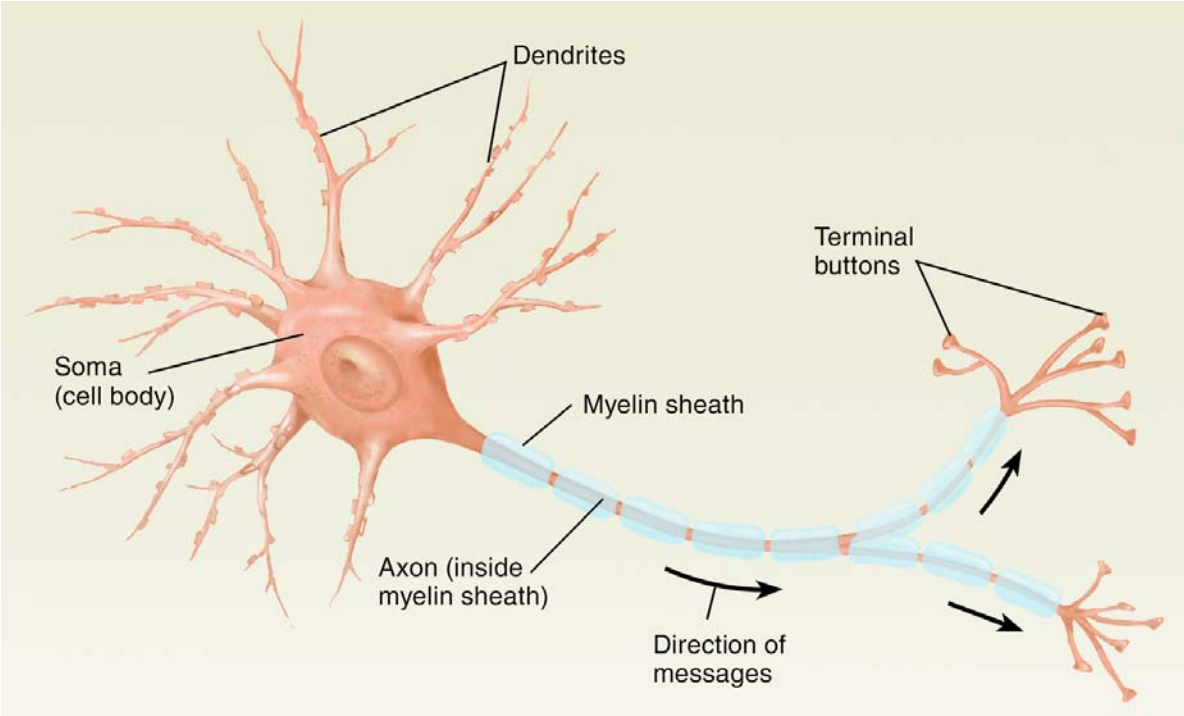
# Neuron Structure



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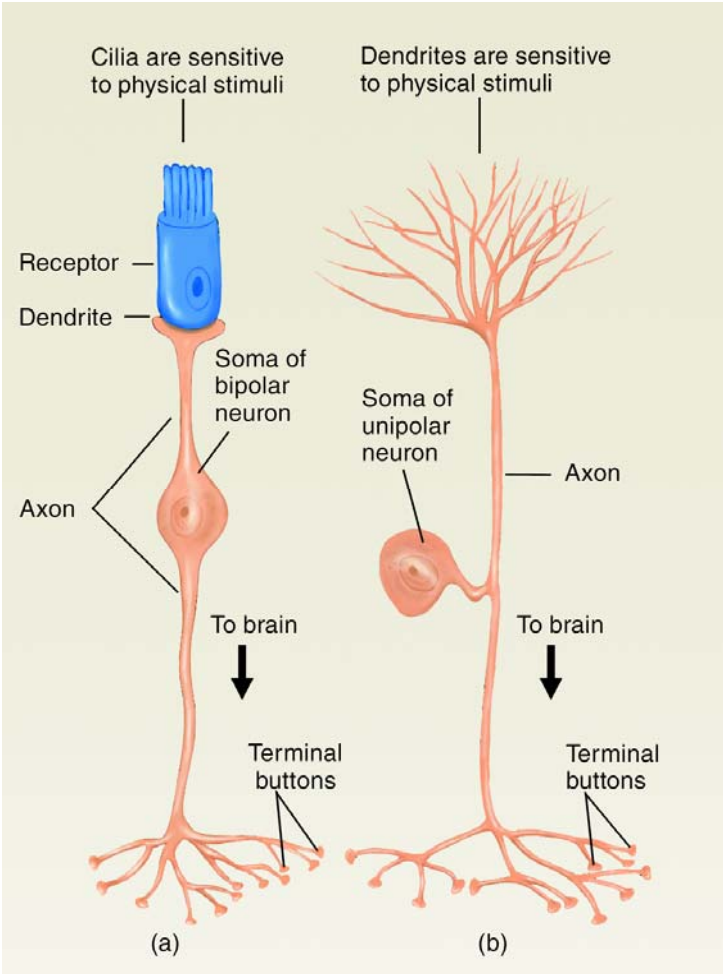
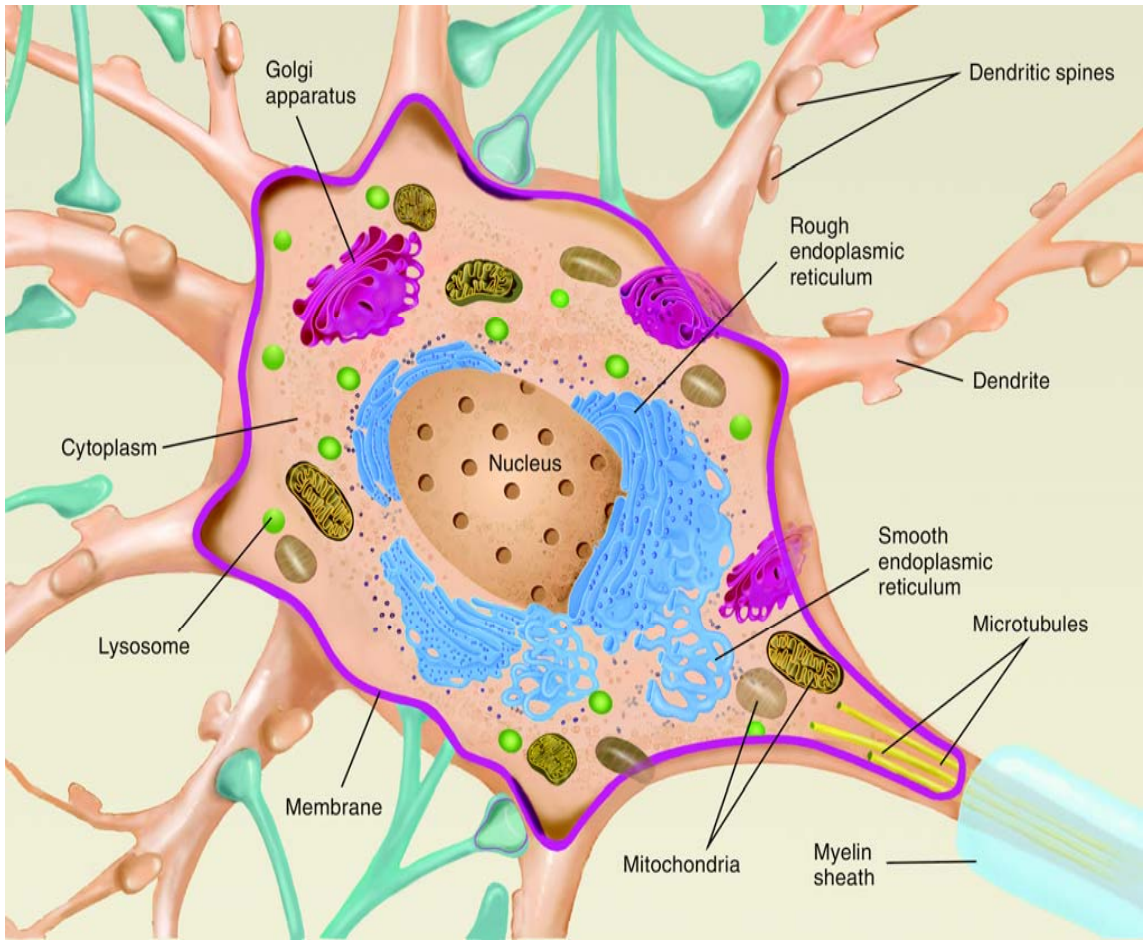
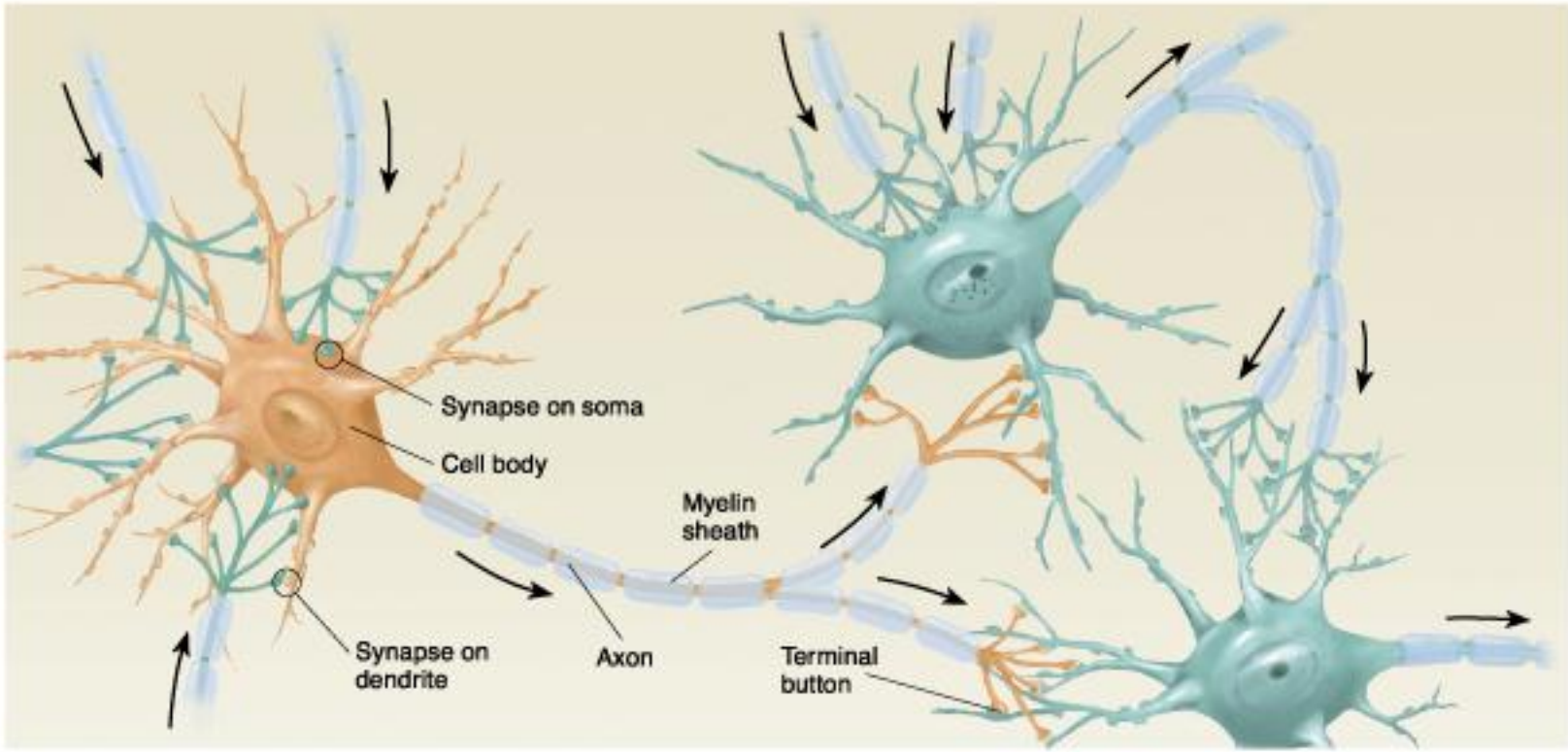
# Bipolar - Unipolar Neurons



# Neuron Internal Structure



## ▶ Synaptic Connections Between Neurons

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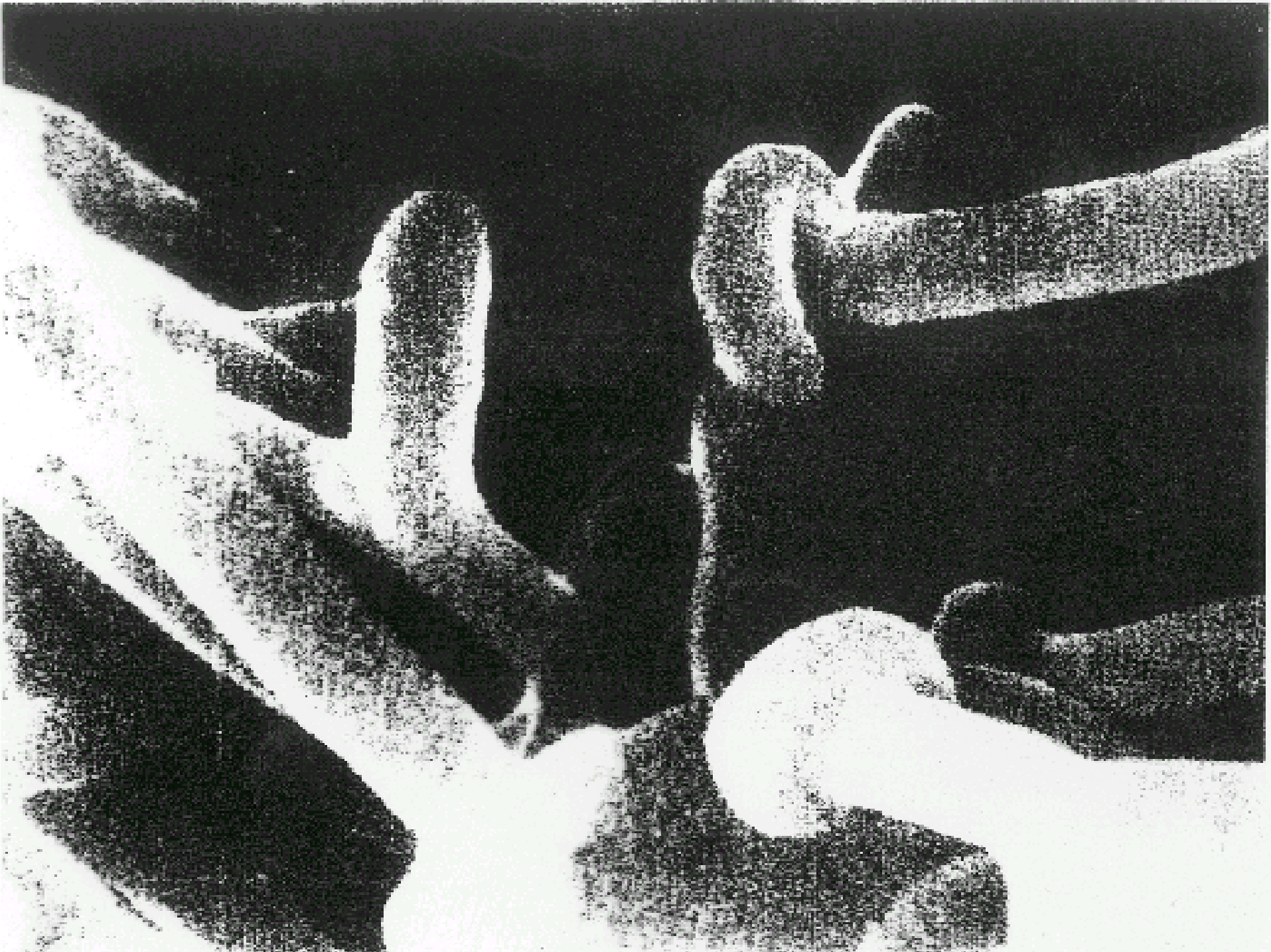
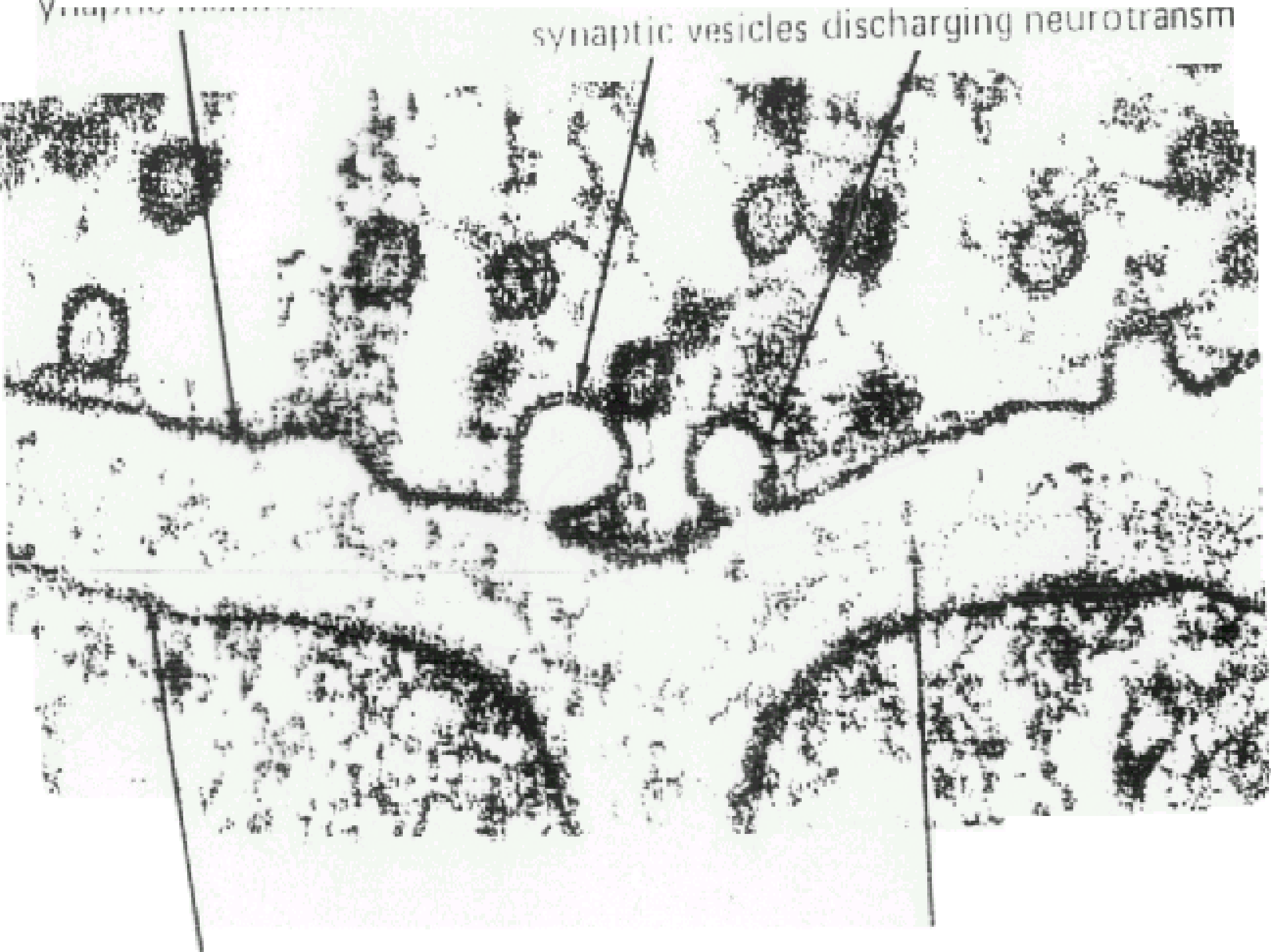
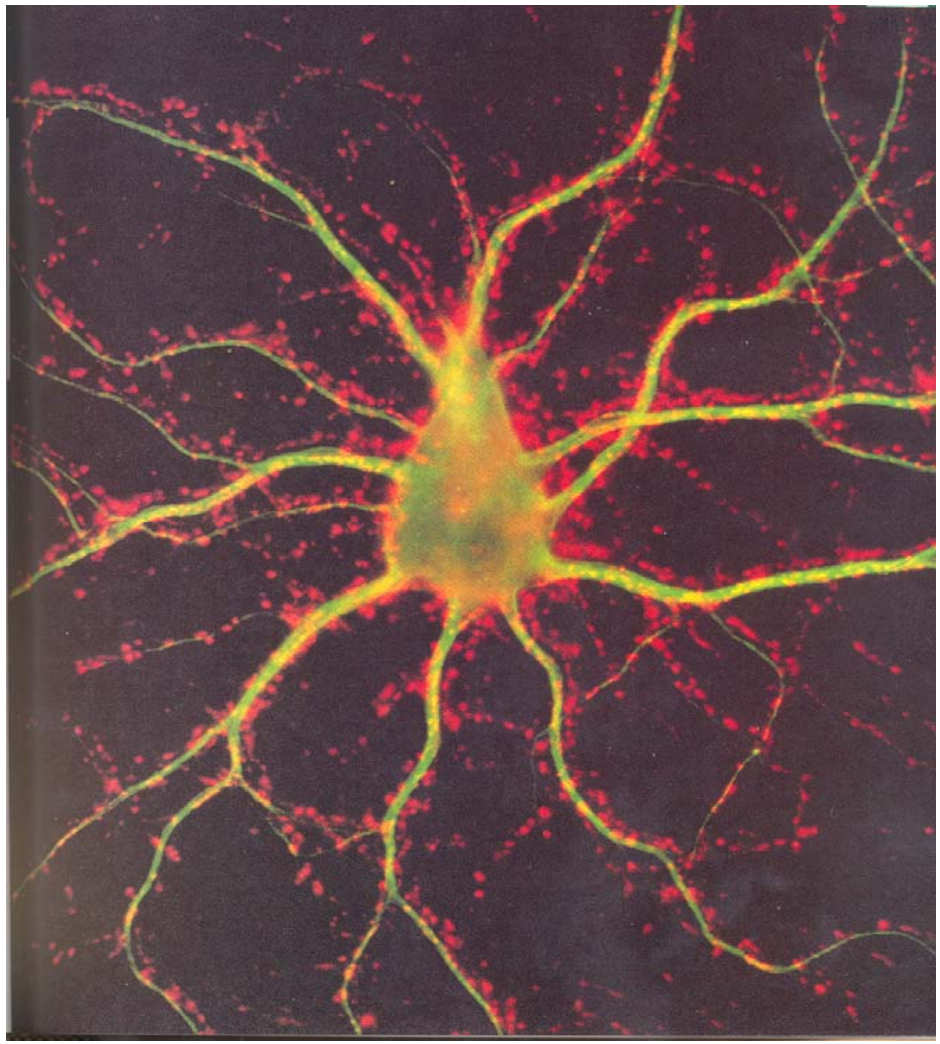



synaptic vesicles discharging neurotransm

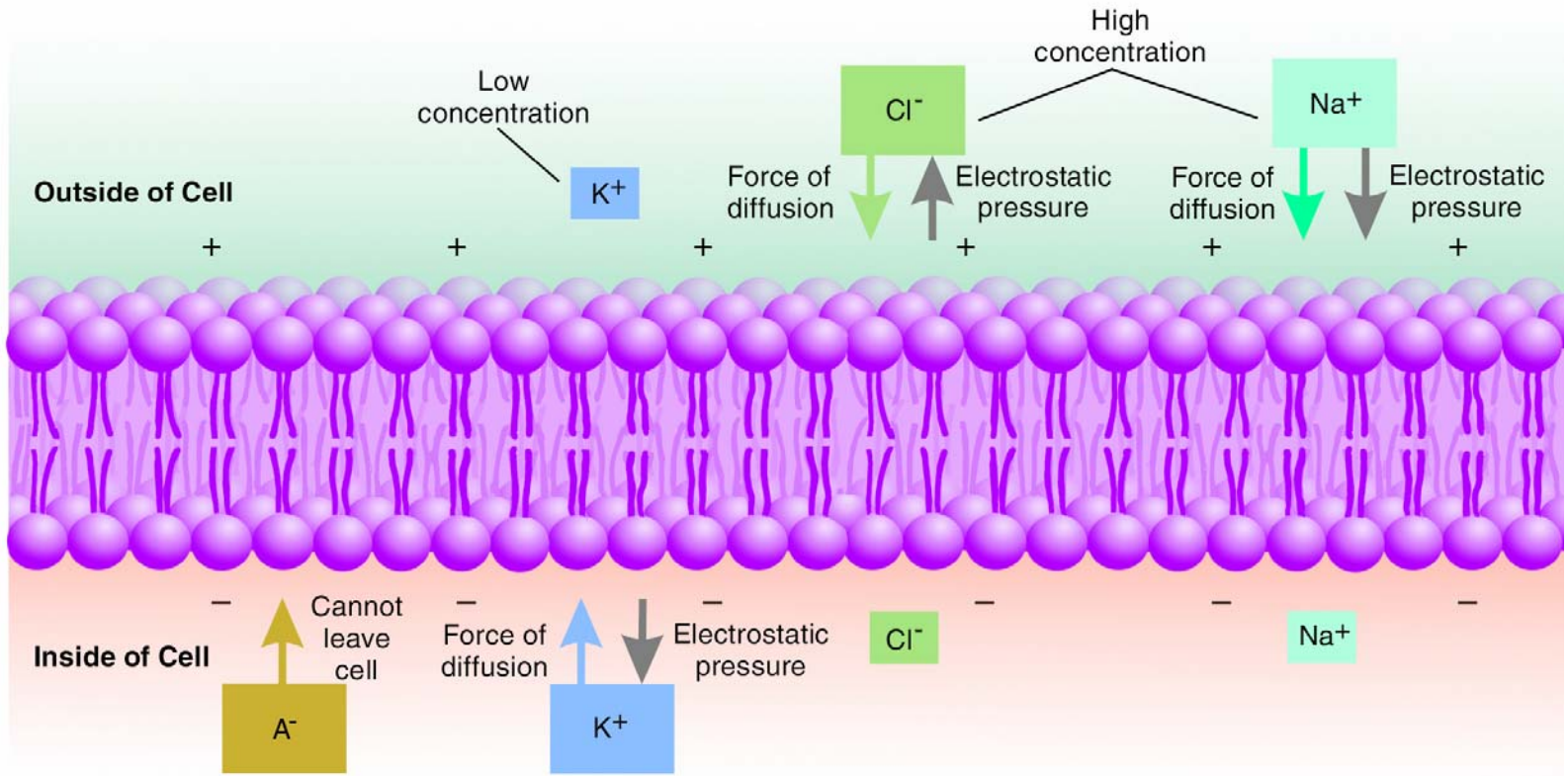
**Hippocampal Pyramidal Neuron:**

Green Fluorescent Dye Reacts with Dendritic Protein MAP2.

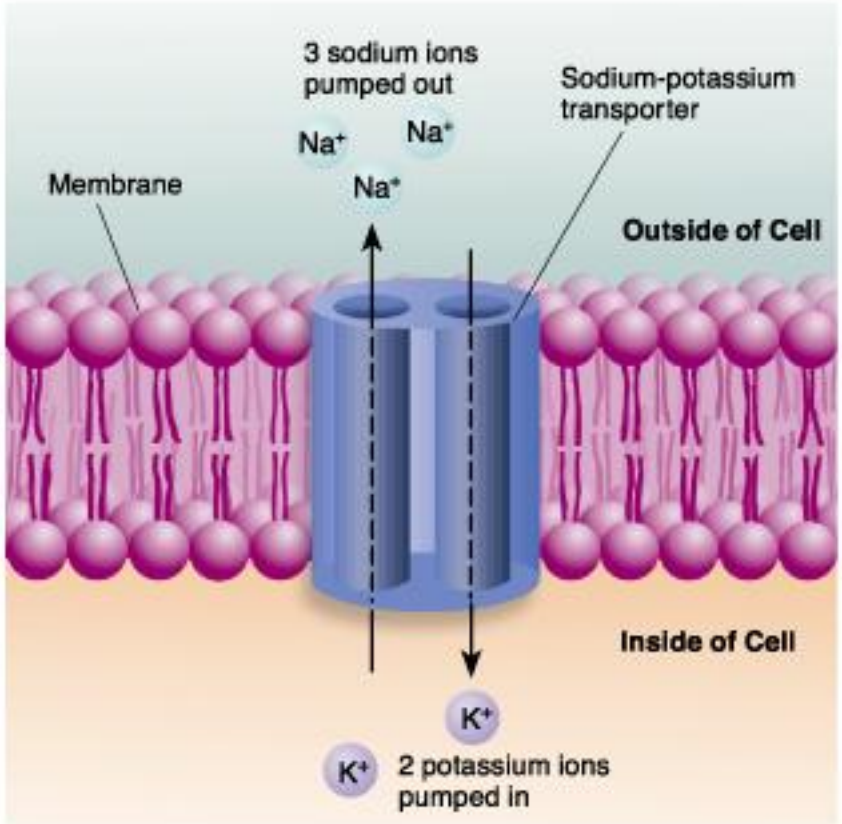
Red Fluorescent Dye Reacts with vesicles of Pre-Synaptic terminals.



# Relative Ion Concentrations Across the Axon Membrane



## ▶ A Sodium-Potassium Transporter, Situated in the Cell Membrane

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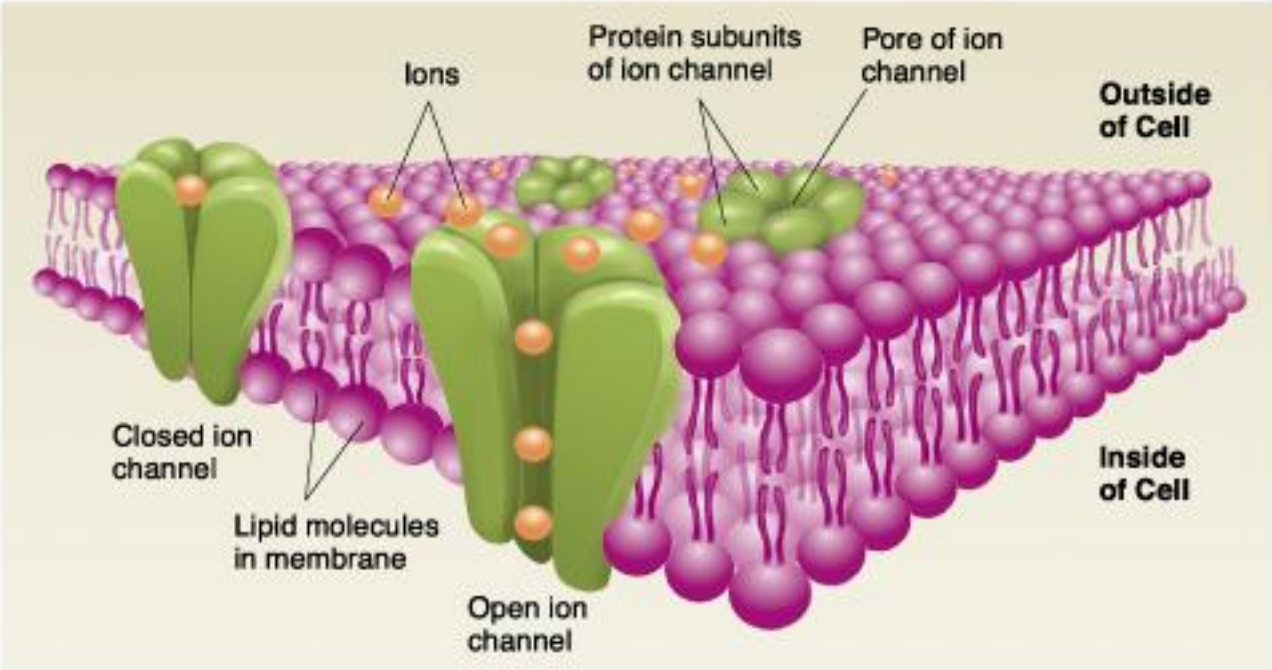
## ▶ Ion Channels

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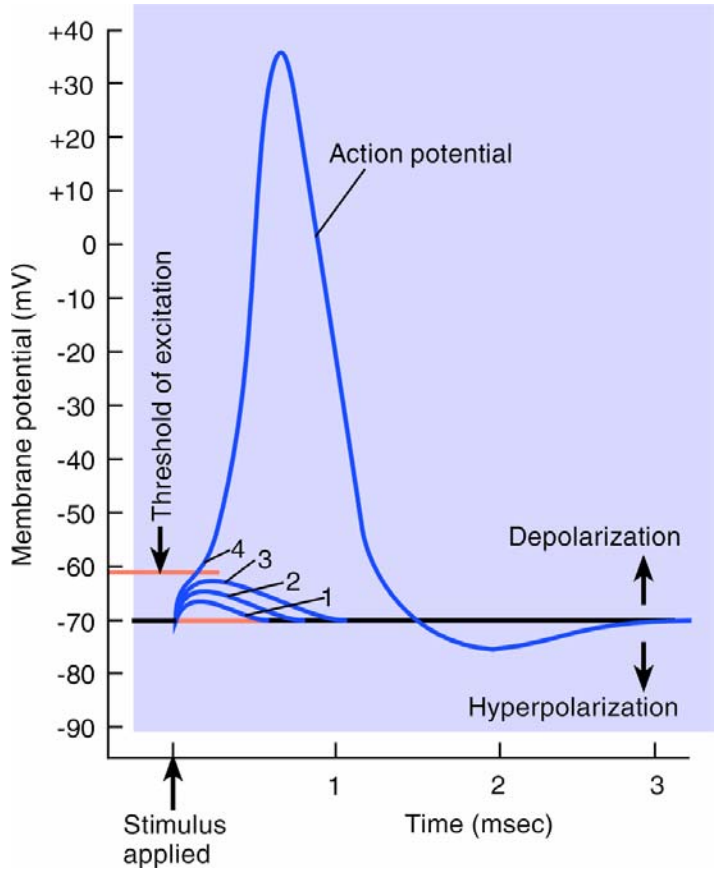
| CONDITION | VOLTAGE | ION | ESF | OSF | ESF+OSF=NET | Net Force | Perm | Outcome | COMMENT |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| RESTING | -70 | K+ | HI/IN | HI/OUT | SUBTRACTS | LOW/OUT | HI | LOW FLOW/OUT | EQUAL TO Na+ RATE |
| RESTING | -70 | Na+ | HI/IN | HI/IN | ADDS | Very HI/IN | LO | LOW FLOW/IN | EQUAL TO K+ RATE |
| | | | | | | | | | |
| RUPTURE | -70 | Na+ | HI/IN | HI/IN | ADDS | Very HI/IN | HI | VERY HI FLOW/IN | |
| | -35 | Na+ | MEDIUM/IN | HI/IN | ADDS | HI/IN | HI | HI FLOW/IN | |
| | 0 | Na+ | ZERO | HI/IN | | MEDIUM/IN | HI | MEDIUM FLOW/IN | |
| | 20 | Na+ | MEDIUM/OUT | HI/IN | SUBTRACTS | LOW/IN | HI | LOW FLOW/IN | |
| EQ FOR Na+ | 40 | Na+ | HI/OUT | HI/IN | SUBTRACTS | ZERO | HI | NO FLOW | |
| | | | | | | | | | |
| | 40 | K+ | HI/OUT | HI/OUT | ADDS | Very HI/OUT | HI | Very HI FLOW/OUT | |
| | 20 | K+ | MEDIUM/OUT | HI/OUT | ADDS | HI/OUT | HI | HI FLOW/OUT | |
| | 0 | K+ | ZERO | HI/OUT | | MEDIUM/OUT | HI | MEDIUM/OUT | |
| | -70 | K+ | HI/IN | HI/OUT | SUBTRACTS | LO/OUT | HI | LO FLOW/OUT | |
| EQ FOR K+ | -76 | K+ | HI/IN | HI/OUT | SUBTRACTS | ZERO | HI | NO FLOW | |

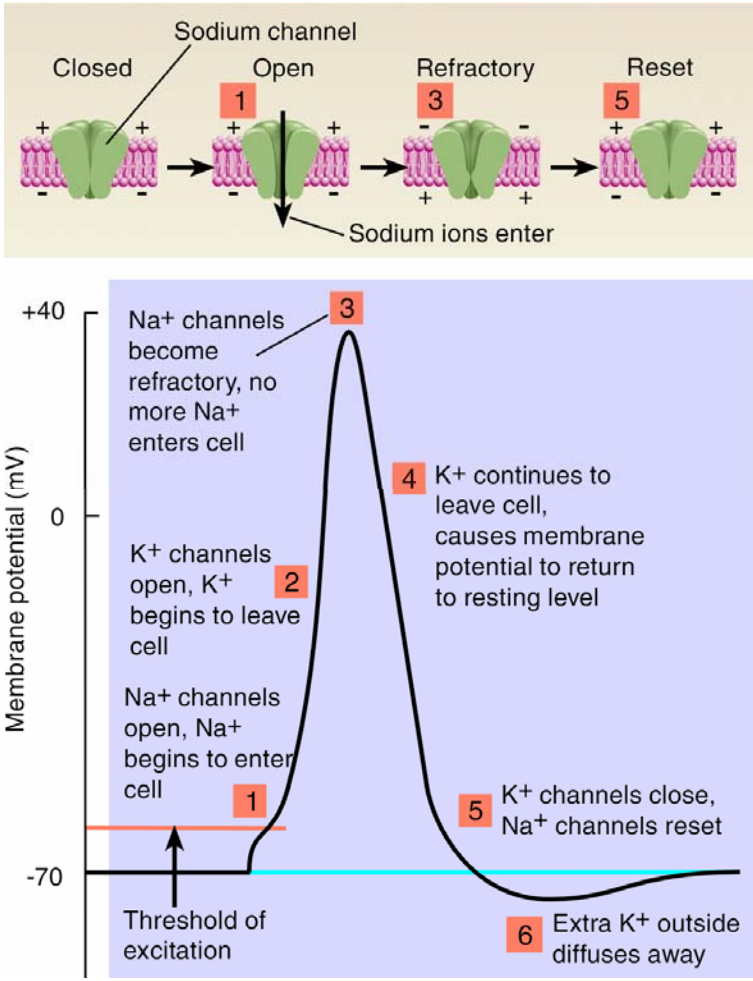
# The Action Potential

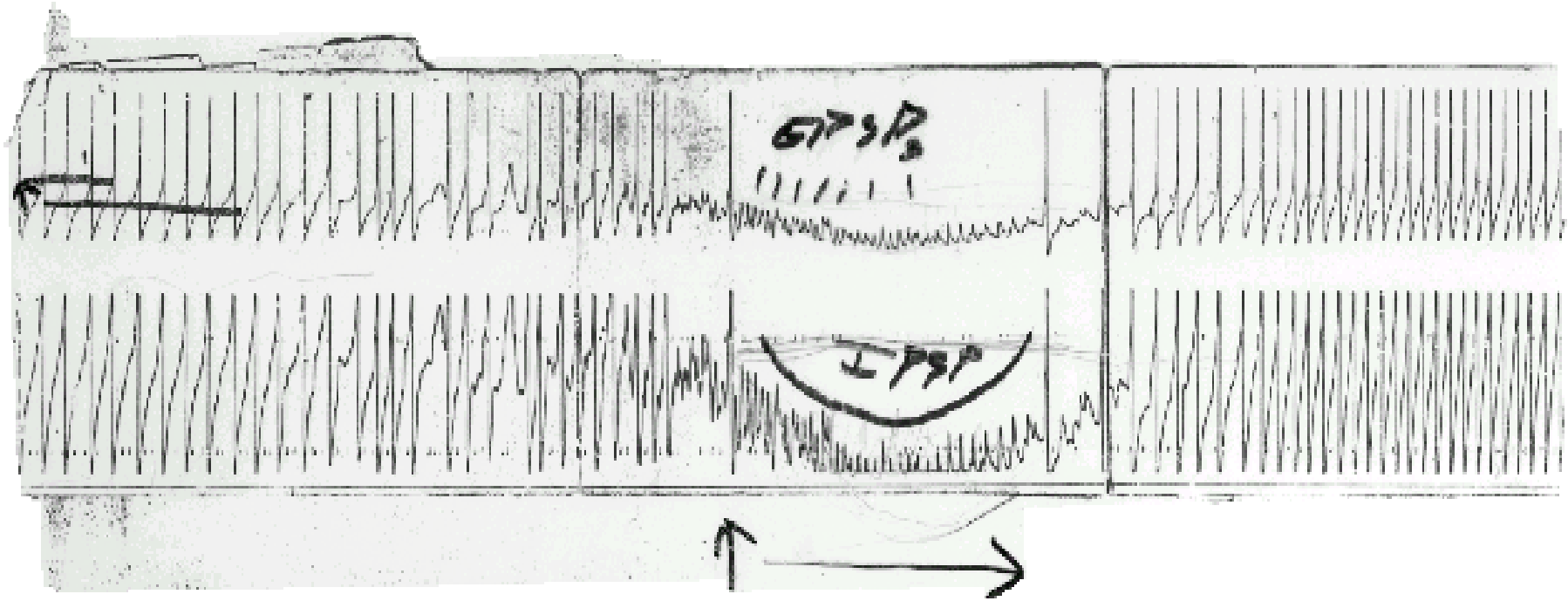
- AP is a stereotyped change in membrane potential
  - If RMP moves past threshold, membrane potential quickly moves to +40 mV and then returns to resting
- Ionic basis of the AP:
  - $NA^+$ in: upswing of spike
    - Diffusion, electrostatic pressure
  - $K^+$ out: downswing of spike



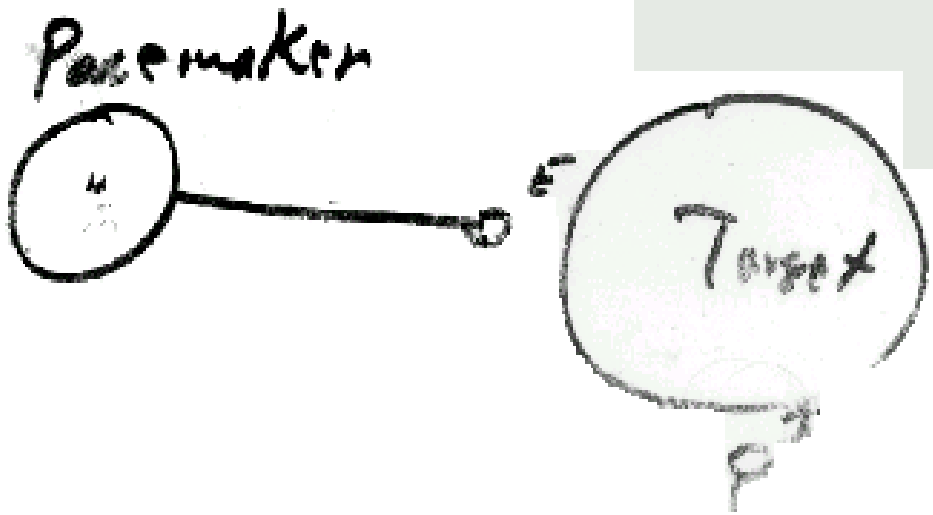

2.12

# Ion Channels and the AP



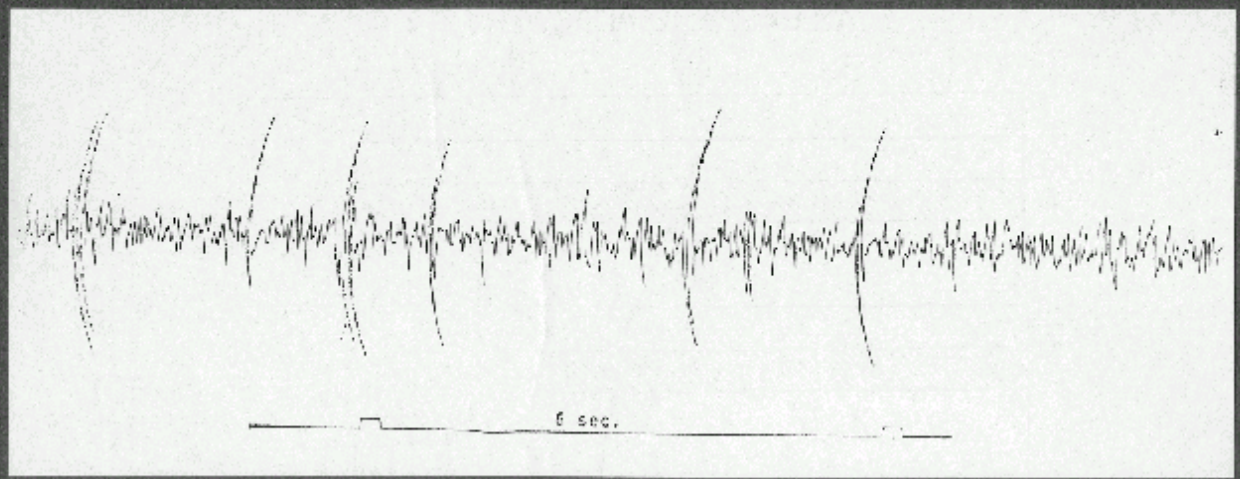


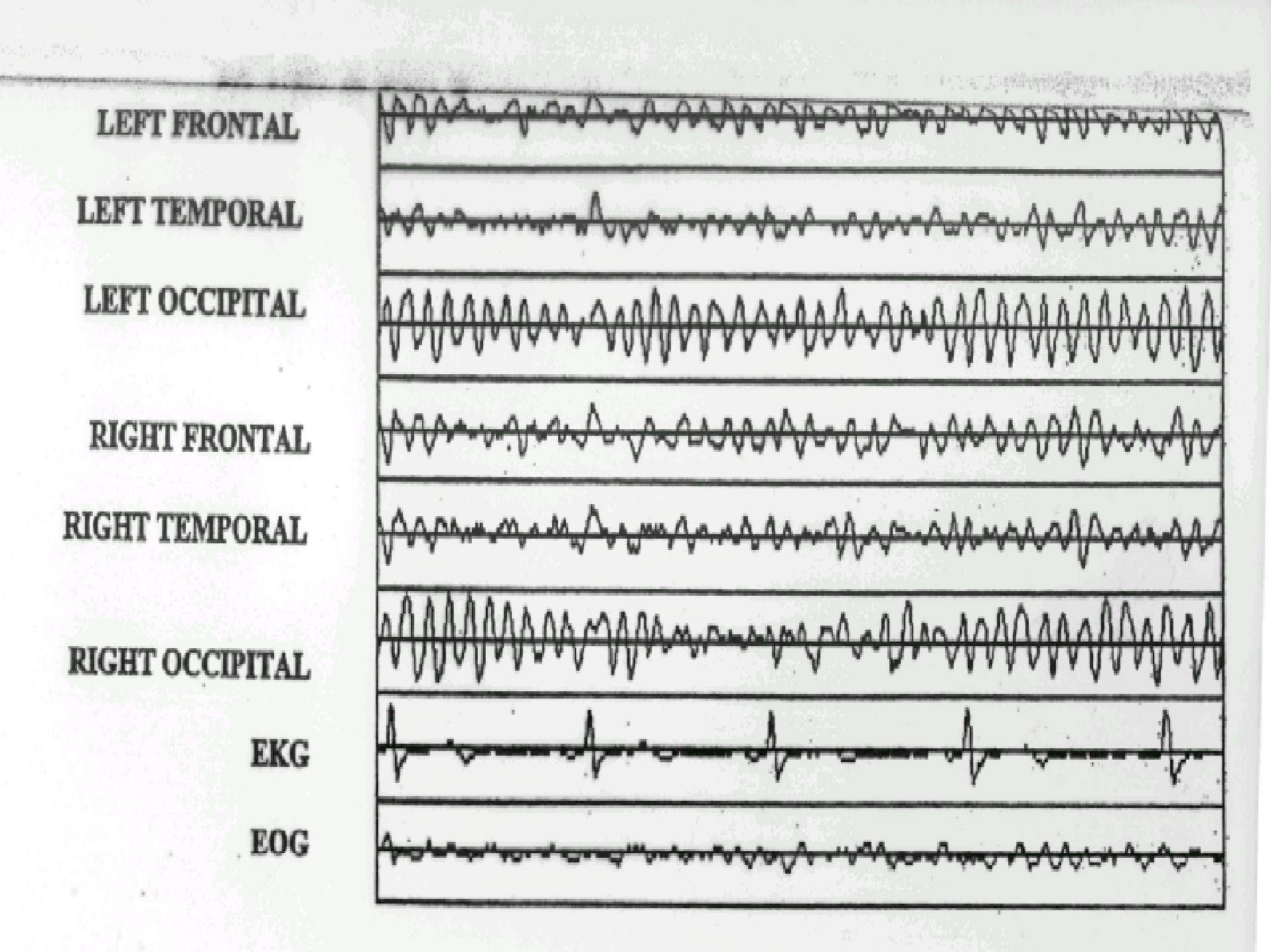

Temporal-Spatial Neuronal Integration



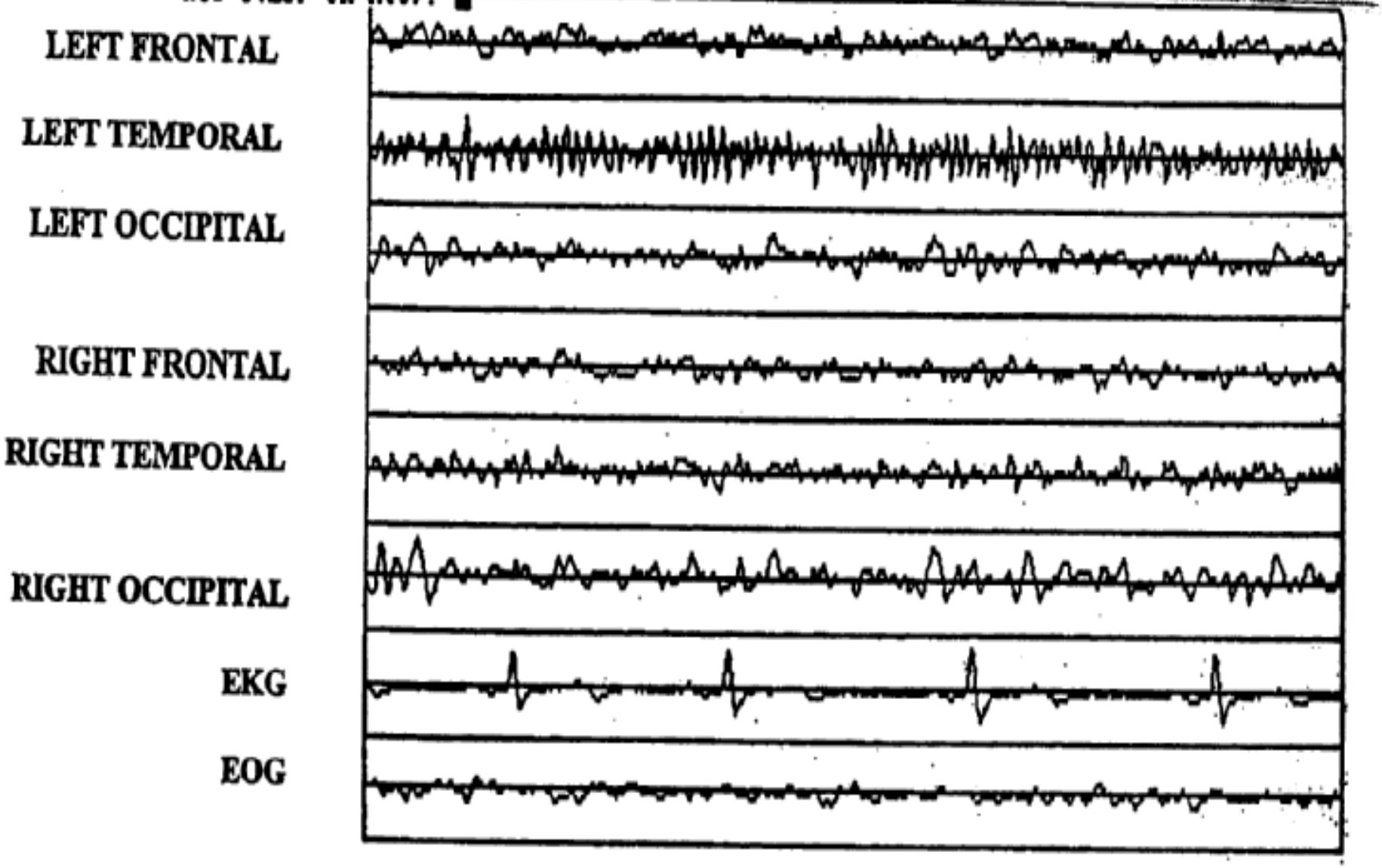

IPSP: Longer than EPSP
Outlasts Synaptic Trans-
Mission.

SPONTANEOUS INTER-ICTAL SPIKE DISCHARGE FROM AMYGDALA
(STIMULATION HAD NOT BEEN GIVEN FOR 24 HOURS)



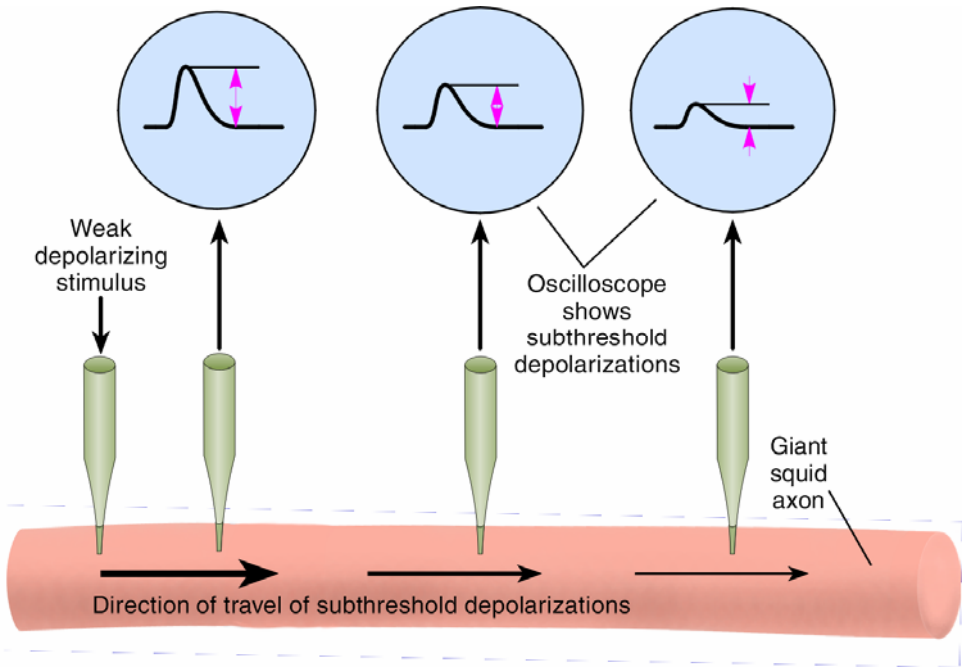

LEFT FRONTAL
LEFT TEMPORAL
LEFT OCCIPITAL
RIGHT FRONTAL
RIGHT TEMPORAL
RIGHT OCCIPITAL
EKG
EOG

HIT Y(ES) OR N(O)?

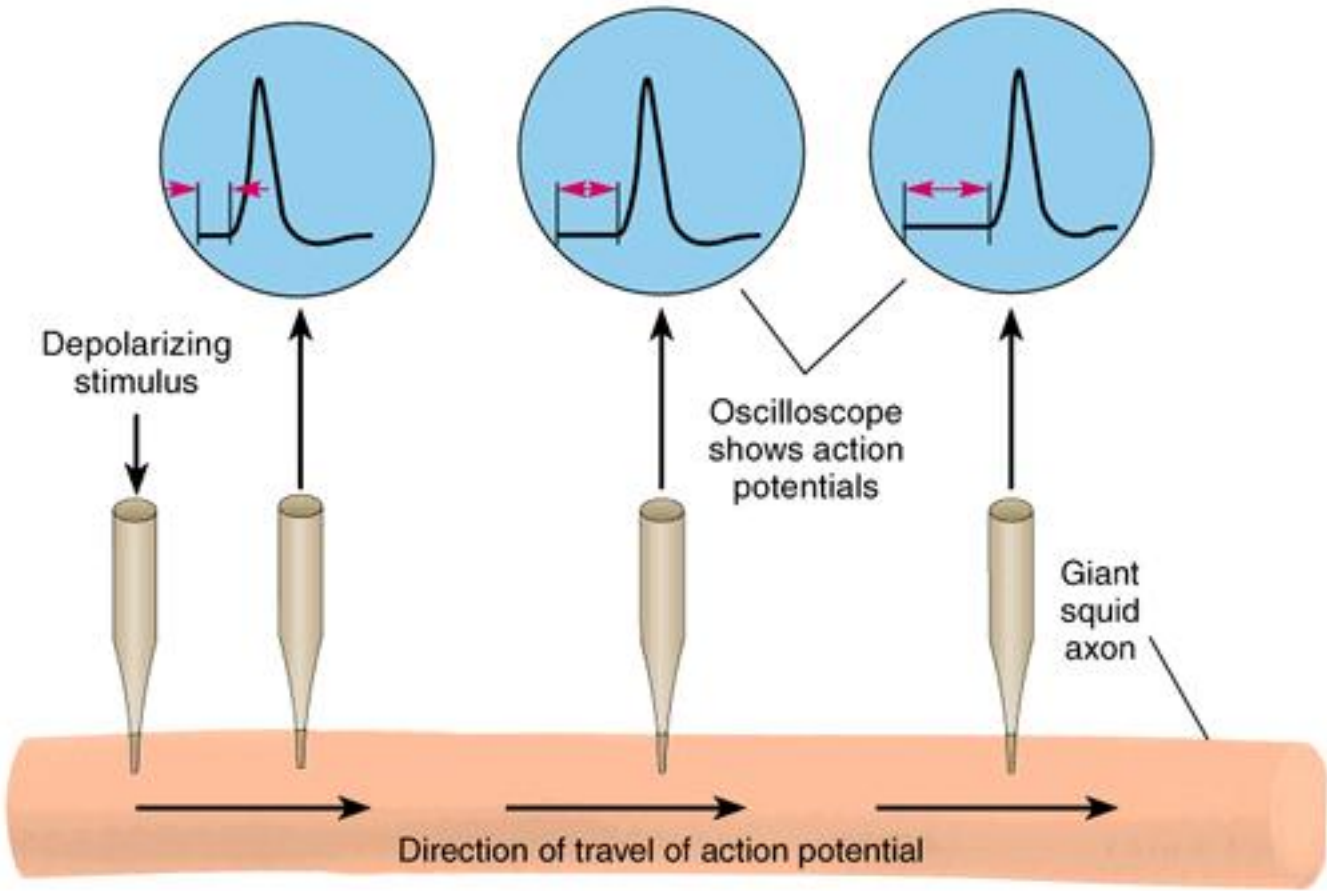

LEFT FRONTAL
LEFT TEMPORAL
LEFT OCCIPITAL
RIGHT FRONTAL
RIGHT TEMPORAL
RIGHT OCCIPITAL
EKG
EOG

# Local Potentials

- Local disturbances of membrane potential are carried along the membrane:
  - Local potentials degrade with time and distance
  - Local potentials can summate to produce an AP



## ► Conduction of the Action Potential

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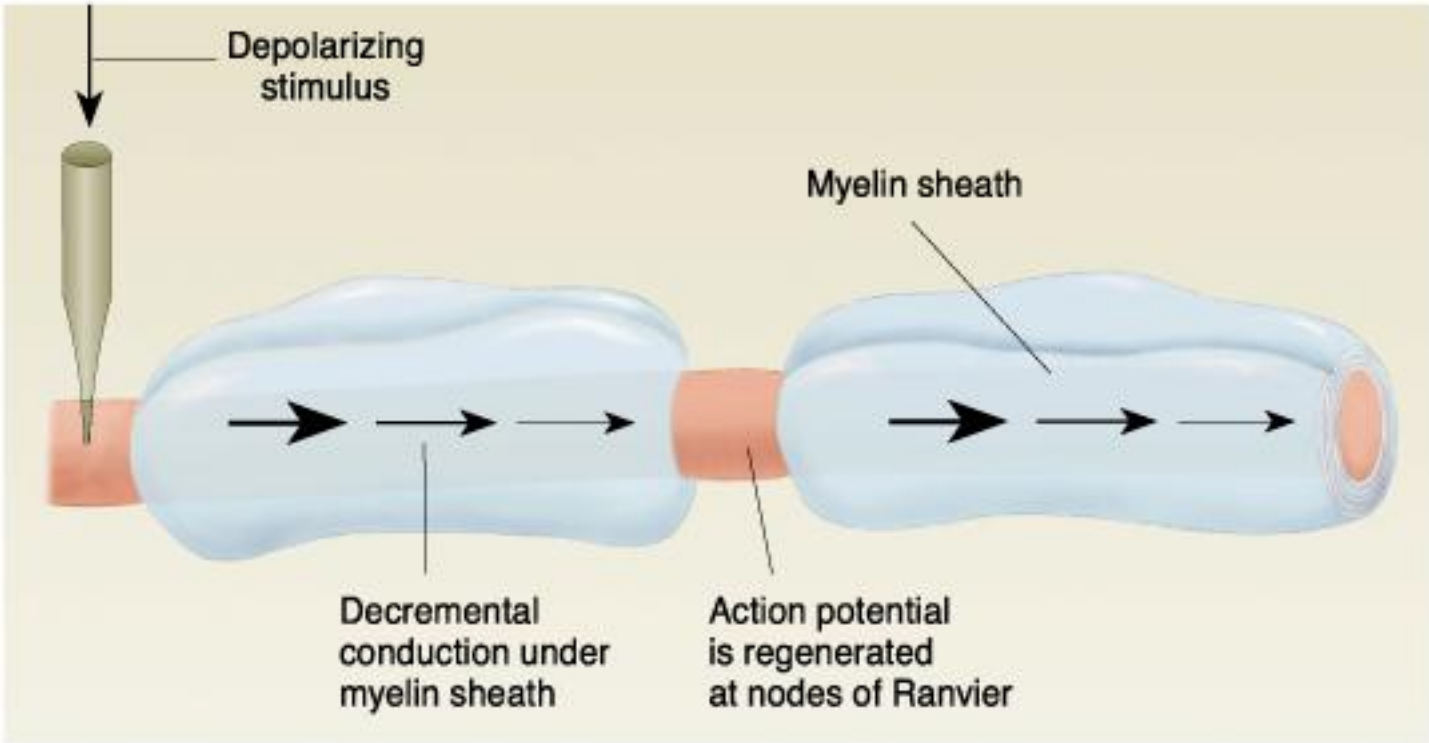
## ▶ Saltatory Conduction

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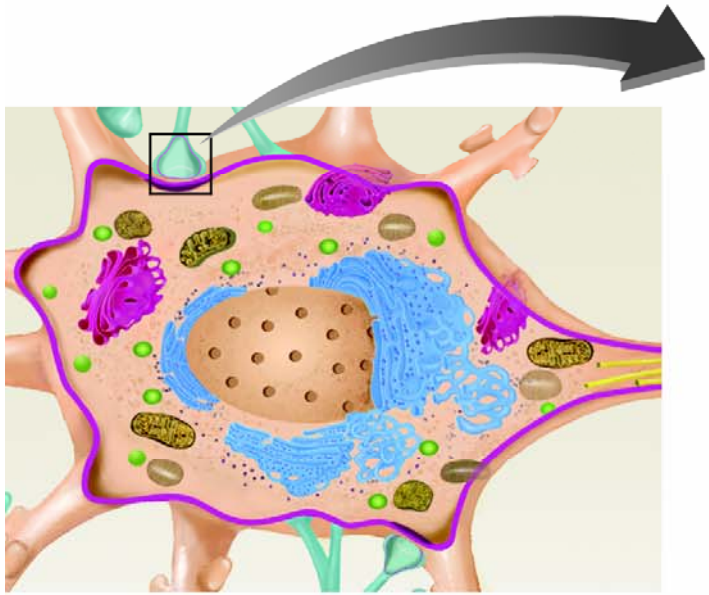
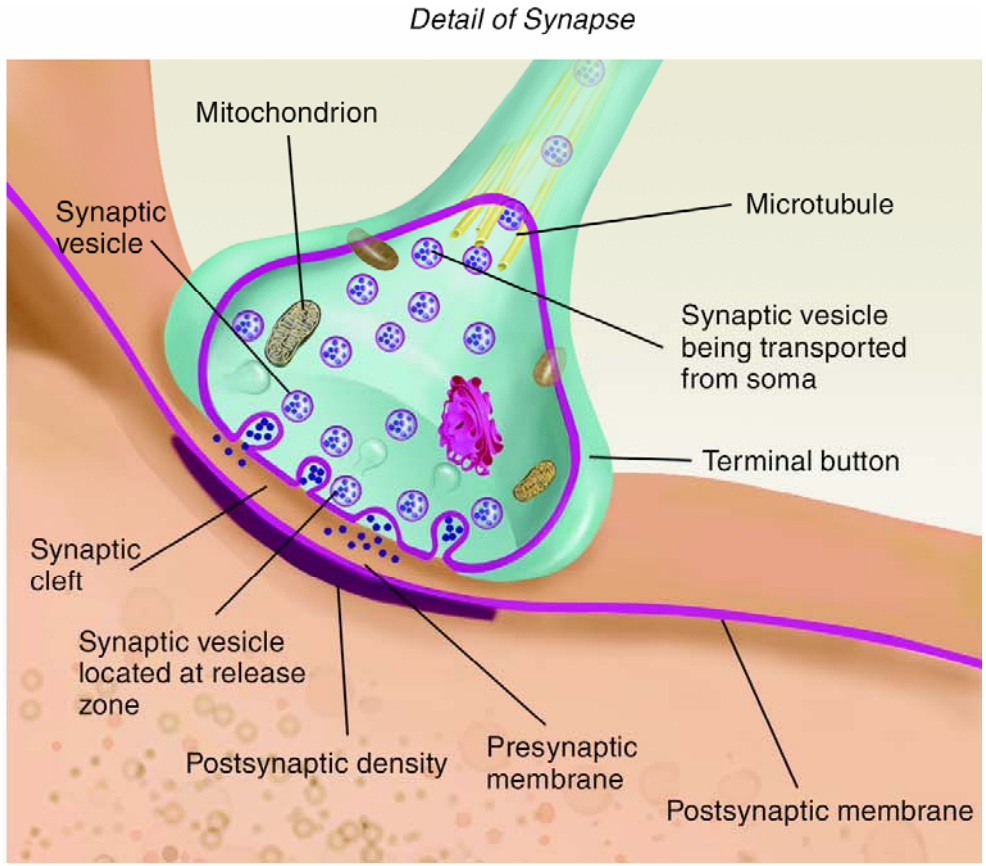
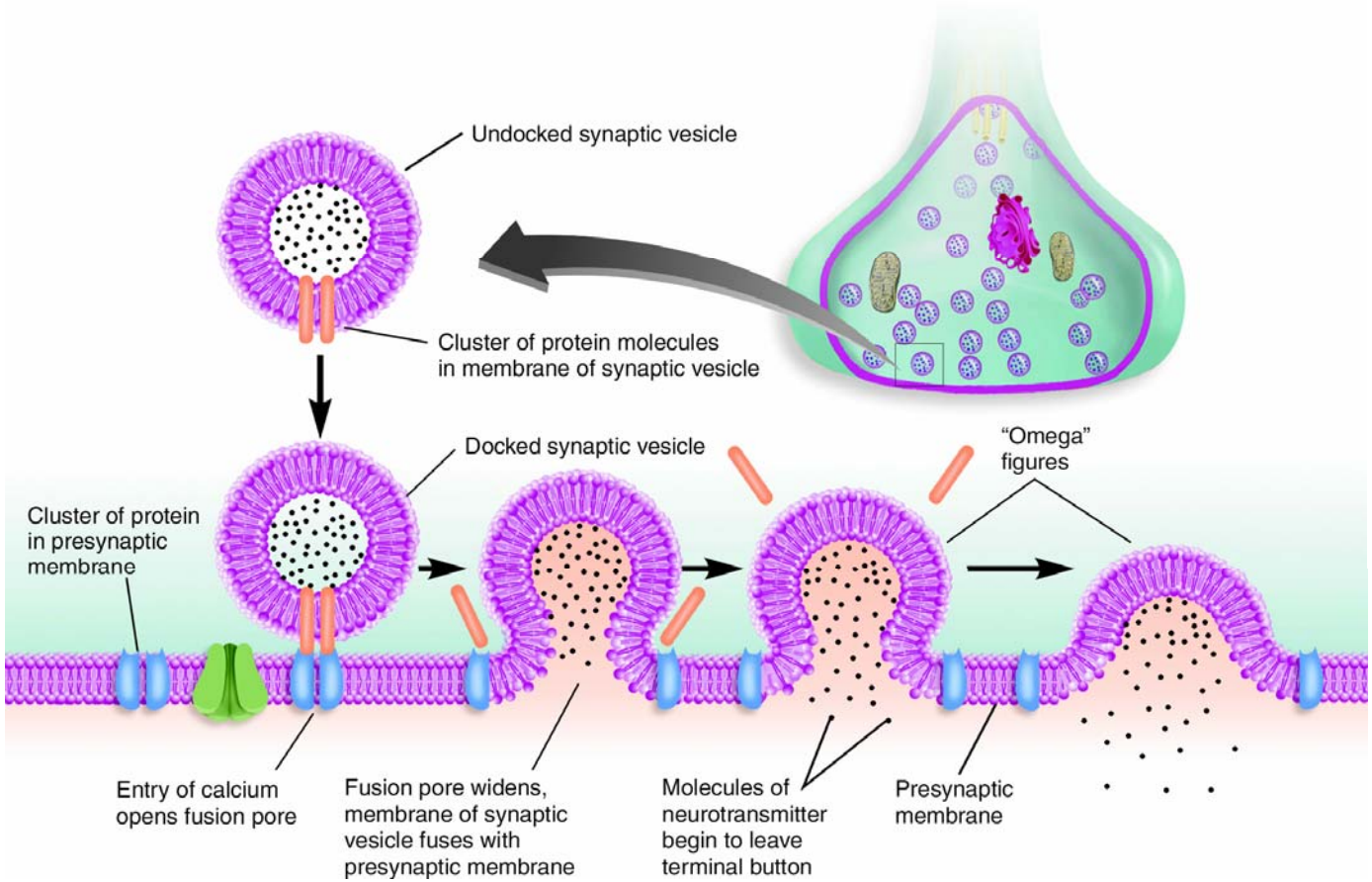
# Overview of the Synapse



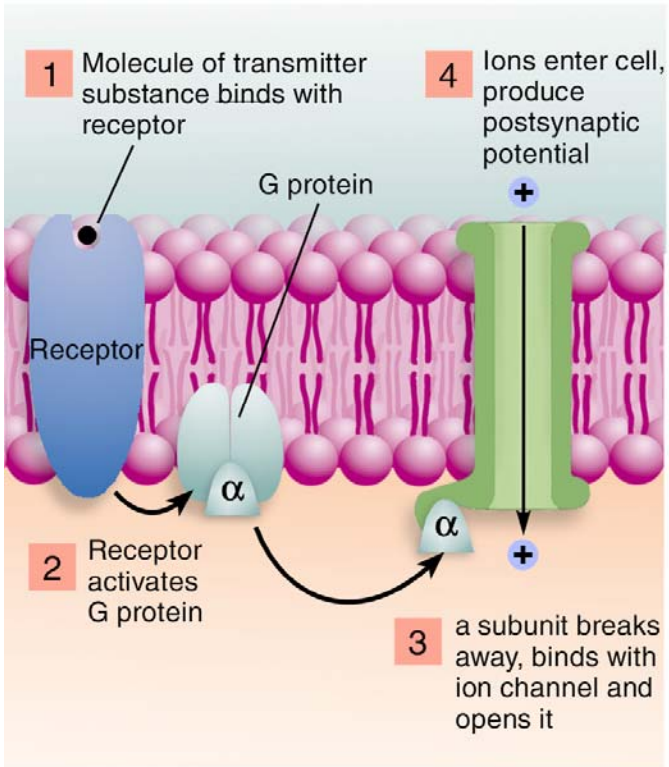
Neuron



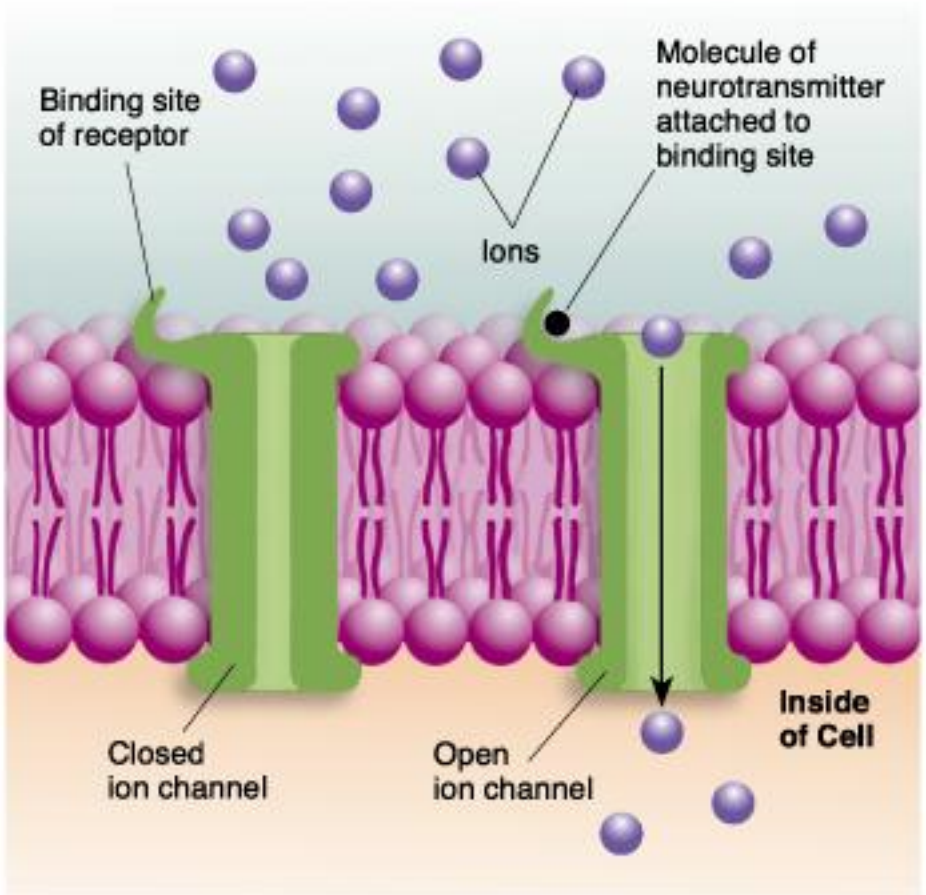
# Overview: Transmitter Release



# Metabotropic Receptors



## ▶ Ionotropic Receptors

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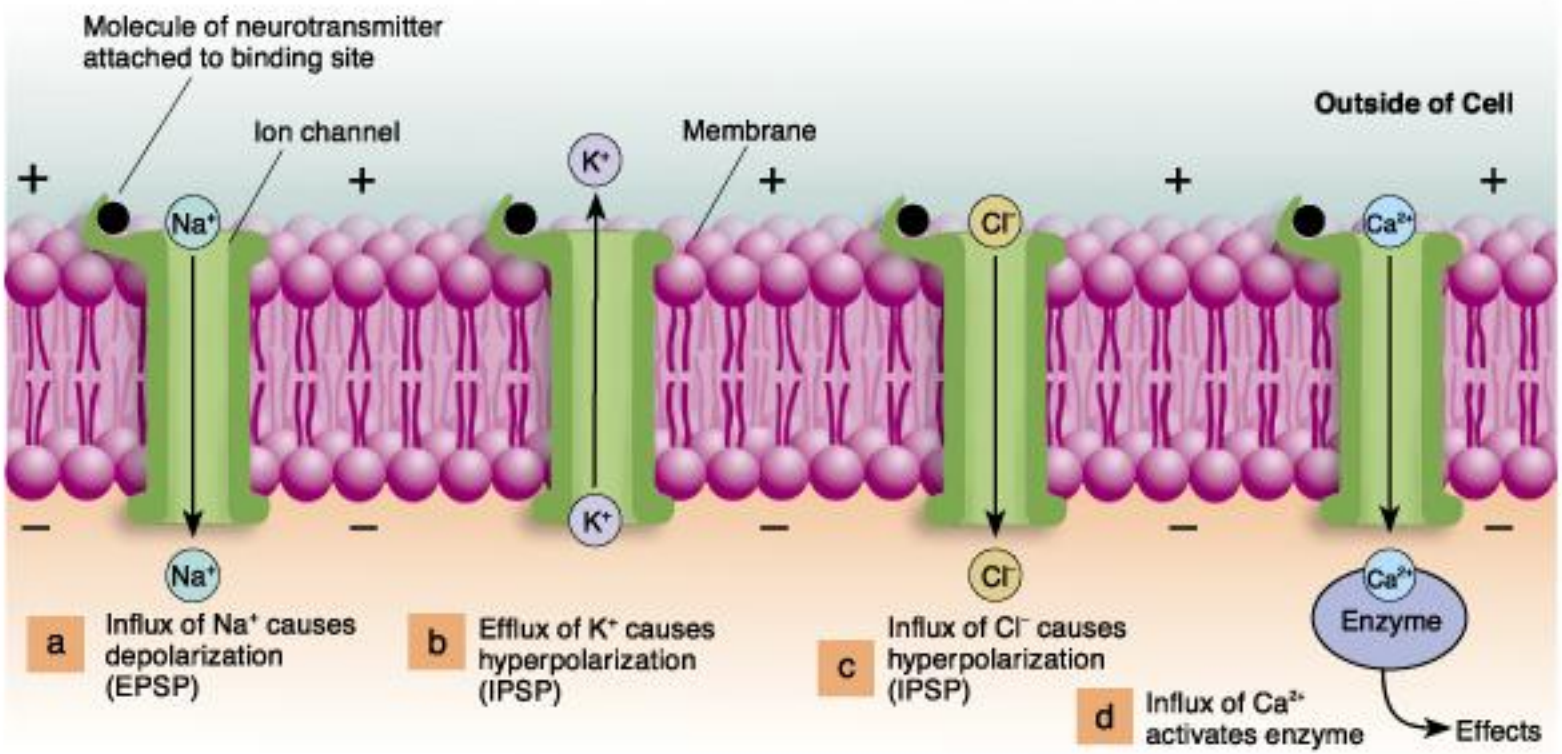
## ► Ionic Movements during Postsynaptic Potentials

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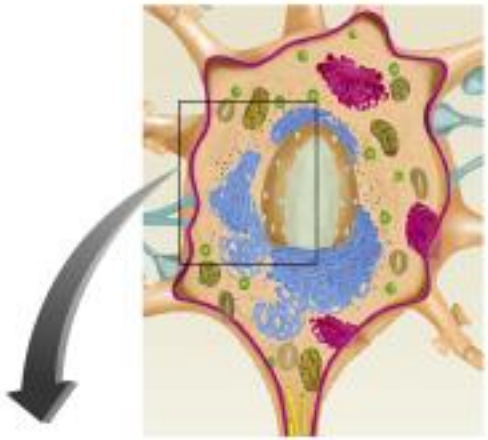
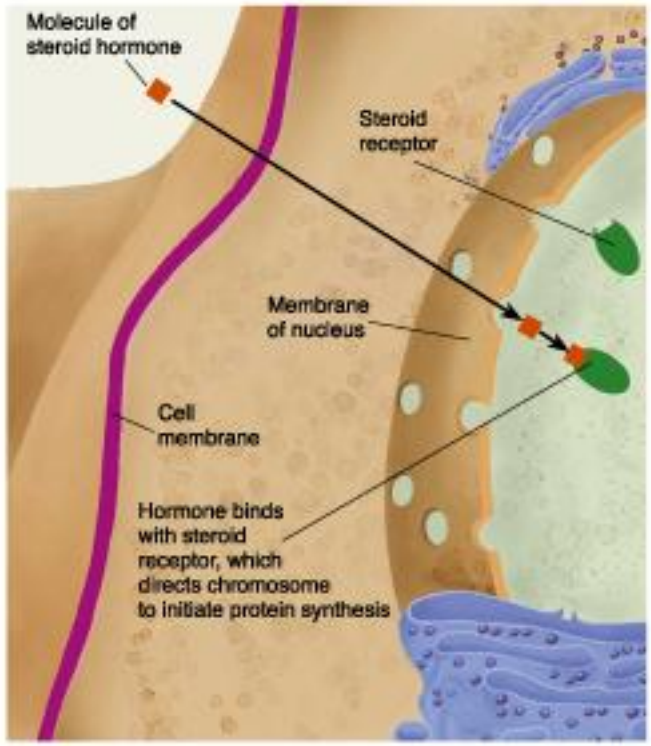
## ▶ Action of Steroid Hormones



*Detail of Cell*

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