

Essential idea: Neurons transmit the message, synapses modulate the message.

6.5 Neurons and synapses

Nature of science:

Cooperation and collaboration between groups of scientists—biologists are contributing to research into memory and learning. (4.3)

Understandings:

- Neurons transmit electrical impulses.
- The myelination of nerve fibres allows for saltatory conduction.
- Neurons pump sodium and potassium ions across their membranes to generate a resting potential.
- An action potential consists of depolarization and repolarization of the neuron.
- Nerve impulses are action potentials propagated along the axons of neurons.
- Propagation of nerve impulses is the result of local currents that cause each successive part of the axon to reach the threshold potential.
- Synapses are junctions between neurons and between neurons and receptor or effector cells.
- When presynaptic neurons are depolarized they release a neurotransmitter into the synapse.
- A nerve impulse is only initiated if the threshold potential is reached.

Applications and skills:

- Application: Secretion and reabsorption of acetylcholine by neurons at synapses.
- Application: Blocking of synaptic transmission at cholinergic synapses in insects by binding of neonicotinoid pesticides to acetylcholine receptors.
- Skill: Analysis of oscilloscope traces showing resting potentials and action potentials.

Guidance:

- The details of structure of different types of neuron are not needed.
- Only chemical synapses are required, not electrical, and they can simply be referred to as synapses.

Utilization:

- An understanding of the workings of neurotransmitters and synapses has led to the development of numerous pharmaceuticals for the treatment of mental disorders.

Syllabus and cross-curricular links:

Biology

Topic 1.4 Membrane transport

Chemistry

Topic C6 Electrochemistry, rechargeable batteries and fuel cells

Psychology

Core: Biological level of analysis

Aims:

- **Aim 8:** The social effects of the abuse of psychoactive drugs could be considered, as could the use of the neurotoxin *Botox* for cosmetic treatments.