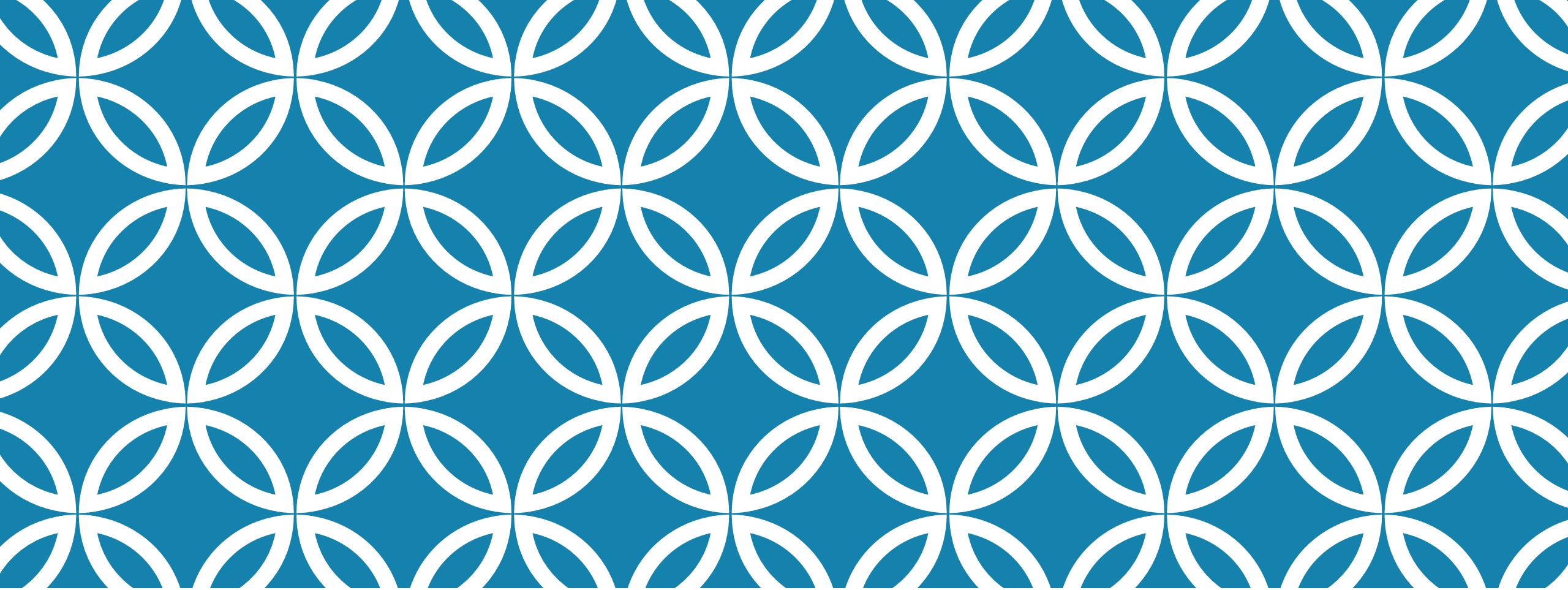
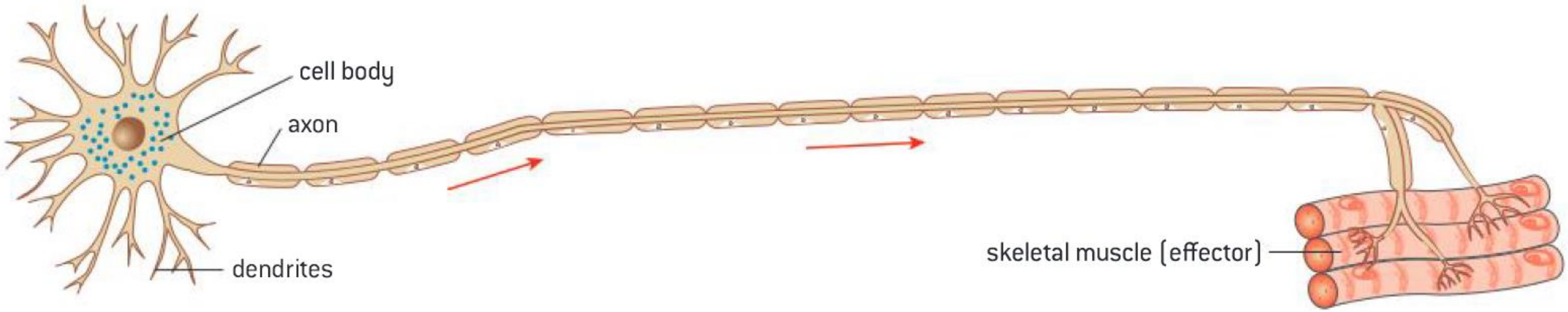


CHAPTER 6.5

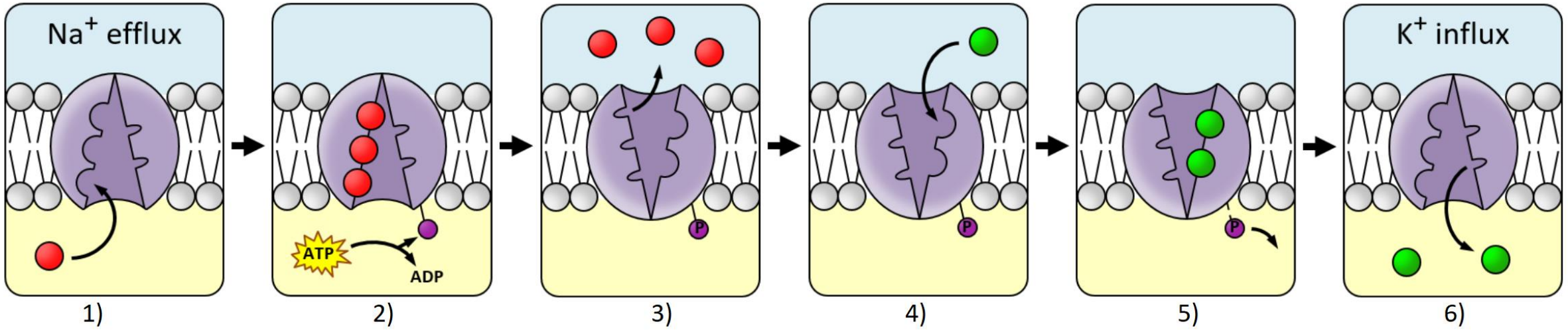
Neurons & Synapses

NEURONS

Neurons transmit electrical impulses.



REVISION: SODIUM-POTASSIUM PUMP



REVISION: SODIUM-POTASSIUM PUMP

1) Three sodium ions bind to protein pump

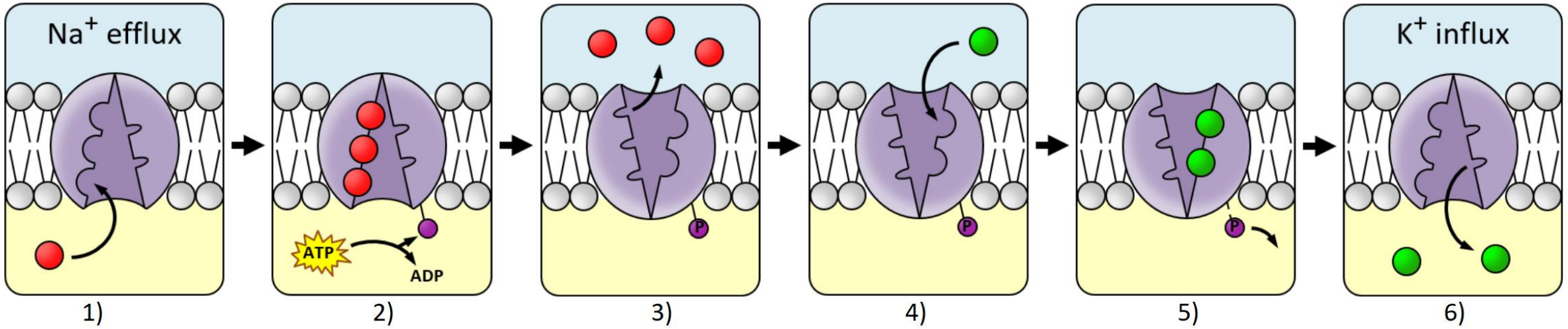
2) ATP transfers a phosphate group to the pump (hydrolysis) → changes conformation

3) Interior of pump opens to outside → sodium ions are released

4) Two potassium ions from outside attach to potassium pump

5) Binding of potassium → releases phosphate group

6) release of phosphate → changes conformation and potassium ions are released



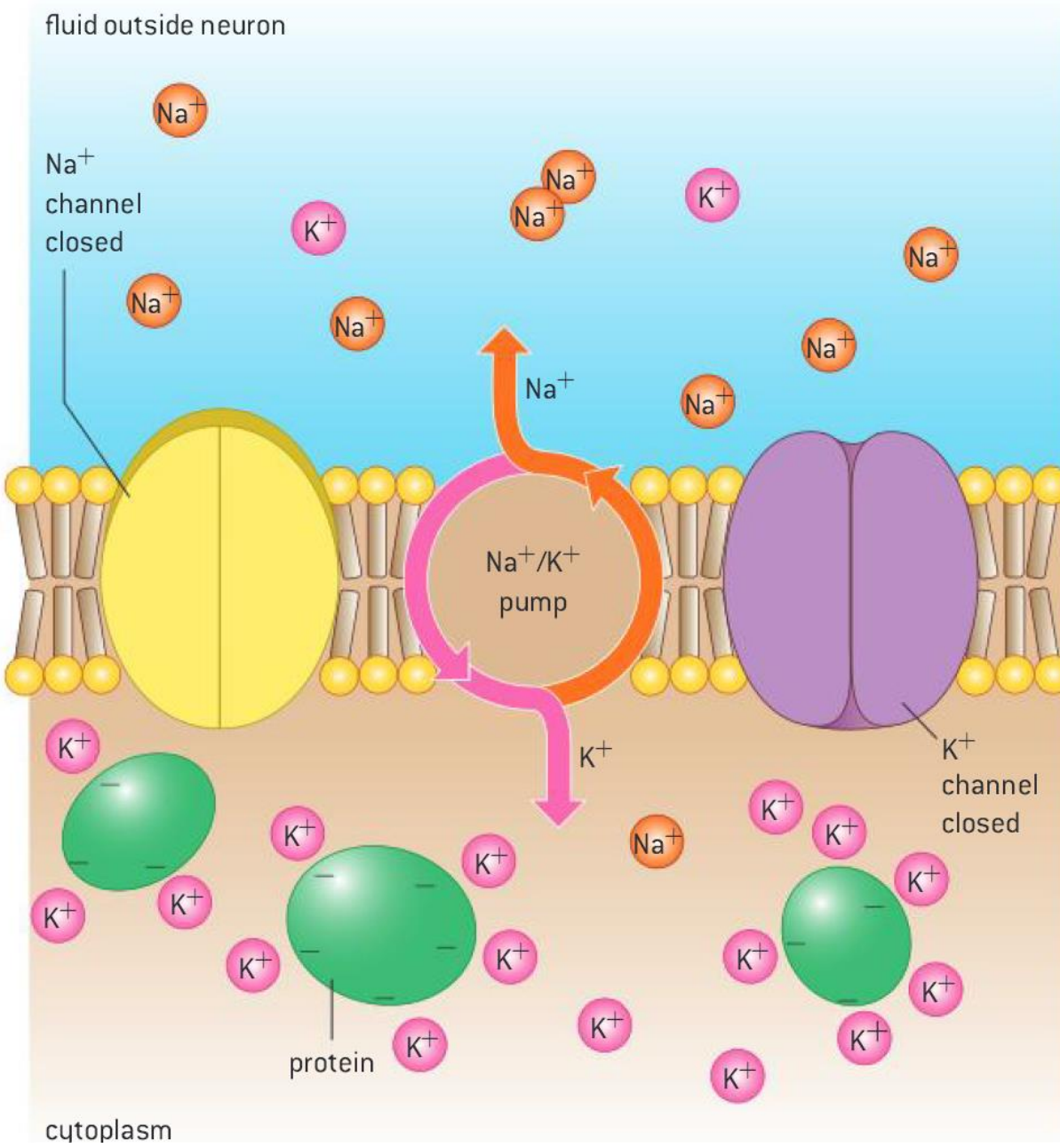
RESTING POTENTIAL

= difference in charge across the membrane when a neuron is <u>not</u> firing

- normally <u>inside</u> of the neuron is more negative relative to the outside (approximately –70 mV)

- K+ leaks back faster than Na+

- there are a lot of negatively charged proteins inside the nerve fibre



ACTION POTENTIAL

Two phases:

- depolarisation – a change from negative to positive
- repolarisation – a change back from positive to negative

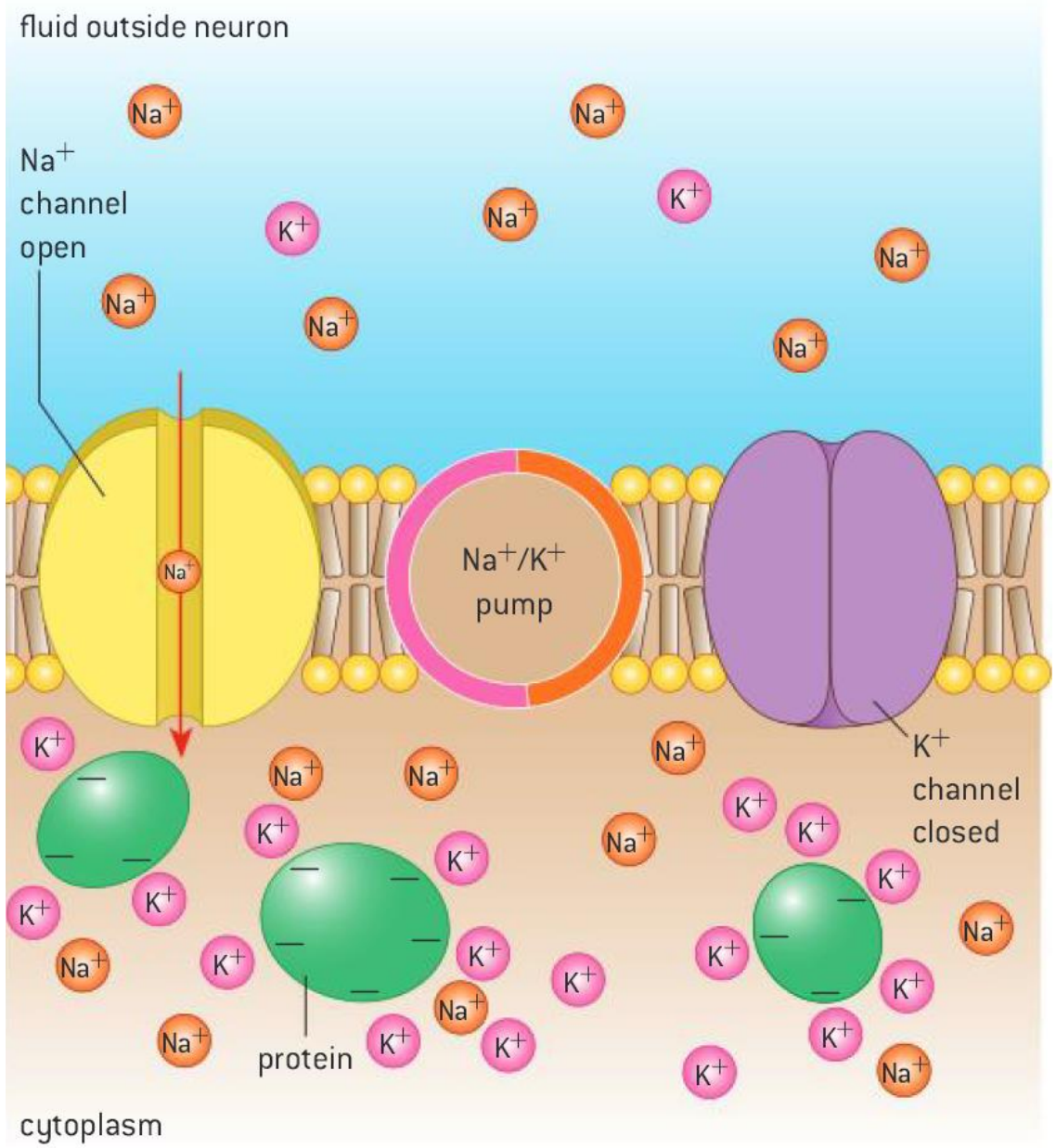
DEPOLARISATION

- sodium channels open

- Na+ diffuses into the neuron

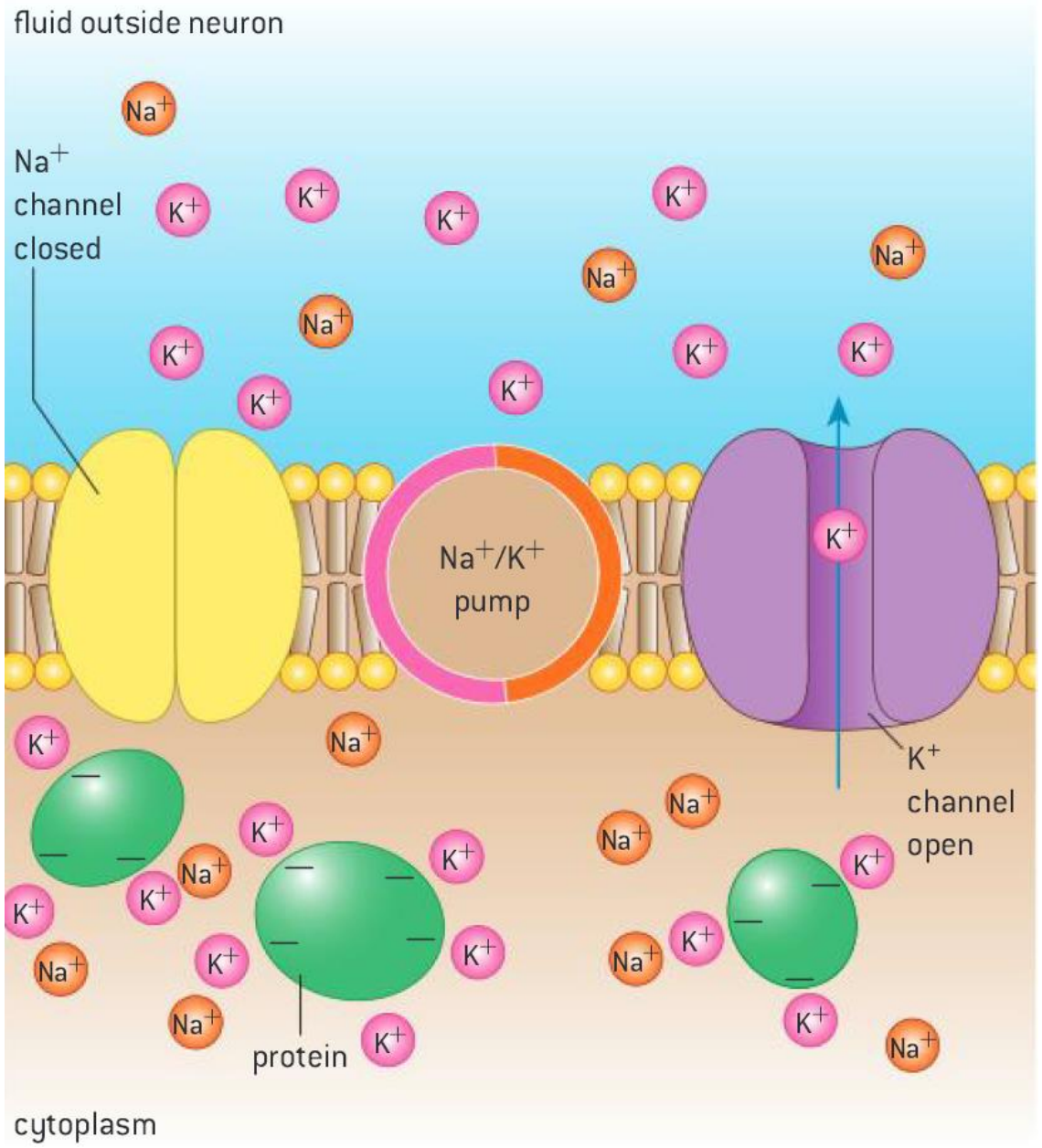
- reverses the charge imbalance across the membrane

- inside is positive relative to the outside (roughly +30mV)

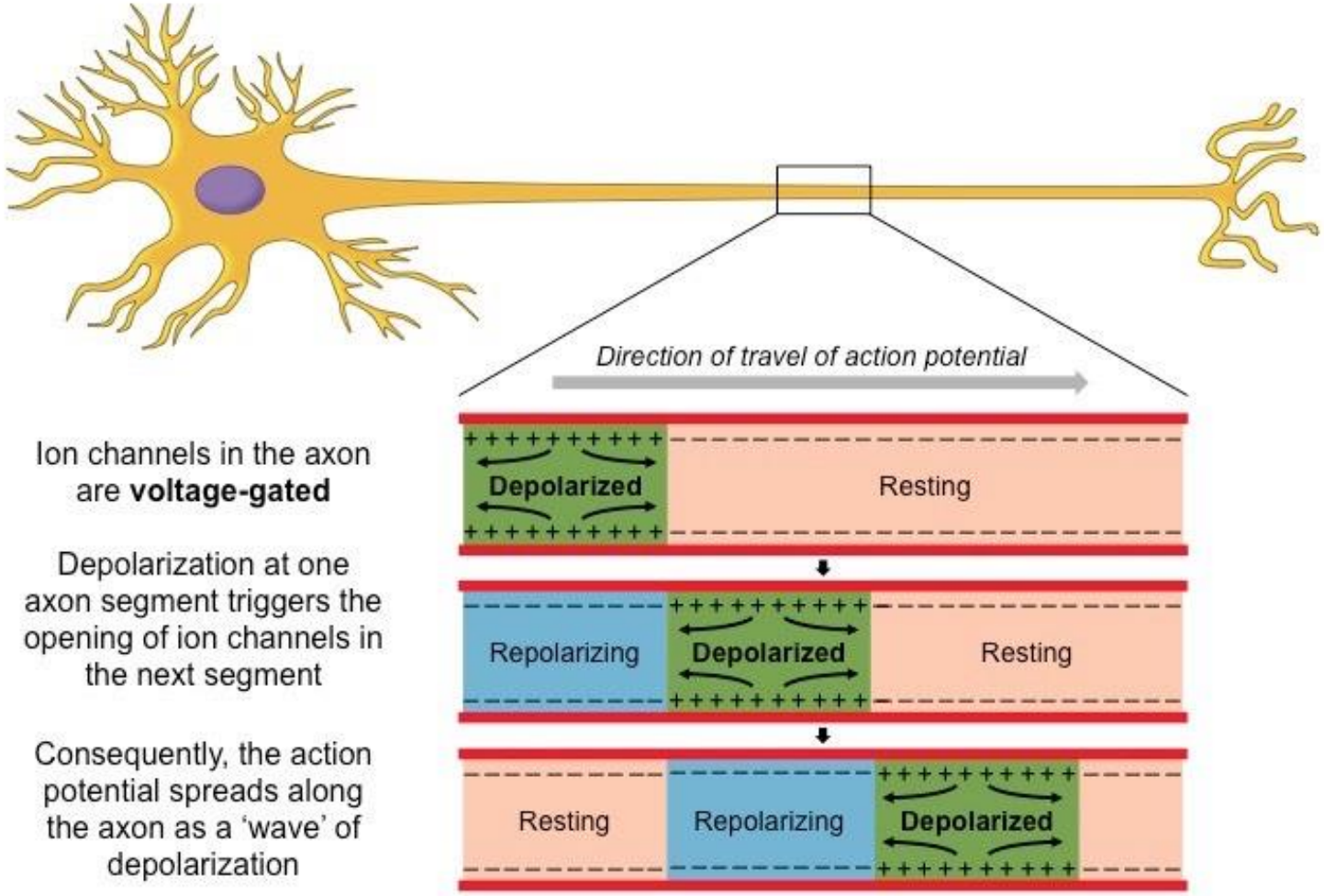


REPOLARISATION

- right after depolarisation
- sodium channels close
- potassium channels open
- potassium diffuses out of the neuron
- makes inside negative again (close to -70mV)
- does not restore resting potential



PROPAGATION OF ACTION POTENTIAL



Ion channels in the axon are **voltage-gated**

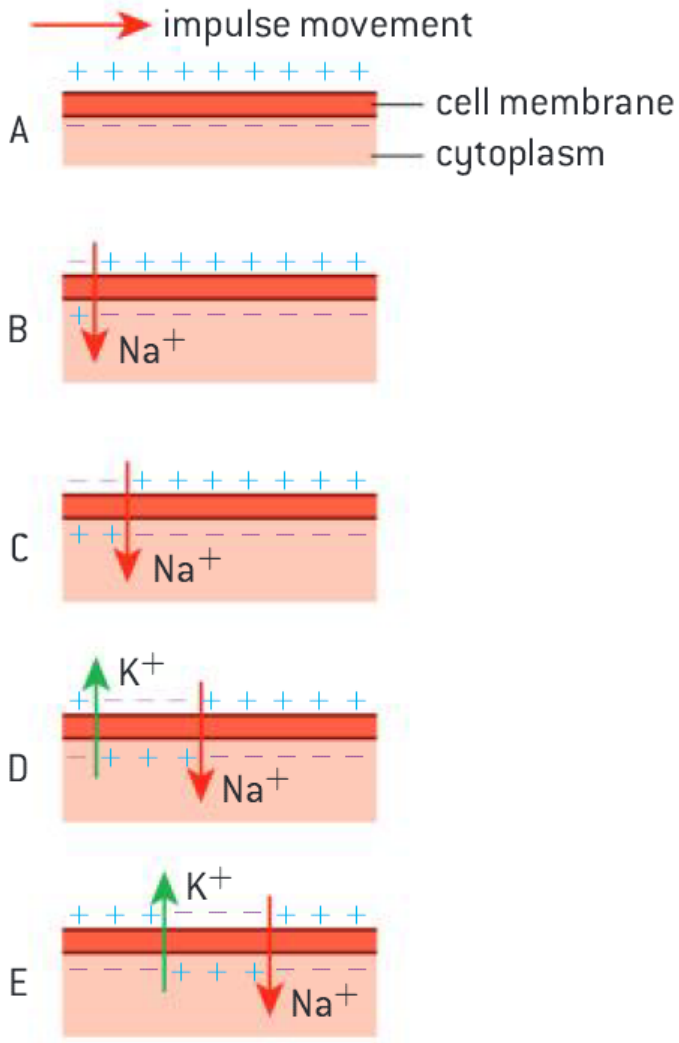
Depolarization at one axon segment triggers the opening of ion channels in the next segment

Consequently, the action potential spreads along the axon as a 'wave' of depolarization

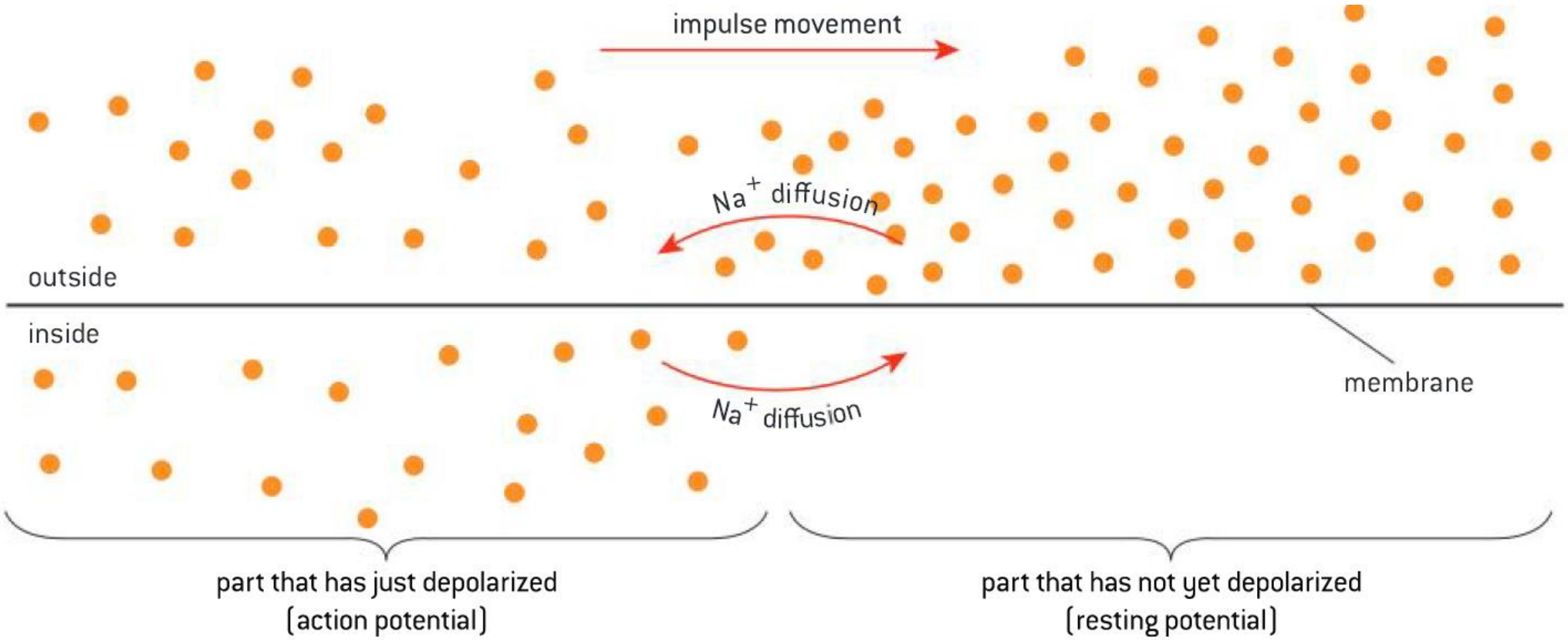
PROPAGATION OF ACTION POTENTIAL

- nerve impulse = action potential that is propagated from one end of a neuron to the other one

- ion movements that depolarize one part of neuron, trigger depolarization in the neighbouring part



LOCAL CURRENTS



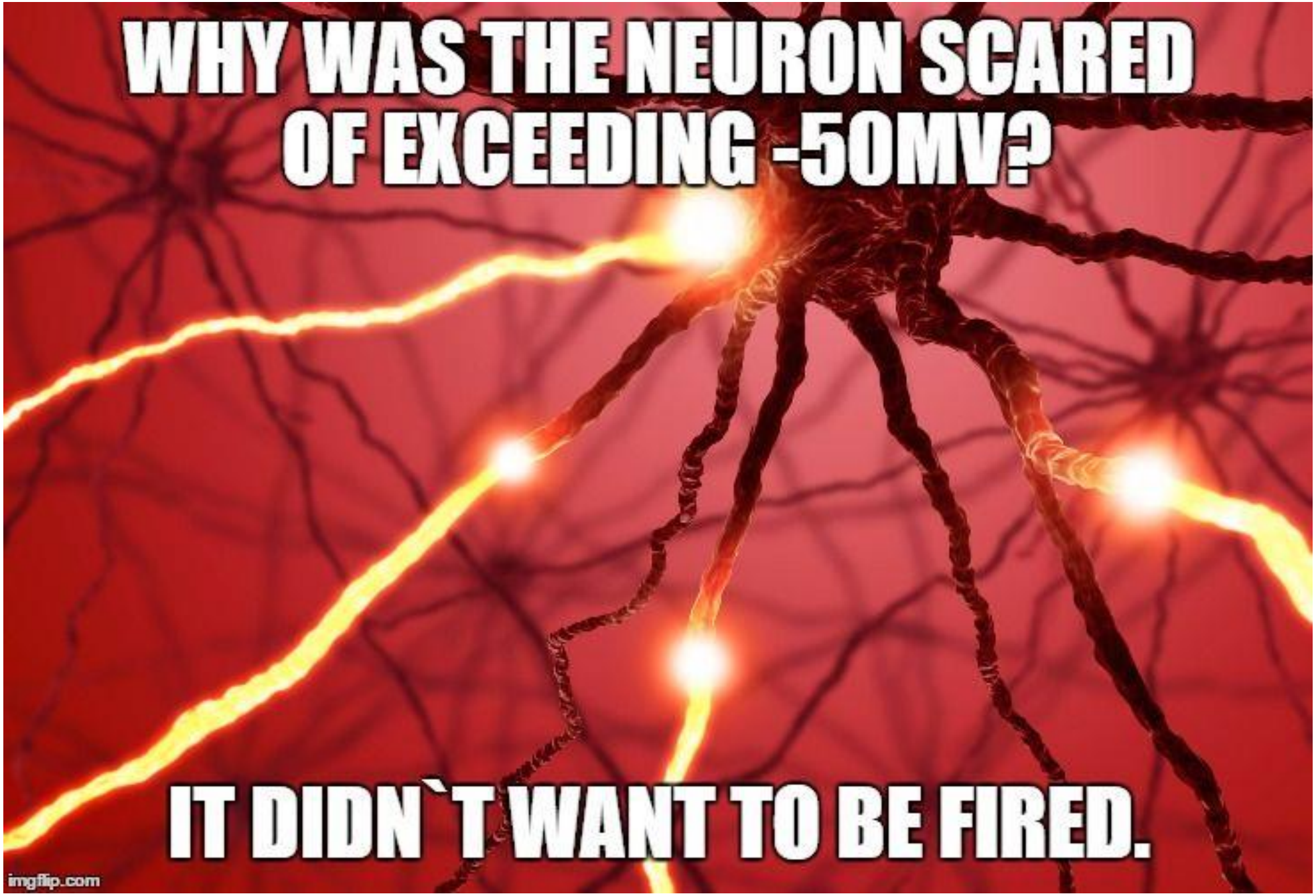
THRESHOLD POTENTIAL

- Action potentials propagate according to the all-or-none-rule

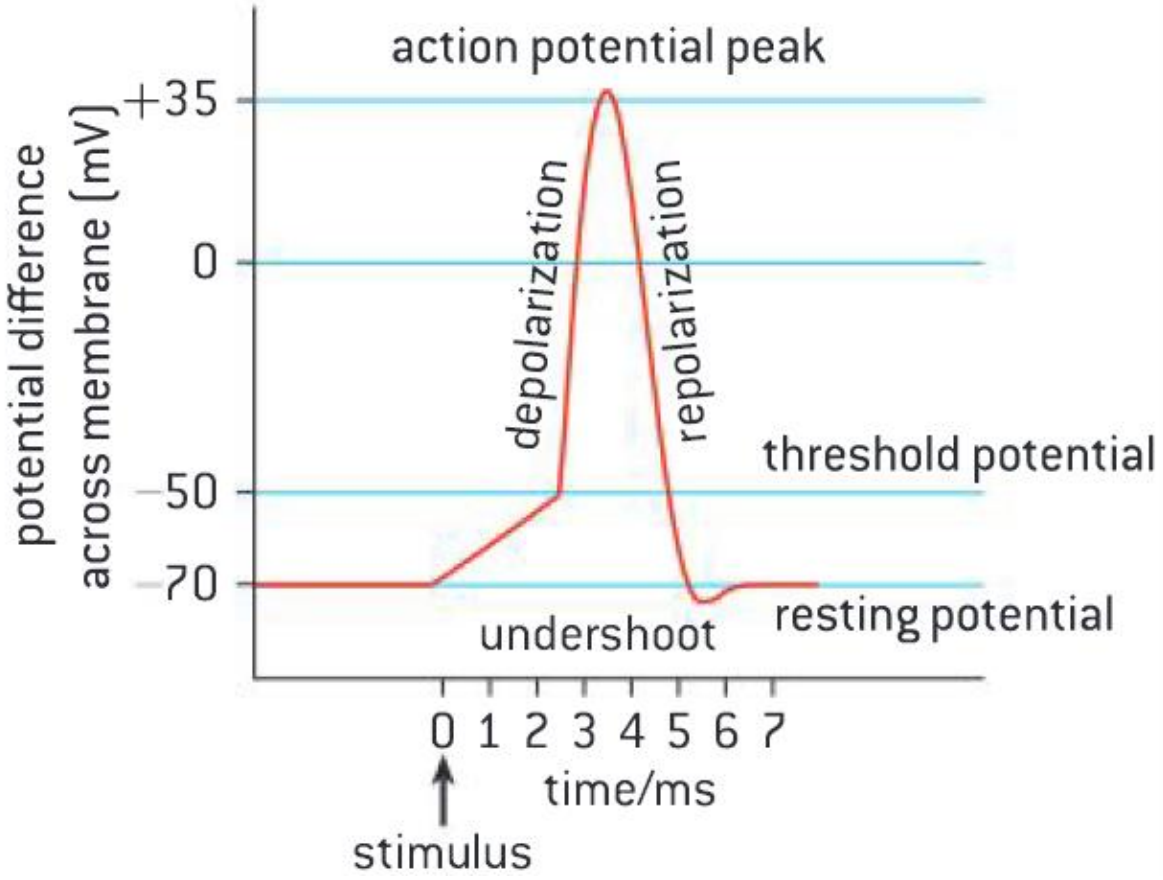
- the minimum stimulus recquired = threshold potential (roughly -50mV)

- that stimulus is needed to open voltage gated channels

- if that potential is not reached, the action potential will not be generated and the neuron will not fire


WHY WAS THE NEURON SCARED OF EXCEEDING -50MV?
IT DIDN`T WANT TO BE FIRED.
imgflip.com

OSCILLOSCOPE TRACES



DATA BASED QUESTIONS

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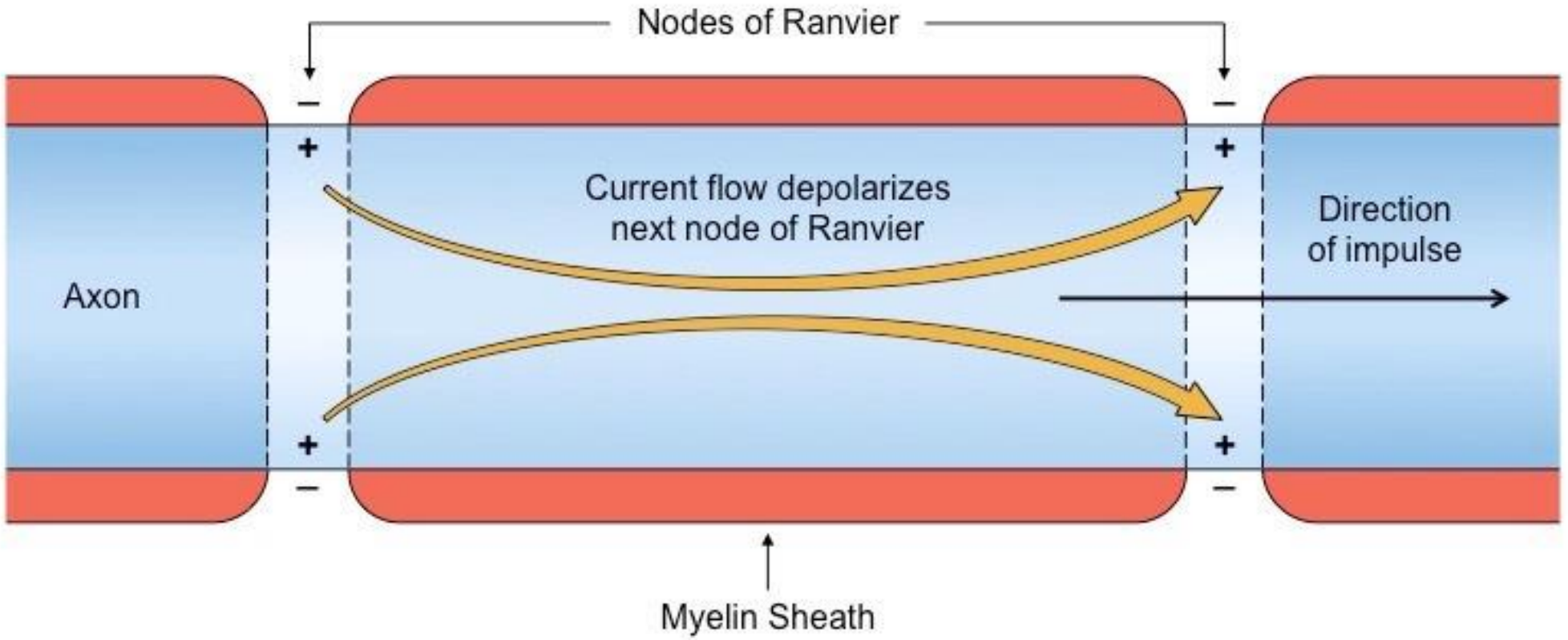
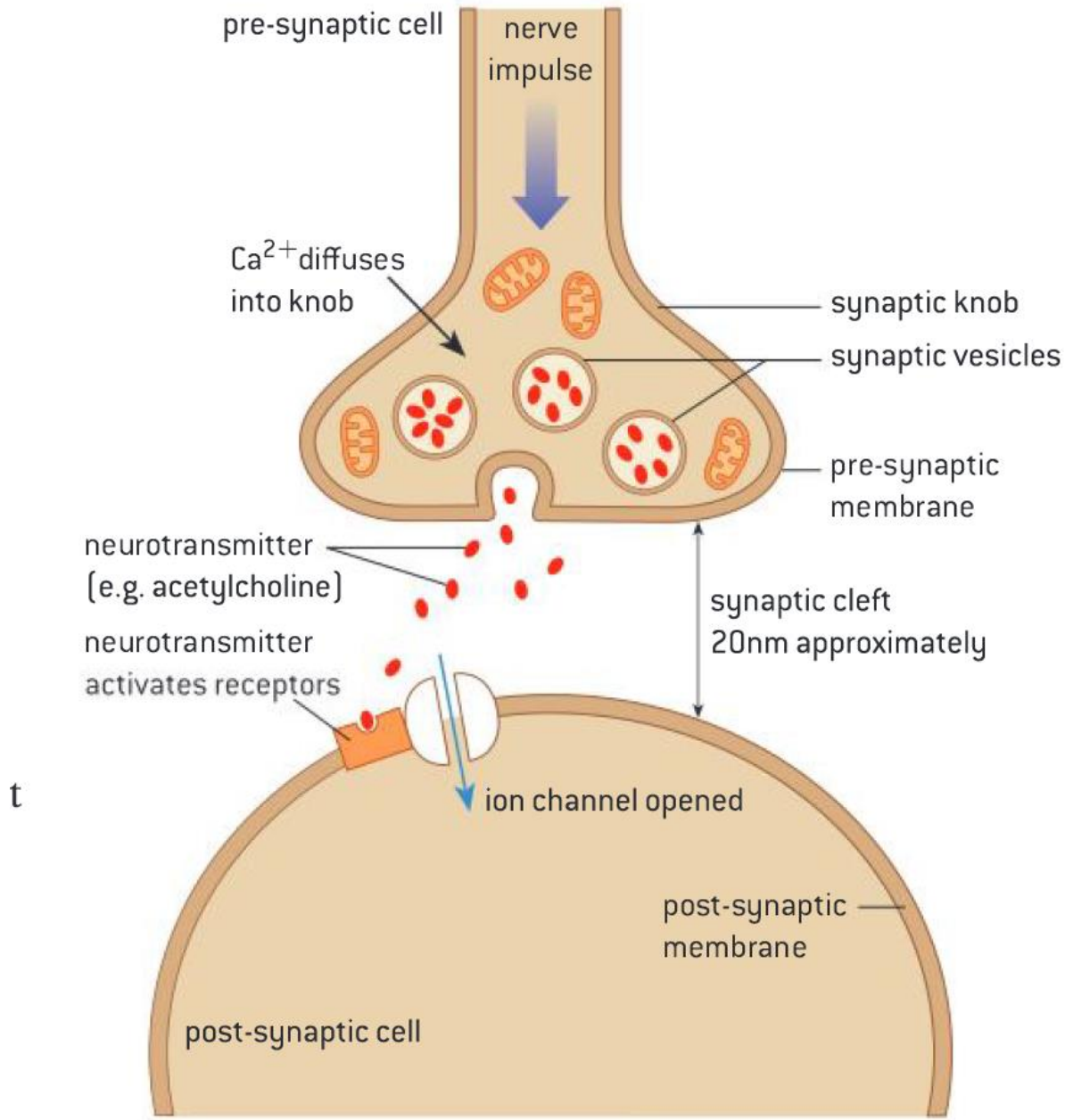
MYELINATION



SYNAPSES


pre-synaptic cell
nerve impulse
Ca^{2+} diffuses into knob
synaptic knob
synaptic vesicles
pre-synaptic membrane
neurotransmitter (e.g. acetylcholine)
neurotransmitter activates receptors
synaptic cleft 20nm approximately
ion channel opened
post-synaptic membrane
post-synaptic cell

NEUROTRANSMITTERS: ACETYLCHOLINE

Used in many synapses (e.g. between neuron and muscle fibres).

choline (from food) + (aerobic respiration)

Postsynaptici cell → binding to receptors (for a very short time)

Acetylcholinesterase in synaptic cleft

Choline reabsorbed in pre-synaptic neuron –> recmobining with Acetyl

NEONICOTINOIDS

Orange box p. 326/327