Action Potentials

Structure of a Nerve

- The endoneurium, the innermost layer, wraps each individual axon along with its myelin sheath.
- It consists of a collagen mesh, fibres, fibroblasts and macrophages.
- The perineurium holds the axon group together in bundles called fascicles.
- It is a layer of thick, connective tissue.
- The epineurium is the outermost covering of the entire nerve.
- It consists of fibroblasts and thick collagen fibres.
- Extensions of this layer also fill the fascicles.

Action Potentials

- Occurs when there is a difference in membrane potential between the inside and outside of an axon.
- Results in a potential difference being created across the membrane.
- Resting membrane potential is -70mV - the inside of the cell is more negative than the outside.
- Always lead to membrane depolarisation.

Graded Potentials

- Only occur at very short distances, usually in dendrites.
- Their size is proportional to stimulus strength.
- Can depolarise or hyperpolarise a membrane.

Resting Phase

1) All voltage-gated Na^+ and K^+ channels are closed, and the membrane is at resting potential of -70mV: the membrane is polarised.
2) There are equal small build-ups of cations in the extracellular fluid and anions in the cytosol.
3) The negative charge of the inside of the cell is maintained by Na^+ / K^+ ATPases, which pump 3 Na^+ in to the cell for every 2 K^+ pumped out.

Depolarisation

1) When the membrane of the axon reaches the threshold potential (about -50mV), voltage-gated Na^+ channels open as the membrane is depolarised.
2) There is an influx of Na^+ ions through Na^+ channel activation gates into the cell as they diffuse down their concentration gradient.
3) The membrane potential increases to about +30mV as Na^+ continue to flood into the cell.

Repolarisation

1) Voltage-gated Na^+ channels close whilst voltage-gated K^+ channels gradually open.
2) The inflow of Na^+ ions slows down whilst some K^+ ions are emitted from the cell to restore the resting potential.
3) The membrane potential drops from +30mV back towards -70mV as a negative net charge builds up on the inside of the cell once again.