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PART SIX :

NERVOUS

TISSUE

Nervous Tissue

It organized anatomically into:

I. Central Nervous System (CNS): Brain and Spinal cord.

II. Peripheral Nervous System (PNS): Outside CNS, cranial nerves, spinal nerves and ganglia.

- A collection of nerve fibres in PNS: **"nerve"**.
- A collection of nerve fibres in CNS: **"tract"**.

1. Components of Nervous Tissue:

1.1 Neurons:

Consists of:-

1. Cell body (Perikaryon)

2. Cytoplasmic processes: "Dendrites and Axon".

• Neurons are divided into:-

1. Bipolar: two processes (dendrite + axon). – Spindle (fusiform) shaped.

2. Multipolar: More than two processes (many dendrites, one axon)

* Most common form. Forms most of CNS

* Can be:

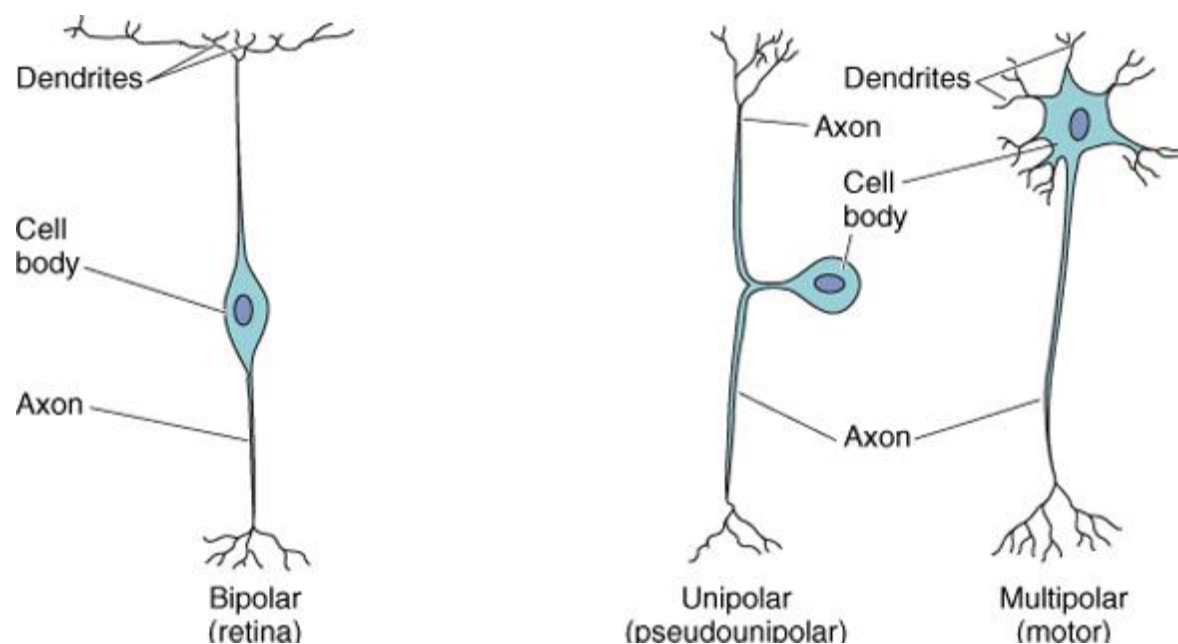
- star-shaped e.g. sympathetic ganglia.

- pyramidal. e.g. motor area in cerebrum that controls skeletal muscles.

- pyriform (pear shaped). e.g. cerebellum

3. Pseudounipolar: (unipolar): One process dividing into two (e.g. spinal ganglia).

– spherical shape.



The Neuron Cell Body (perikaryon):

Cell body: Large, variable according to activity.

- **Cytoplasm:**

- Basophilic.
- Abundant RER and polyribosomes .
- Abundant sER that forms **hypolemmal cisterna**.
- Most have only **one centriole** associated with a basal body of cilium.

- **Cytoskeleton:** neurofibrils, found in all parts of a neuron. They include:

- microtubules (E/M)
- neurofilaments (intermediate filaments)
- microfilaments (actin) (E/M)

- **Nucleus:** – Large – centrally located – vesicular (open-face)– with euchromatin – prominent nucleolus.

- Nucleus could be eccentric e.g. sympathetic ganglia.

- Neurons can not divide

Types of nerve fibers “according to their coverings”:

- 1-Unmyelinated without neurilemmal sheath.
- 2- Myelinated without neurilemmal sheath.
- 3- Myelinated with neurilemmal sheath.
- 4- Unmyelinated with neurilemmal sheath.

Dendrites

- Contains: RER, SER, neurofibrils, and mitochondria. But does NOT contain golgi complex.
- Can be one or more in a neuron.
- Receive stimuli from sensory cells, axons and other neurons, and transmit impulses into the soma.

Axons

- Arises at the **axon hillock**, which is a pyramid-shaped region of the soma with no ribosomes.
- An axon may branch at the end forming **terminal arbors**.
- It ends by dilations known as **axon terminals** that synapse with other neurons, muscles or glands.
- They have **Schwann cells** (are neurolemmated) in PNS, and can be:
 1. Myelinated neurolemmated axon (with myelin sheath) may be sensory or motor.
 2. Unmyelinated neurolemmated axon (without myelin sheath) may be sensory or motor.
- In CNS, they don't have Schwann cells around them (not neurolemmated)
 - Can be myelinated (white matter), or unmyelinated (grey matter).

1.2 Schwann cells:

- They are located only in PNS, around axons, and form either myelinated or unmyelinated sheath.
- The Schwann cells of myelinated axon in PNS form myelin sheath around the axon.
- In the unmyelinated axon a Schwann cell supports several axons without forming myelin sheath
- Schwann cells have a basal lamina.

- They are flattened cells with flattened nuclei, containing a small Golgi apparatus, and a few mitochondria.
- **Function:** 1- Insulation. 2- Regeneration and synthesis of myelin.

1.2.1 Myelinated Axon

Myelin Sheath

- Myelin sheath is concentric layers of the Schwann cell membrane around the axon

In myelinated axon:

- Each Schwann cell forms one segment of myelin sheath around the axon called **internode**.. Each internode is about 200-1000 μm long. A Schwann cell can wrap several times around the axons.
- Schwann cell cytoplasm trapped within the lamella of myelin is called cleft of Schmidt-lantermann.
- Between internodes is a gap called node of Ranvier where there is no myelin sheath (between 2 schwann cells)

1.2.2 Unmyelinated Axon

- Successive Schwann cells surround the axon without forming myelin sheath

2. Peripheral Nerve:

- Contains parallel bundles of axons containing both motor & sensory axons.
- Each bundle contains myelinated & unmyelinated axons
- No nerve cell bodies
- Covered by connective tissue, which can be divided into:
 1. Epineurium.
 2. Perineurium.
 3. Endoneurium.

SYNAPSES: it is the point of contact between the end of the axon and another neuron, muscle or gland cell.

SPINAL GANGLION:

- Contains pseudounipolar neurons in groups (spherical) (so no synapse)
- contains myelinated axons.
- Sensory ganglion.

SPINAL CORD

NEUROGLIA:

"in the CNS" :

- 1- Astrocytes
- 2- Oligodendrocytes
- 3- Microglia
- 4- Ependyma

N.B. Schwann cells, Satellite cells

NERVE ENDINGS:

A- Receptors:

e.g. Pacinian corpuscle, Muscle spindle.

B- Effectors:

e.g. Neuromuscular junction

Pacinian Corpuscle:

- Pressure receptor found in the skin
- Oval in shape, covered by a CT capsule which is lost along with the neurolemmal sheath and myelin as it enters the corpuscle.

MUSCLE SPINDLE:

- Spindle-shaped (cylindrical).
- covered by an acidophilic CT capsule
- Supplied by afferent & efferent fibers but acts sensory (receives effectors from CNS)
- Stretch receptor found in skeletal muscle

(Neuromuscular junction):

- Synapse of a motor axon with a skeletal muscle fiber at synaptic cleft.
- The axon of a single neuron divides to supply more than 100 muscle fibers
- The axon terminal is numerous in mitochondria.
- Neuron cell body originates in the CNS (ventral horn of spinal cord).
- Neuron & muscle fibers it supplies is called a motor unit