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Ease on down, ease on down

Propagation is the way...

Today's Topics

- Driving force and equilibrium potential
- Action potential propagation

Driving force and equilibrium potential

- "Driving Force" on a given ion depends on its equilibrium potential.
- Driving force larger if membrane potential far from equilibrium potential for ion.
- *Equilibrium potential*
  - Voltage that keeps current (inside/outside) concentrations the same
  - Voltage membrane potential will approach if **only** that ion flows

Equilibrium potentials calculated under typical conditions

Ion	[inside]	[outside]	Voltage
K+	~150 mM	~4 mM	~ -90 mV
Na+	~10 mM	~140 mM	~ +55-60 mV
Cl-	~10 mM	~110 mM	- 65-80 mV

Action potential and driving forces

Rising phase

- Membrane permeability to Na+ increases
- Na+ inflow
- Na+ driving force (toward +55 mV) dominant

Falling phase

- High Na+ permeability ends
- Permeability to K+ increases
- K+ outflow
- K+ driving force (toward -90 mV) dominant

AP propagation

- Propagation

- move down axon, away from soma, toward axon terminals.
- Unmyelinated axon
  - Each segment "excites" the next

AP propagation is like

AP propagation

- Myelinated axon
  - AP "jumps" between Nodes of Ranvier, *saltatory conduction*
  - Nodes of Ranvier == unmyelinated sections of axon
  - voltage-gated Na+, K+ channels exposed
  - Current flows through myelinated segments

Question

- Why does AP flow in one direction, away from soma?
  - Soma does not have (many) voltage-gated Na+ channels.
  - Soma is not myelinated.
  - Refractory periods mean polarization only in one direction.

Question

- Why does AP flow in one direction, away from soma?
  - **Soma does not have (many) voltage-gated Na+ channels.**
  - Soma is not myelinated.
  - **Refractory periods mean polarization only in one direction.**

Conduction velocities

Information processing

- AP amplitudes don't vary (much)
  - All or none
- AP frequency and timing vary
  - Rate vs. timing codes

Review for Exam 1

Exam 1 Study Guide

References