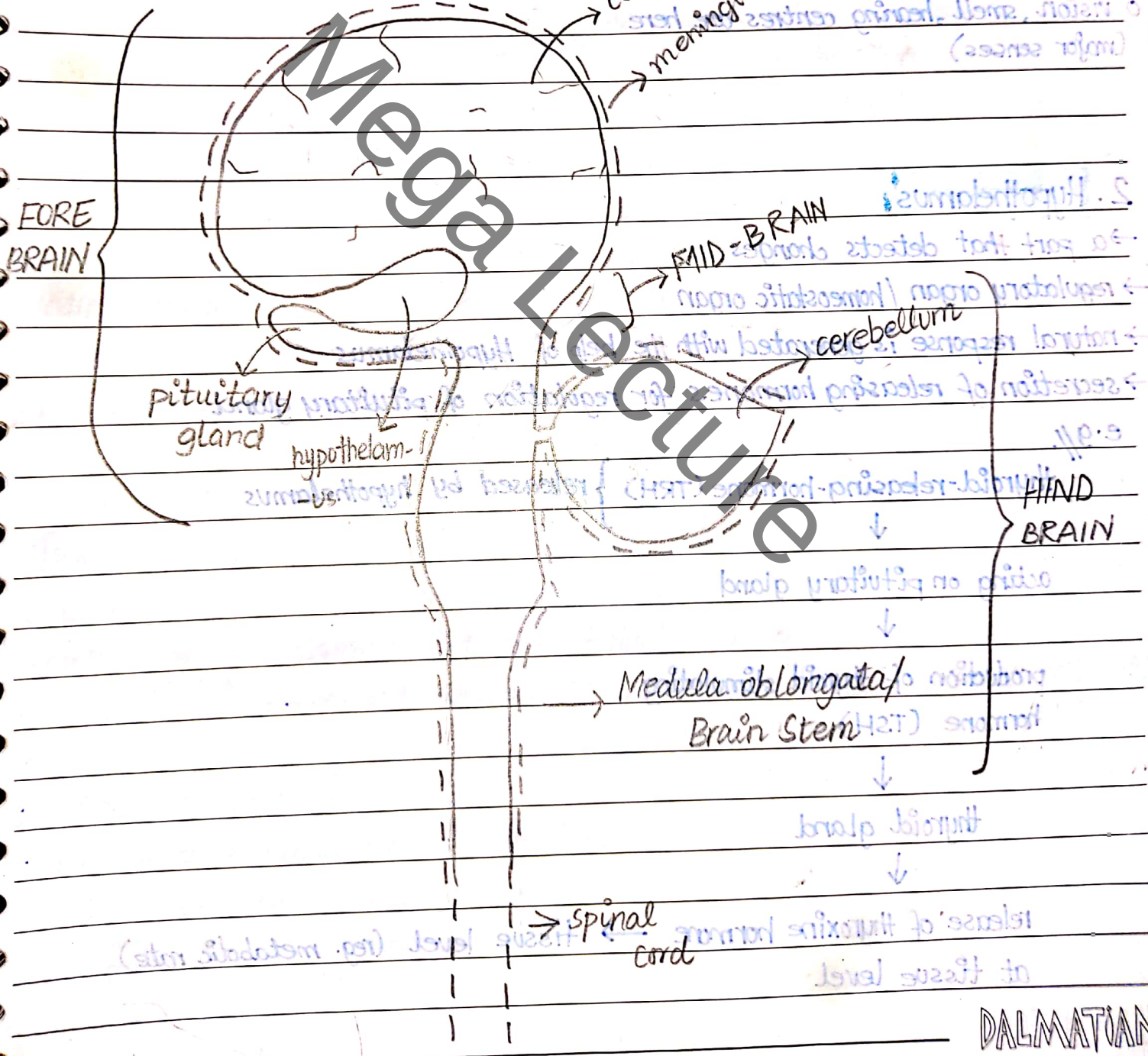
1. Fore-Brain
   (i). Pituitary gland
   (ii). Hypothelamus
   (iii). Cerebrum
2. Mid-Brain
3. Hind-Brain
   (i). Cerebellum
   (ii). Medula oblongata



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## 1. Cerebrum / Cerebral hemisphere


→ all left side parts of our body are controlled by right side of the cerebrum

→ integration:

- memory centre and past experiences
- voluntary movements of muscles — e.g. limbs
- developing feelings for us — e.g. anger, hunger, happiness, sadness
- vision, smell, hearing centres are here (major senses)

→ controls our ~~Balance~~ language, memory and consciousness

## 2. Hypothelamus

→ a part that detects changes

→ regulatory organ / homeostatic organ

→ natural response is generated with the help of Hypothelamus

→ secretion of releasing hormones for regulation of pituitary gland

e.g.

thyroid-releasing-hormone (TRH) } released by hypothelamus

↓

acting on pituitary gland

↓

production of thyroid stimulating hormone (TSH)

↓

thyroid gland

↓

release of thyroxine hormone → tissue level (reg. metabolic rate) at tissue level

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→it is a negative feedback

3. Pituitary gland

→endocrine gland

→very smaller size as compared to others

→major gland of the body:

★producing 9 hormones. e.g// - ADH (anti-diuretic hormone)
- TSH (which acts on thyroid gland)
- FSH (follicle stimulating hormone) (which acts on gamets (ovary + testis))
- GH (growth hormone)

●in infants if something is wrong with pituitary gland their growth is hindered

## MID-BRAIN

→relay station/path way

→link between fore-brain and hind

## HIND-BRAIN

1. Cerebellum

→controls cerebellum through envolvement of fluid of ear canal

→controls posture, balance and co-ordinate movements/muscle co-ordination

2. Medulla oblongata

→also called involuntary centre of the brain.

e.g// - breathing rate
- heart rate
- peristalsis

} actions involving smooth muscles



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★ hind-brain is basically involved in maintaing balance and involuntary actions

★ fore-brain has the major part and thus the most volome in the brain

★ mid-brain is only providing passage between the fore-brain and the hind-brain

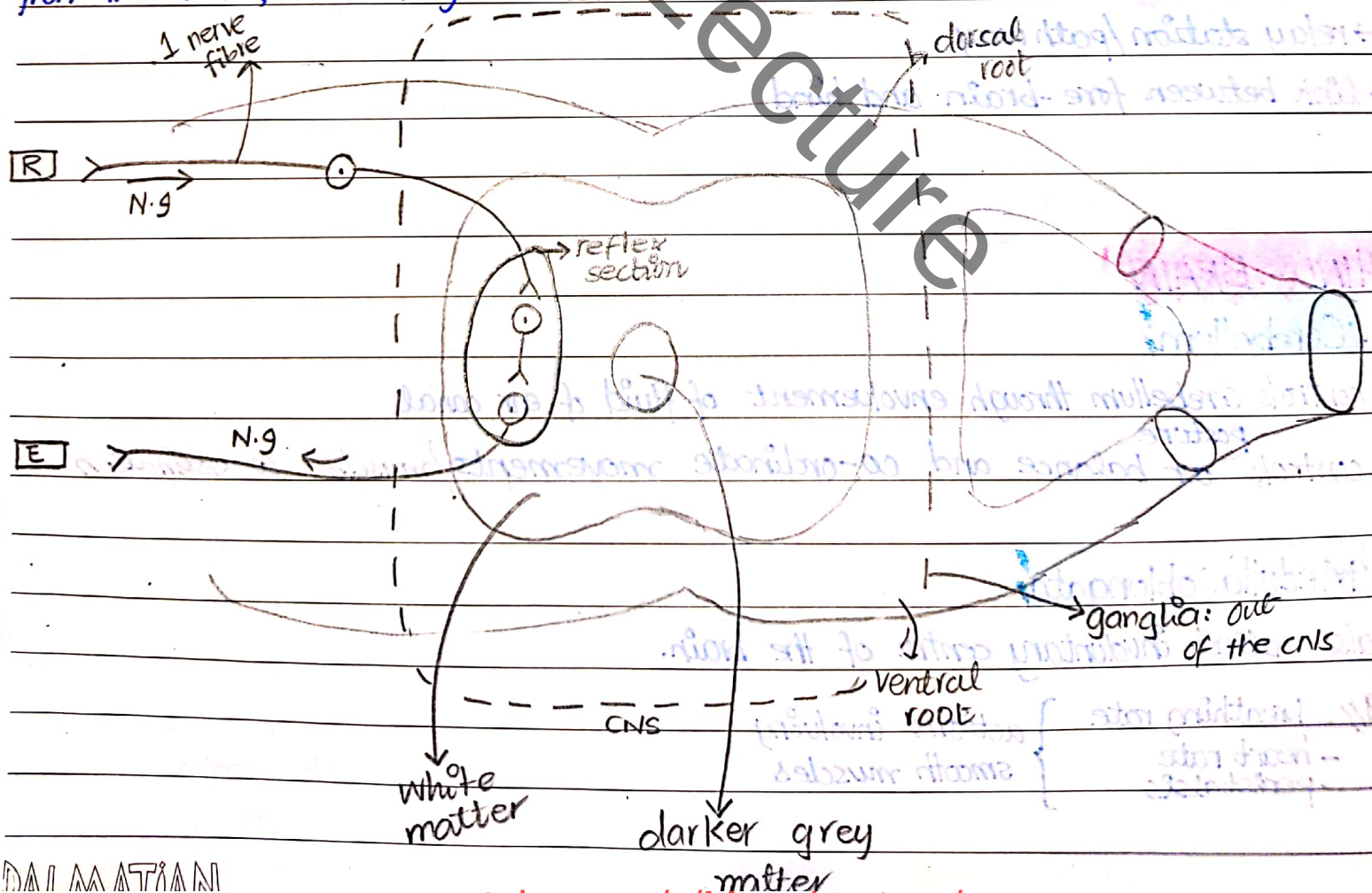
## 3. Spinal Cord

→ part of CNS, continuation of brain

→ present in mid-axis of the body and protected by vertebral column

→ present at the dorsal side (indicated by s.c)

→ one spinal cord must be carrying a dendron of the S.N and the axon from the M.N, hence they are called mixed nerves



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- White matter:
→ milenated axon gives us the white the colour (usually long axons are milerated)

- grey matter:
→ non-milenated axon gives us the darker grey colour

★. spinal cord connects all the lower parts of the body to the brain

★.

## RESPONSES:

Cerebrum is the most integrating part of the body

(i). Voluntary actions
(ii). Involuntary actions
(iii). Reflex actions

### (iii). REFLEX ACTION:

→ reflex is a sudden response without integration
→ brain is not directly involved in reflex action
→ the thinking centre is not used
→ reflex action is the sudden response of the body because of external stimulus
→ its purpose is to protect the body parts from external stimili through immediate response
→ it has 2 types:

1. Spinal reflex: - moving in and out of spinal cord
- uses only the spinal cord as a part of CNS
- e.g // = withdrawl of hand, knee jerk

2. Cranial reflex: - brain is used but only the non-integrating parts

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are involved

- e.g// = salivation, blinking, tearing, pupil reflex (dilation & constriction of pupil)

3. Condition reflex : - whenever natural stimili is used to develop a reflex action → a reflex developed gradually by training in association with a specific repeated stimulus

(iii). INVOLUNTARY ACTION

→ unconcious response by internal stimulus

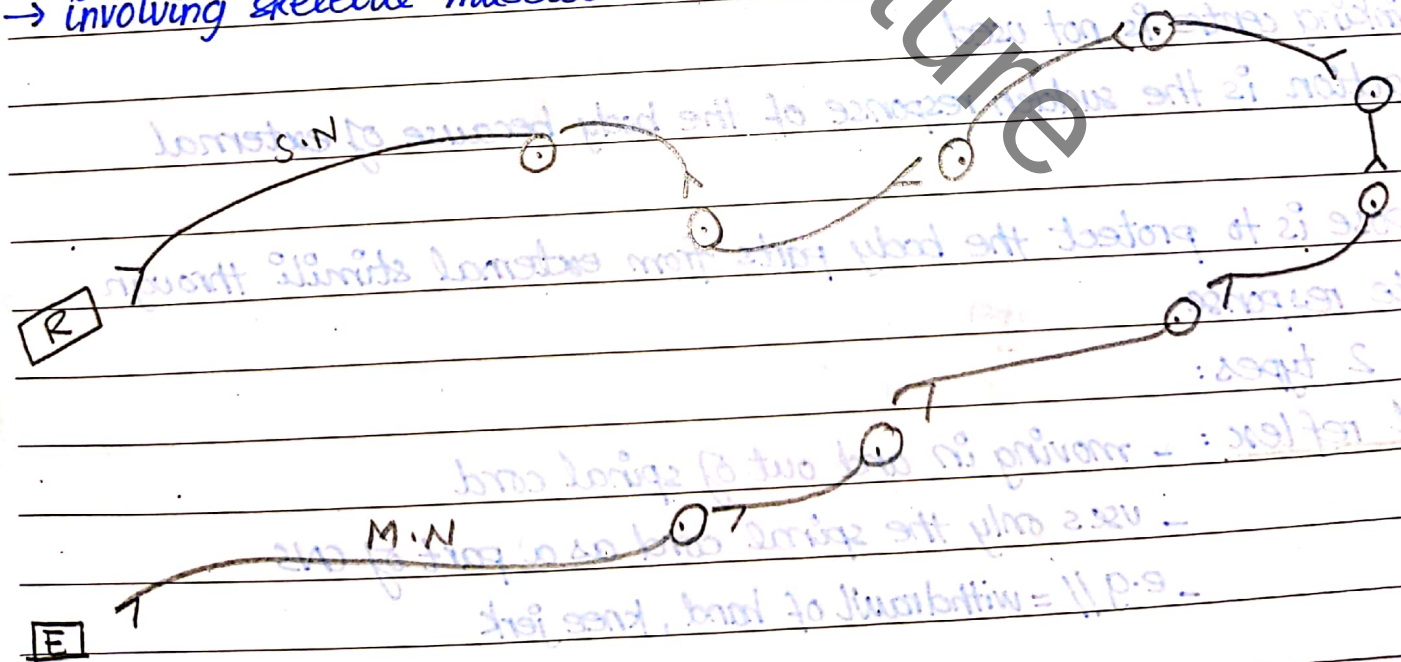
→ smooth muscles become the effectors

→ e.g// - heart beat
- muscles moving blood in blood vessels

(iii). VOLUNTARY ACTION

→ complex pathway involving interpretation by cerebrum of brain

→ involving skeletal muscles

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## RECEPTORS

→ specified tissues which can detect the stimulus and then convert the stimulus into the electrochemical charge, nerve impulse s.o

→ eg. // - photo receptors ⇒ meant to detect intensity of light ——→ Eye
- chemoreceptors ⇒ meant to detect stimulus of taste ——→ Tongue
- thermoreceptor ⇒ meant to detect stimulus of temperature ——→ Skin
- pressure receptor ⇒ meant to detect stimulus of pressure / touch → Skin

Sense Organ : tissue present to facilitate responses

## HUMAN EYE AS A SENSE ORGAN :

→ round ball like structure

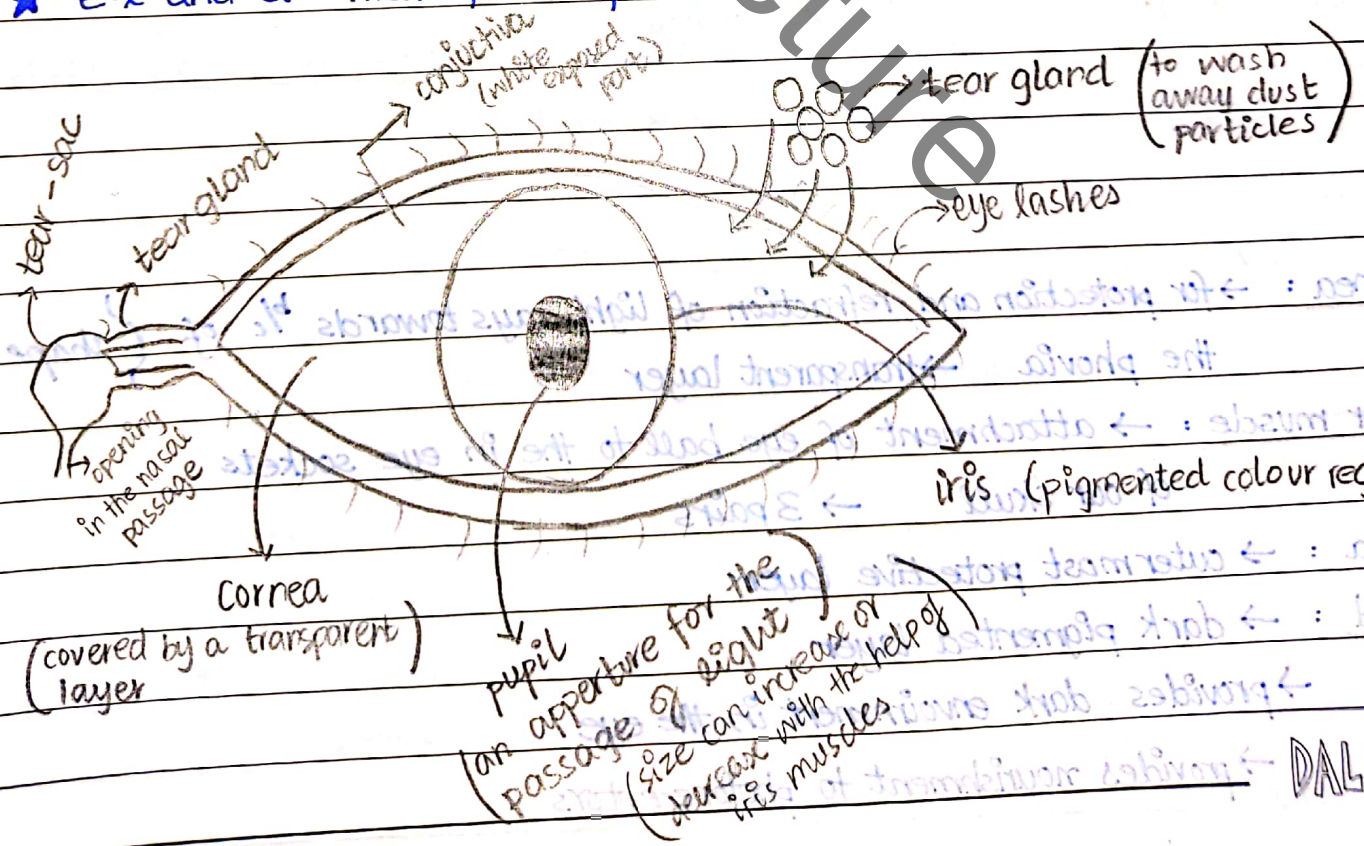
→ External structure :

- one pair present at front face
- covered by skin flaps known as eyelids (enclosing the exposed part of the eye) (upper & the lower eyelid) *
- both eyelids have presence of hair-like parts known as eye lashes. *

★ · e.l and ela meant for the protection of exposed parts

tears are produced as a reflex action

Kangaroo Science Contest



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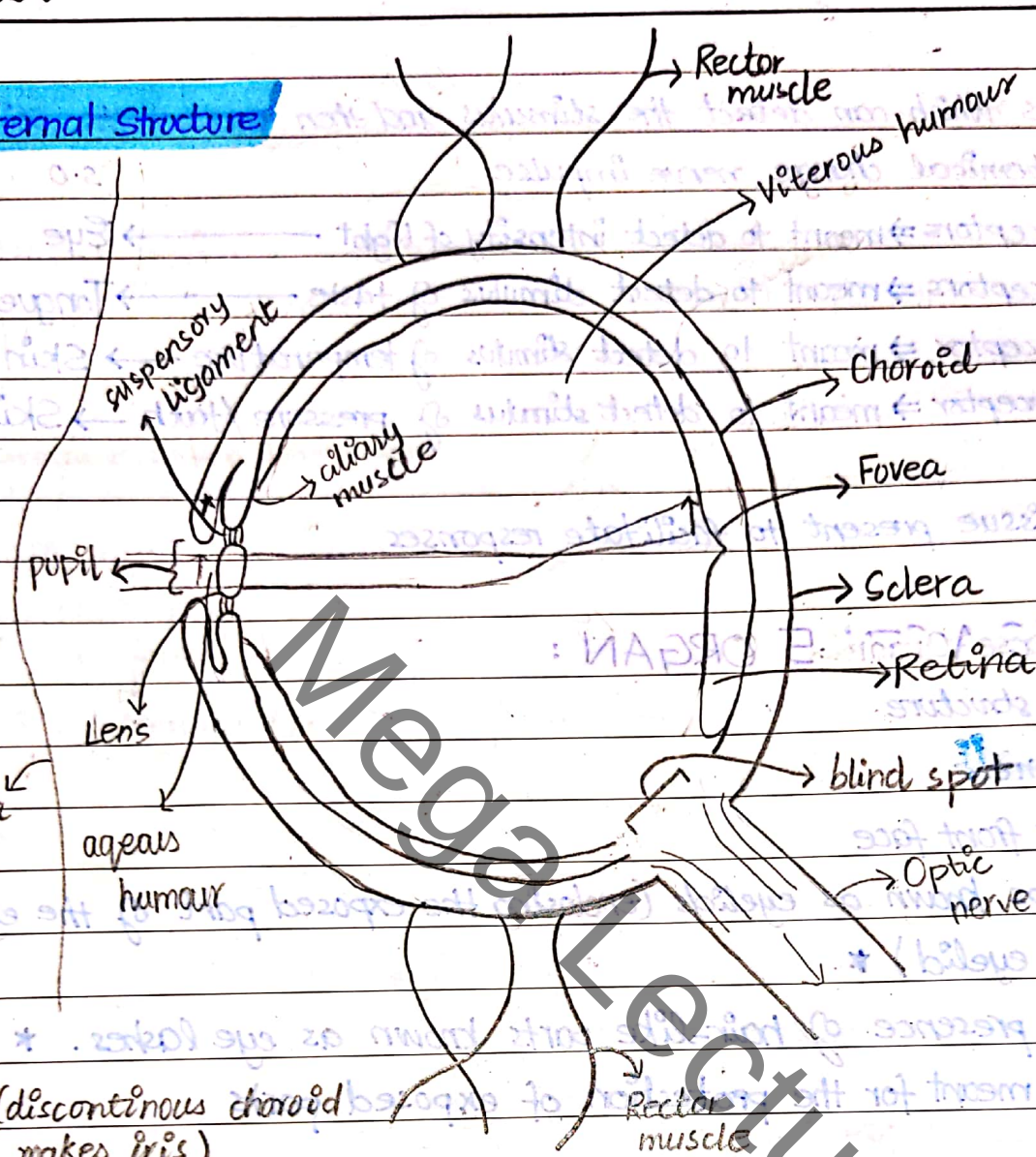
→ Internal Structure




* iris (discontinous choroid makes iris)



1. Cornea : → for protection and refraction of light rays towards b/c of { shape of the phovia → transparent layer

2. Rector muscle : → attachment of eye ball to the in eye sockets of our skull → 3 pairs

3. Sclera : → outermost protective layer

4. Choroid : → dark pigmented layer
→ provides dark envoirnment in the eye
→ provides nourishment to photoreceptors

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→ avoids reflection of light rays so that they converge at phovia

5. Retina : → exactly in layer with pupil → presence of fovea
→ contains concentration of photoreceptors (rods & cones)
→ the reception of photo takes place here → send signals through optic nerves to the brain giving us an image

6. Viterous humour : → maintains shape of the eye ball.
→

7. Fovea : → concentrate photoreceptors
→ focus point, also known as yellow spot
→ point where the light is converged

8. Lens : → biconvex in shape → in position with pupil
→ transparent
→ converges light rays to phovia
→ focusing of image

9. Ageous Humour : → between cornea and lens
→ a fluid
→ diverts image to lens
→ avoids reflection of light rays

10. Suspensory Ligament : → membranous bands
→ can make the lens thinner or thicker
→ adjusts the lens and holds it

11. Cilary Muscles : → can make the lens thinner or thicker
→ adjusts the lens and holds it

= concave

= biconcave

12. Blind spot : → absence of retina
→ absence of photoreceptor cells

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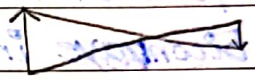
13. Optic nerve : → sensory in nature
→ has the dendrones of only sensory nuerons

*. The optic nerves cross each other to reach the respective opposite sides of the brain. (cerebral hemispheres) ⇒ OPTIC CHISMA

*. The blind spot of one eye is covered by the visual field field of the other eye.
↓
180°

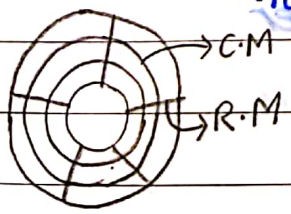
→ the image will be shorter and diminished
→ the image is inverted
→ the light rays cross before coming to an end



→ Visual Acommodation:
·adjustment of different parts of eyes according to the
eg// 1. Pupil reflex
2. Focusing lense

1. PUPIL REFLEX
→ sudden response from pupil / adjustment in case of bright and dim light

Iris — circular muscle *
radial muscle *




*. antagonistic pair

→ arises because of change in intensity of light

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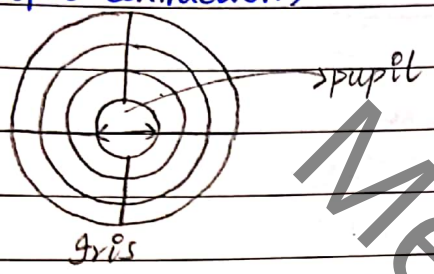
**Bright Light**

- circular muscle contracts
- radial muscle relaxes
- decreasing pupil size
- less light can enter into the eye

(Pupil contraction)

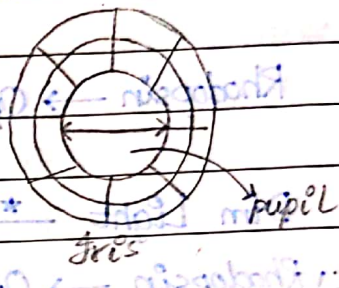



→ happening at a routine
→ if this does not happen, the inner parts are damaged

**Dim Light**

- radial muscle contracts
- circular muscle relaxes
- increase or dilation of pupil size
- more light can enter int the light

(Pupil dilation)




## 2. FOCUSING OF LENS / ADJUSTMENT OF LENS

→ depends on distance of object infront of the eye

- cilary muscle and suspensory ligaments are antagonistic

**Distant Object**

- cilary muscles will relax
- suspensory ligament will contract
- lens will become thinner & longer

to focus on a distant object lens becomes thinner – ~~cilary~~ suspensory ligaments contract ↔ opposite
↓
only slightly refracted light

**Close Object**

- suspensory ligament will relax
- cilary muscle will contract
- lens will become thicker and rounder

★. Eye Strain – continuous contraction of cilary muscle

★. Nearpoint – point till which sharp/fine/focused image can be obtained

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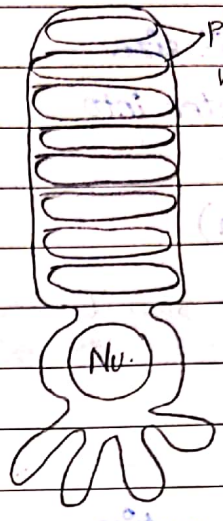
→ **Retina:**

- containing photoreceptor cells → 1. Rods
  → 2. Cones

**1. Rods**

→ filled with membranous sacks
→ the sacks have a pigment called visual pigment and purple pigment
→ the actually have rhopsin inside them




Rhodopsin → Opsin + Retinol
(Retinol → Vitamin A)

Dim Light —*→ Bright Light

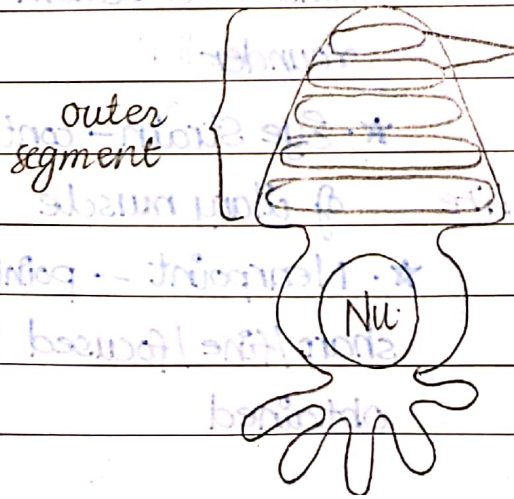
*. Rhodopsin → Opsin + Retinol
Deassociation or the bleaching of Rhodopsin

Bright Light —*→ Dim Light

*. Opsin + Retinol —°→ Rhodopsin
Resynthesis

° there will be a blurred image for some time during the joining of opsin and retinol because of absence of rhodopsin

**2. Cones**




contains pigments for coloured vision
→ 3 primary colours
→ diffrentiation

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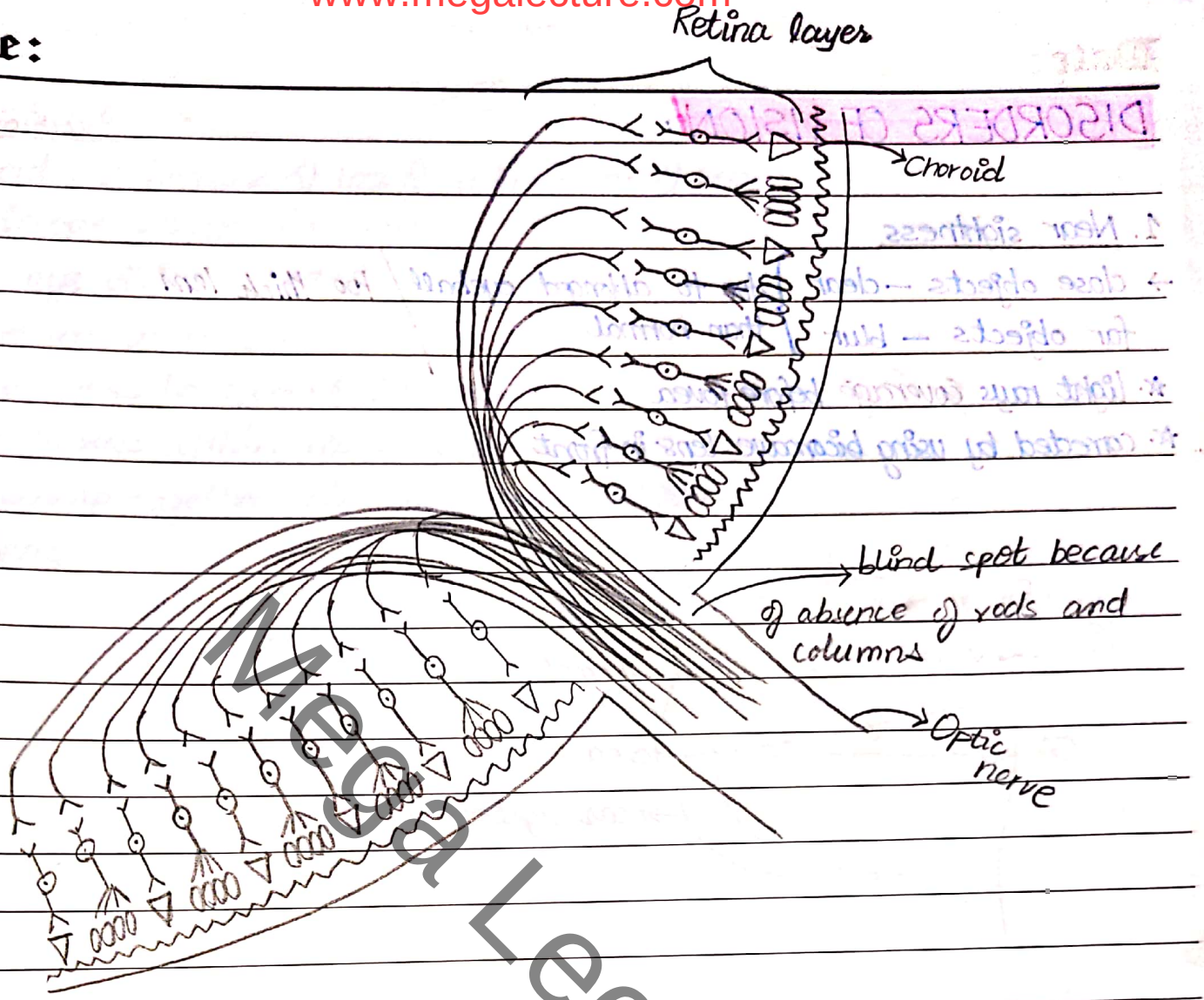




colour blindness ⟹ absence of Vitamin

night blindness ⟹ absence of Vitamin A / problem in resynthesis

→ ⊙ ⟵ bipolar ... more like R.N

ganglion reception cell

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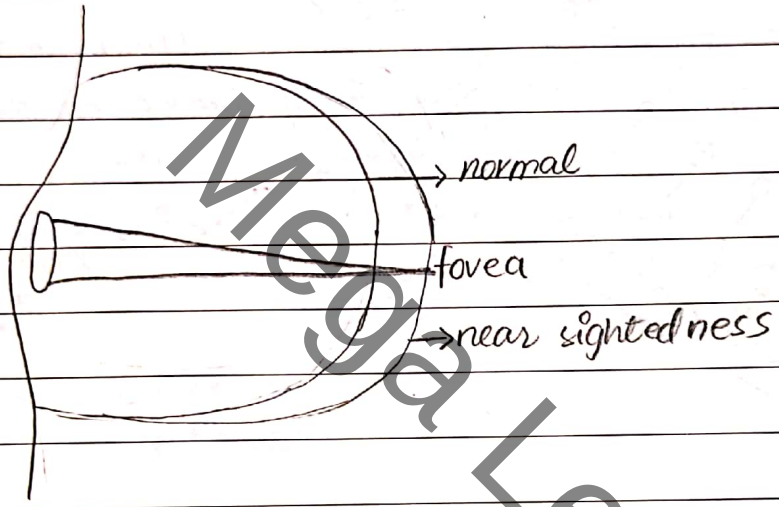
# DISORDERS OF VISION:

## 1. Near sightness

→ close objects — clear
far objects — blur
} due to ablonged eyeball than normal / too thick lens

* light rays converge before fovea
* corrected by using biconcave lens in front

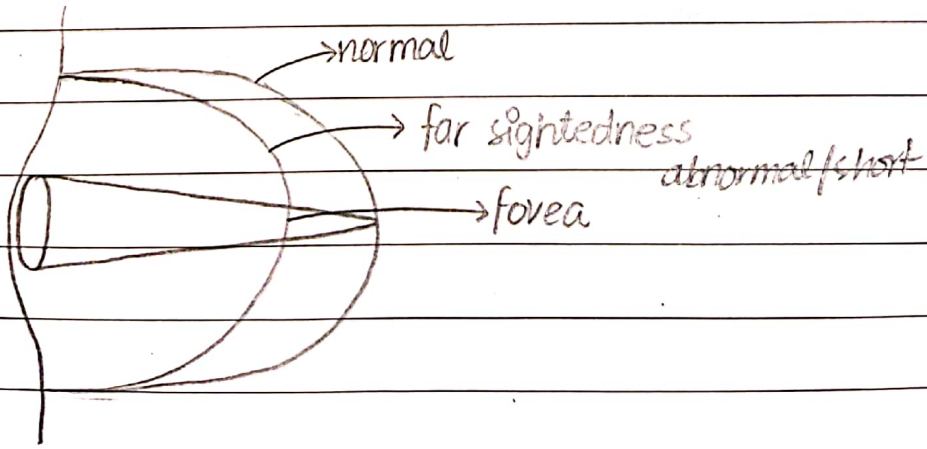



## 2. Far sightedness

→ far object — clear
close object — blur
} shorter eyeball than normal

* light rays converge behind fovea
* corrected by using biconvex lens

* loss of elasticity in lens



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3. Catract

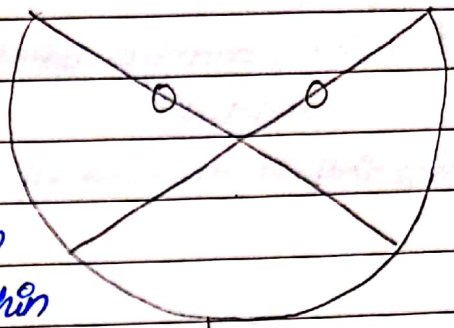
→ in old age because of loss of adjustment of lens

→ steriscope vision (3D vision)

→ one eye vision - 180°

→ the lens in the eyes becomes less flexible, less transparent & thicker

→ the tissues within the lens break down and clump together, clouding areas within the lens



blind spots are covered in overlapping vision