48.1 Neuron structure and organisation reflect function in information transfer

Neuron Structure and Function

- The ability of a neuron to receive and transmit information is based on a highly specialised cellular organisation.
	- Most of the neuron's organelles are located in the cell body/soma.
	- A typical neuron has numerous highly branched extensions called dendrites.
		- Together with the cell body, dendrites receive the signals from other neurons.
	- A neuron also has a single axon, an extension that transmits signals to other cells.
		- Axons are longer than dendrites.
		- The cone-shaped base of the axon is called the axon hillock.
			- Here the signal is generated.
		- At the end of the axon, the axon is usually branched.
			- Each branched end transmits information to another cell at a junction called a synapse.
	- The part of the axon that forms this specialised junction is called a synaptic terminal.
		- Here, chemical messengers known as neurotransmitters pass information from the transmitting neuron to the receiving one.
- The transmitting neuron is called the presynaptic neuron and the receiving cell is called the postsynaptic cell.
	- The postsynaptic cell can be another neuron, muscle, or gland cell.
- Neurons have supporting cells called glial cells or glia.
	- They nourish neurons, insulate the axons, and regulate the extracellular fluid surrounding the neurons.
	- Some also replenish certain types of neurotransmitters and play a role in transmitting information.
	- Glia outnumber neurons in the mammalian brain 10 to 50-fold.

Introduction to Information Processing

- Information processing occurs in three stages:
	- Sensory input.
	- Integration.
	- Motor output.
- Example: Cone snail.
	- To generate sensory input to the nervous system, the snail surveys its environment with its tubelike siphon, sampling scents that might reveal a nearby fish.
	- During the integration stage, the nervous system processes input to determine if a fish is present.
	- Motor output from the processing centre then initiates attack, activating neurons that trigger the release of the harpoon-like tooth towards the prey.
- In most animals, specialised populations of neurons handle each stage of information processing:
	- Sensory neurons:
		- Transmit information about external stimuli such as light, touch, or smell, or internal conditions such as blood pressure and muscle tension.
		- Very long axons, with a cell body midway along the axon.
	- Interneurons:
		- Neurons in the brain or ganglia integrate analyse and interpret the sensory input.
		- These form the local circuits connection neurons in the brain.
		- Highly branched axon.
	- Motor neurons:
		- Neurons that extend out of the processing centres trigger output in the form of muscle or gland activity.
		- Motor neurons in particular transmit signals to muscles causing them to contract.
		- Long axon, highly branched dendrites.
- The neurons that carry out integration are organised in the central nervous system (CNS).
- The neurons that carry information into and out of the CNS constitute the peripheral nervous system (PNS).

- When bundled together the axons of neurons form nerves.

48.1 Summary
- Most neurons have branched dendrites that receive signals from other neurons and an axon that transmits signals to other cells at synapses.
    - Neurons rely of glia for functions that include nourishment, insulation, and regulation.
- A CNS and a PNS process information in three stages: sensory input, integration, and motor output to effector cells.