

# The nervous system

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LO1 - Describe and identify the major components of a neuron, with emphasis of the specific role each structural component has on the function of the neuron

Also called nerve cells

Billions in the body

Structural units of the nervous system

Large, highly specialised cells that conduct messages in the form of nerve impulses from one part of the body to another

Three special characteristics besides ability to conduct nerve impulses;

- Extreme longevity - with good nutrition can function optimally for a lifetime
- Amitotic - neurons cannot be replaced if destroyed, lose their ability to divide as they assume role of communicating links of the nervous system
- High metabolic rate - require continuous abundant supplies of oxygen and glucose; cannot survive for a few minutes without oxygen

## Neuron cell body

Spherical nucleus with conspicuous nucleolus surrounded by cytoplasm

Cell body ranges in diameter from 5 to 140 micrometers, also called the perikaryon or soma, major biosynthetic centre of a neuron, containing the usual organelles needed to synthesise proteins and other materials

Cell body's protein- and membrane-making machinery consist of clustered free ribosomes and rough endoplasmic reticulum - most active and most developed in the body

Rough ER, also called chromatophilic substance stain darkly with basic dyes

Golgi apparatus is well developed, forming an arc or complete circle around the nucleus

Mitochondria are scattered with other organelles

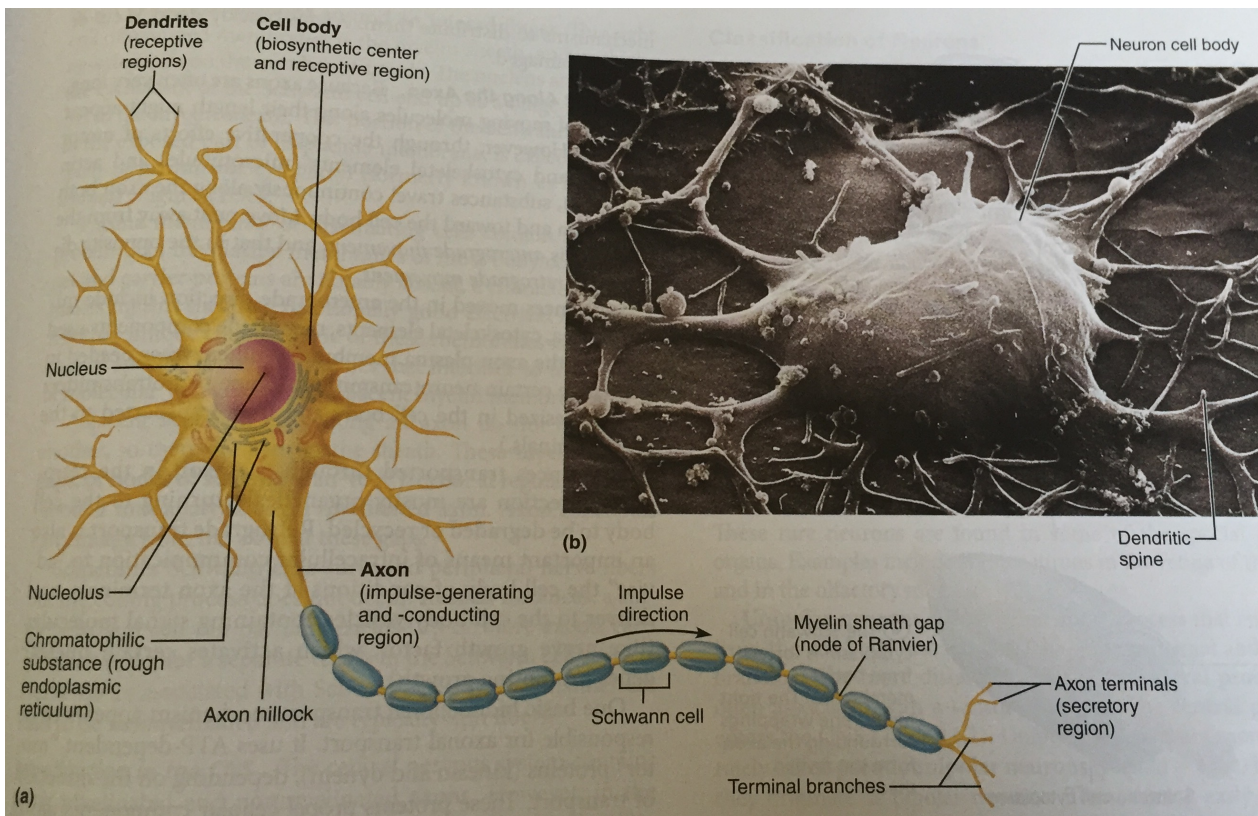
Microtubules and neurofibrils maintain cell shape and integrity, forming a network through the cell body

Cell body is focal point for outgrowth of neuron processes during embryonic development

Cell membrane acts as part of the receptive region that receives information from other neurons

Most cell bodies located in the CNS, clustered groups called nuclei, protected by bones of skull and vertebral column

Clusters of neurons in PNS called ganglia



### Neuron processes

Armlike processes extend from the cell body of all neurons

CNS contains neuron cell bodies and their processes

PNS contains mainly neuron processes

Bundles of neurons are called tracts in CNS and nerves in PNS

There are two types of neuron processes that differ in structure and function of their plasma membrane;

- Dendrites
  - Short, tapering, diffusely branching extensions
  - Motor neurons have hundred of dendrites clustering close to the cell body
  - The main receptive or input regions, provide enormous surface area for receiving signals from other neurons
  - In the brain finer dendrites are highly specialised for collecting information, bristling with dendrites spines which represent points of close contact - synapses - with other neurons
  - Convey incoming messages toward the cell body. Their electrical signals are not action potentials (nerve impulses) but short distance signals - graded potentials

- The axon: structure
  - Every neuron has a single axon
  - Initial region arises from a cone shaped area of the body called the axon hillock, and then narrows to form a slender process that is uniform in diameter for the rest of its length
  - Axon can be very short or absent, but can also account for nearly the whole length of the neuron
  - Any long axon is called a nerve fiber
  - Each neuron has only one axon, but each axon may have branches called axon collaterals
  - Axon branches at its end - terminus - into 10000 or more terminal branches
  - Knoblike distal endings of the terminal branches are called axon terminals or terminal boutons
- The axon: functional characteristics
  - The conducting region of neuron
  - Generates nerve impulses and transmits them, away from the cell body, along the plasma membrane - axolemma
  - Nerve impulse is generated at the junction of the axon hillock and axon and conducted along the axon to the axon terminals, which are the secretory region of the neuron
  - When impulse reaches the axon terminals neurotransmitters are released into the extracellular space
  - Neurotransmitters either excite or inhibit neurons
  - Axon contains the same organelles found in the dendrites and cell body with two exceptions - lacks rough ER and a Golgi apparatus which are responsible for protein synthesis and packaging