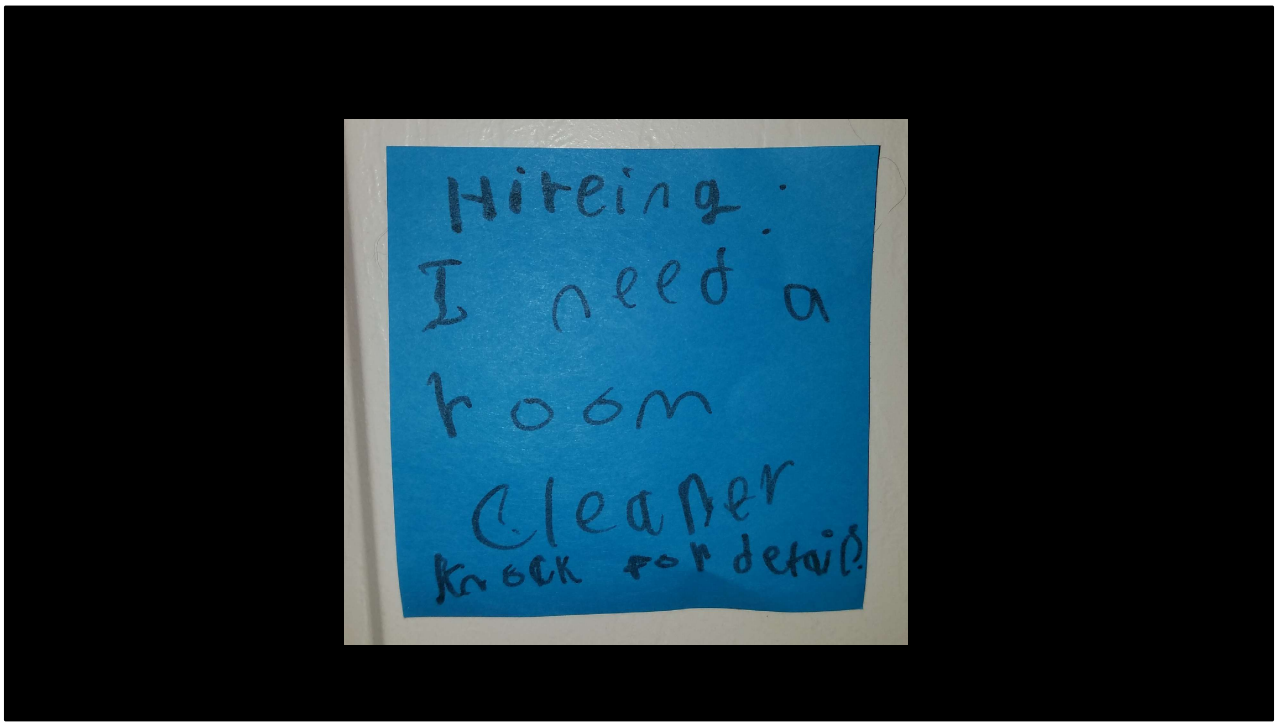
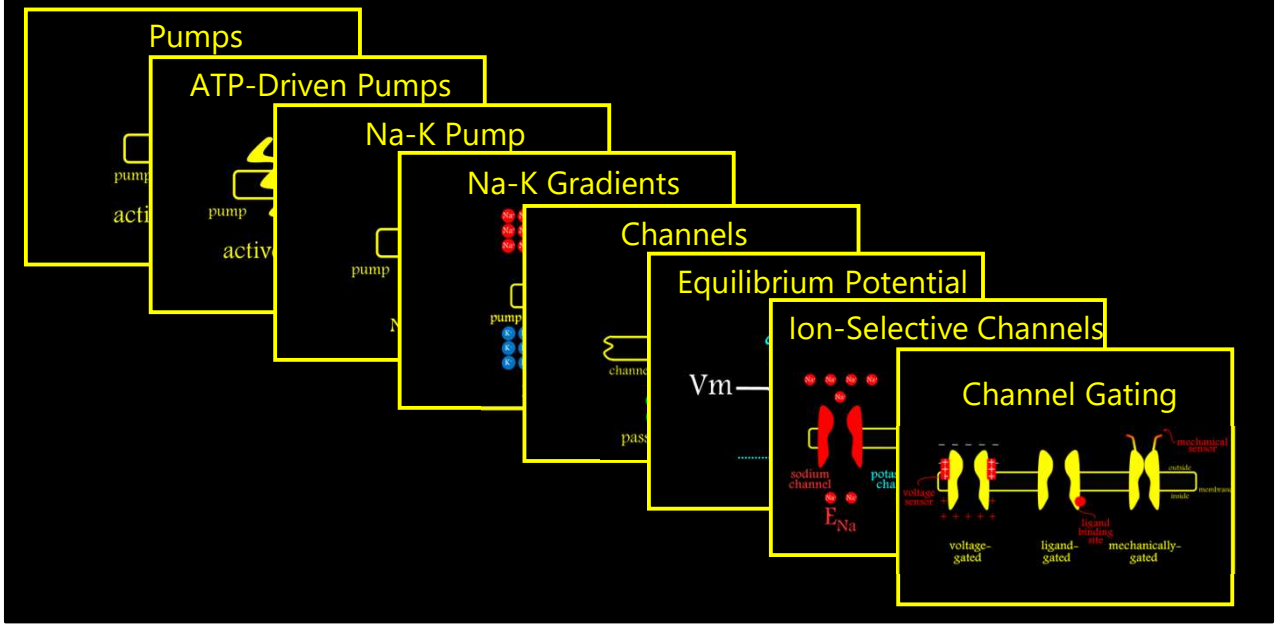

Hiring:
I need a
room
Cleaner
Knock for details

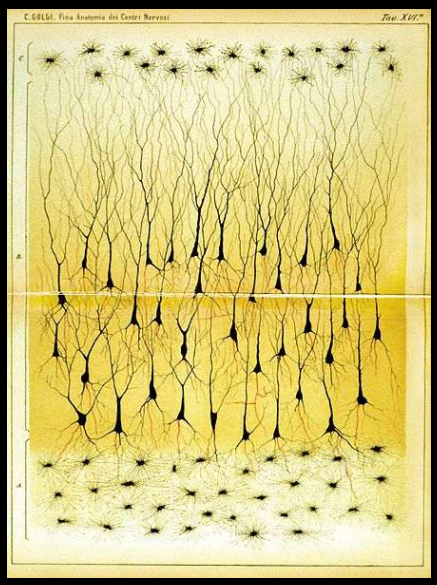
Ion Channels & Cellular Electrophysiology



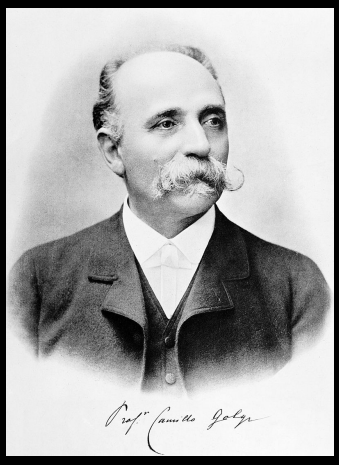
Synaptic Transmission
&
Neurotransmitter Receptors


0-2
1
SUNTRUST
braves.com
TROUBLE
CURVE

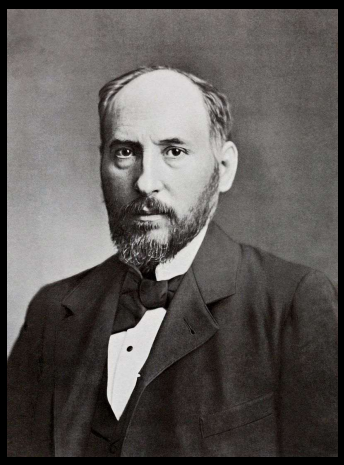
Two Ways Neurons Can Communicate



Two Ways Neurons Can Communicate



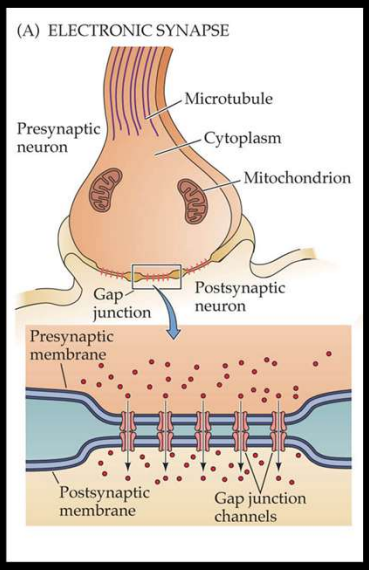
Camillo Golgi



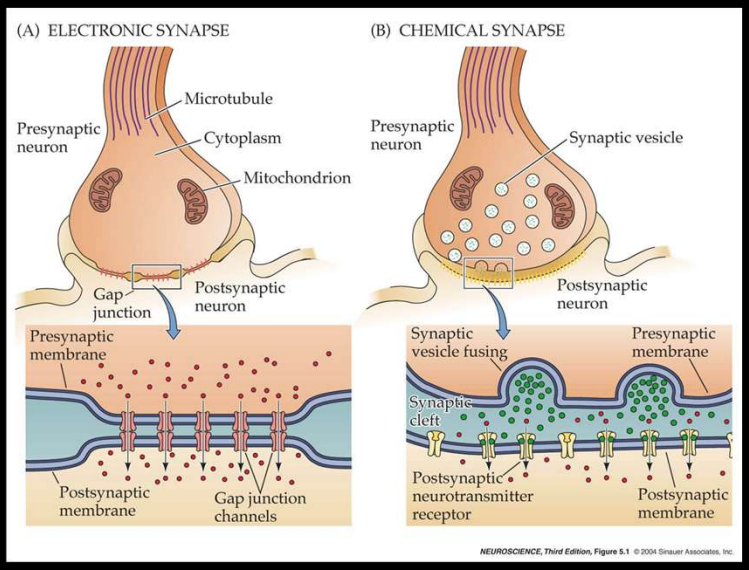
Santiago Ramon y Cajal

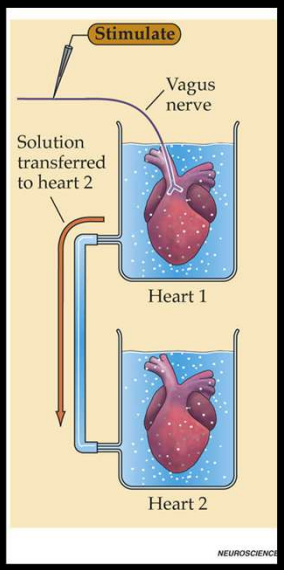
Nobel: 1906

Two Ways Neurons Can Communicate

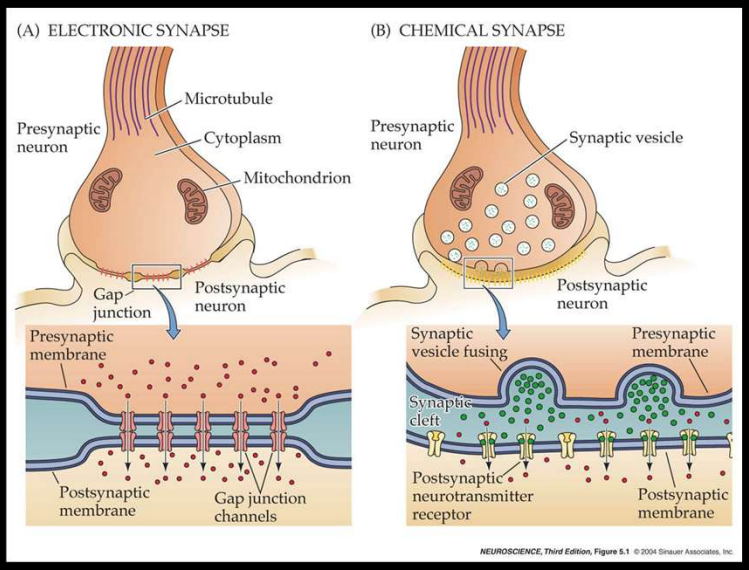


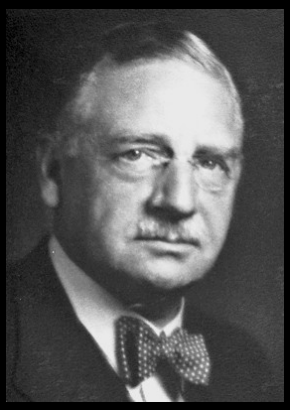
Two Ways Neurons Can Communicate





Two Ways Neurons Can Communicate

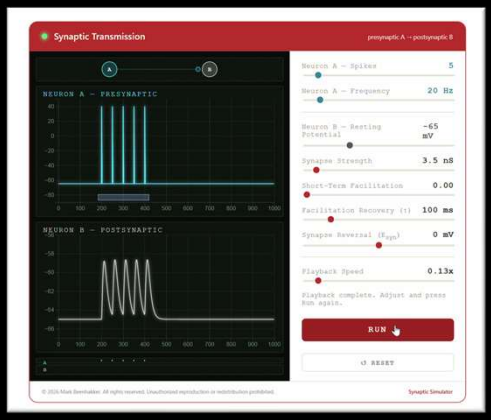


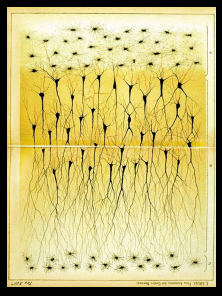


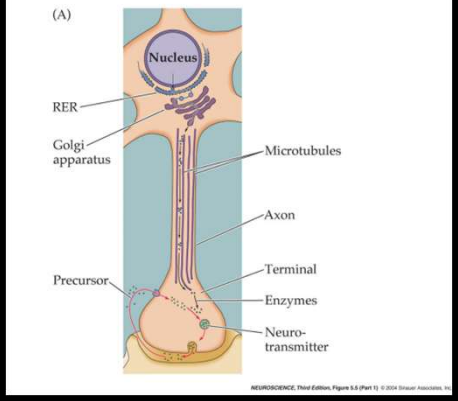
Otto Loewi

Nobel 1936

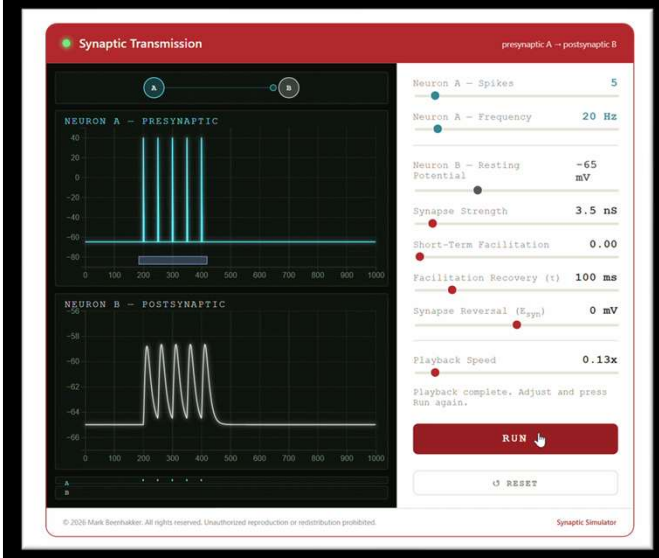
Special Structures For Neurotransmission

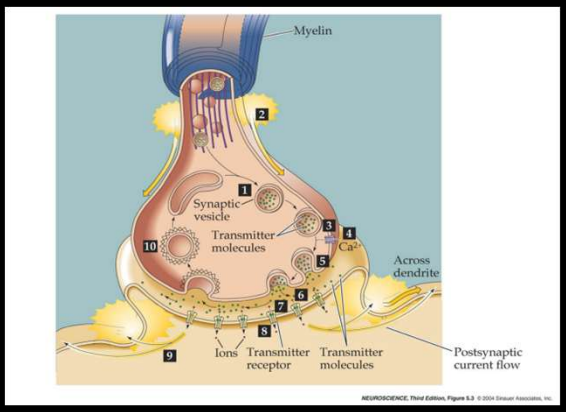




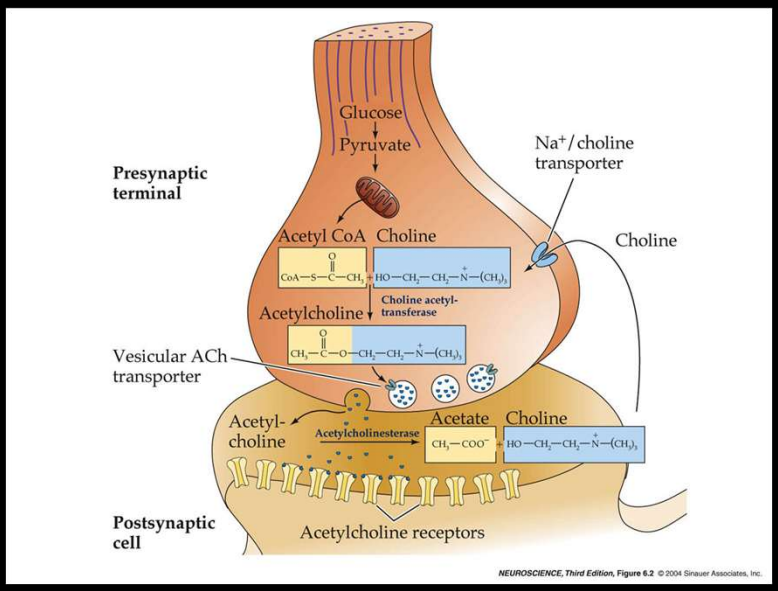


Steps of Neurotransmission

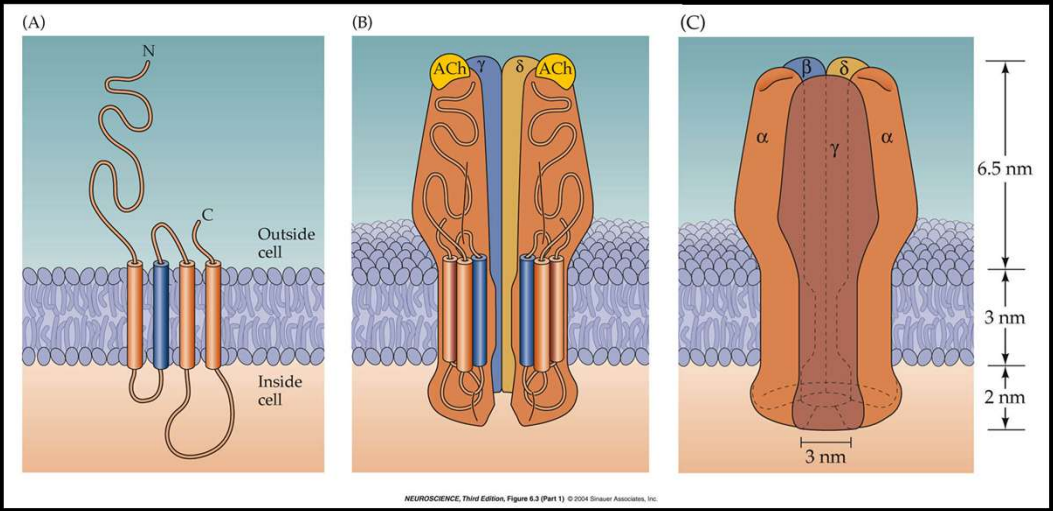




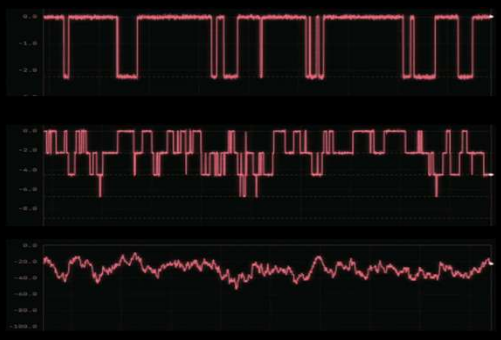
Cholinergic Synapse

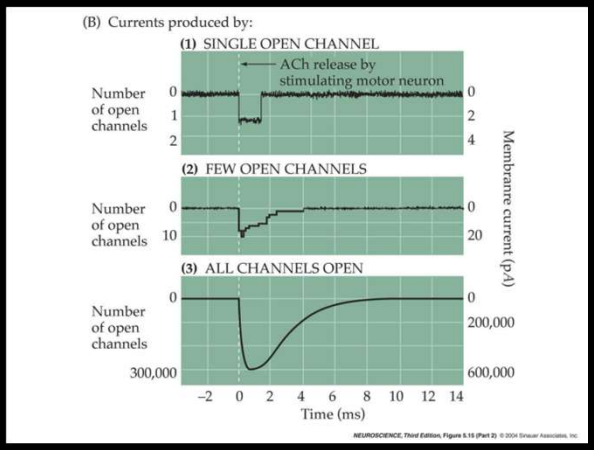


Acetylcholine Receptor

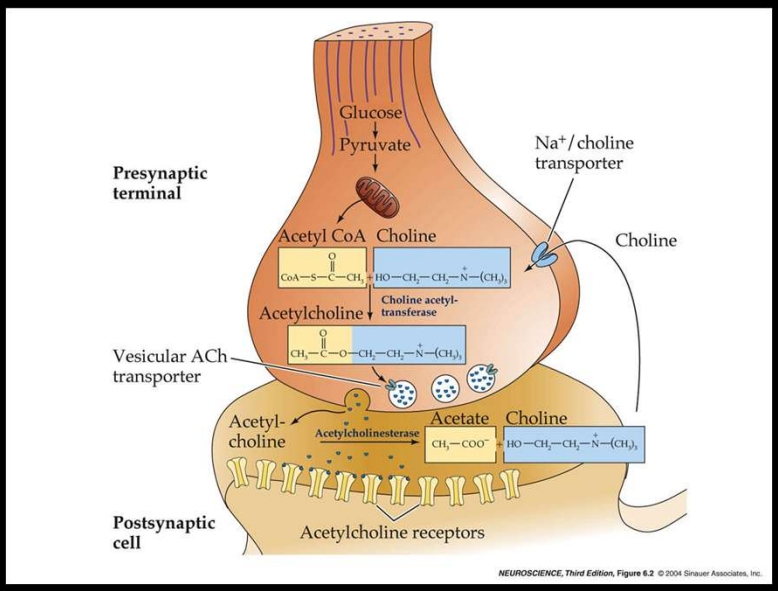


Cholinergic Currents



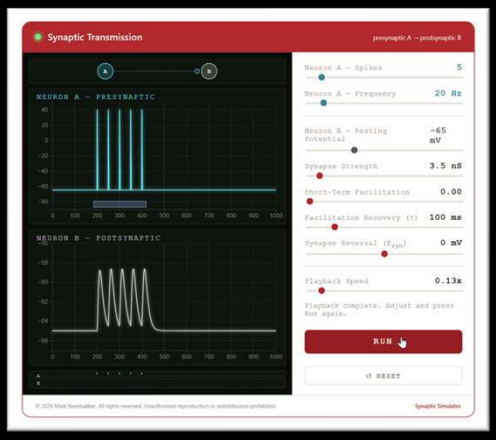


Cholinergic Currents



Recording Synapses

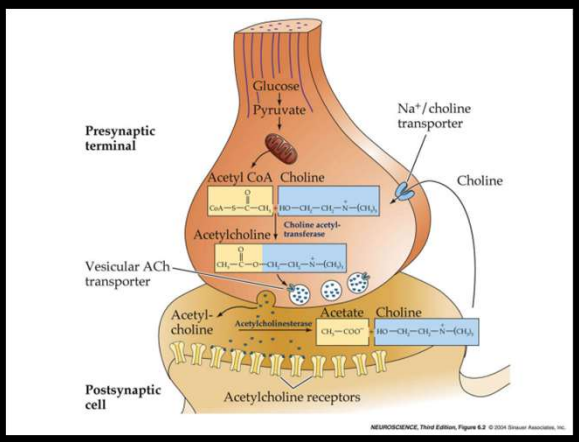
Presynaptic & Postsynaptic

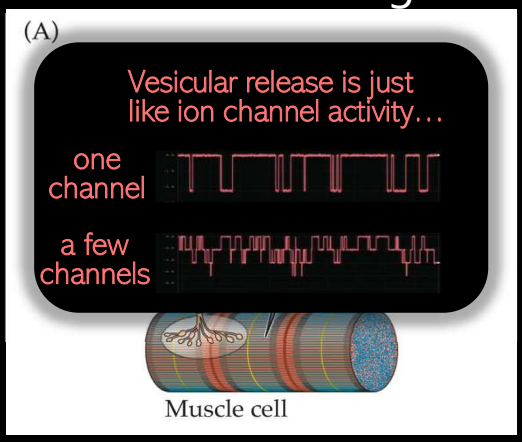


Recording Synapses

Presynaptic & Postsynaptic

Measure Voltage

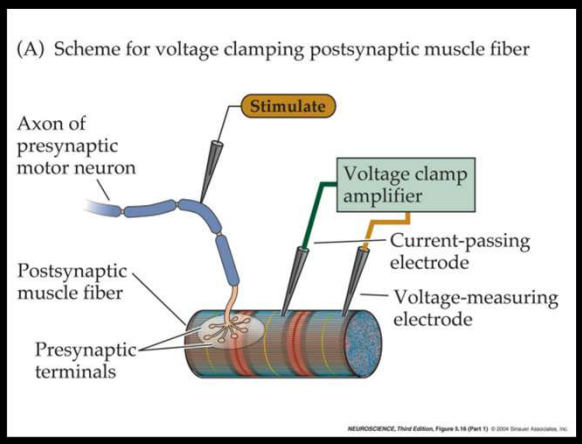




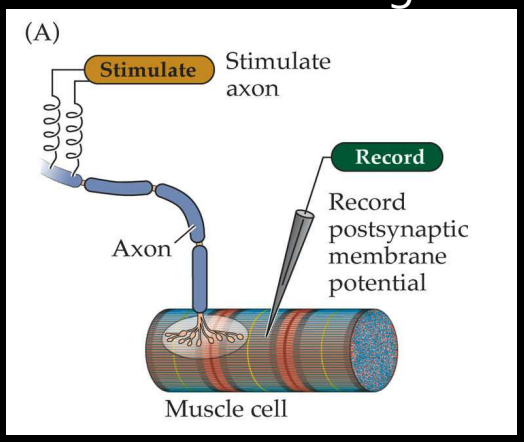
Recording Synapses

Presynaptic & Postsynaptic

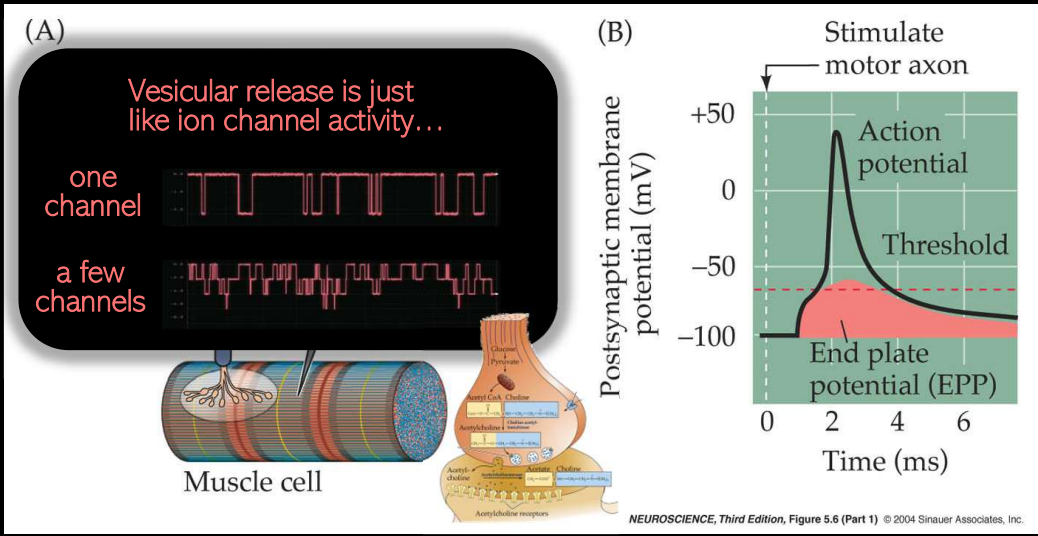
Measure Current



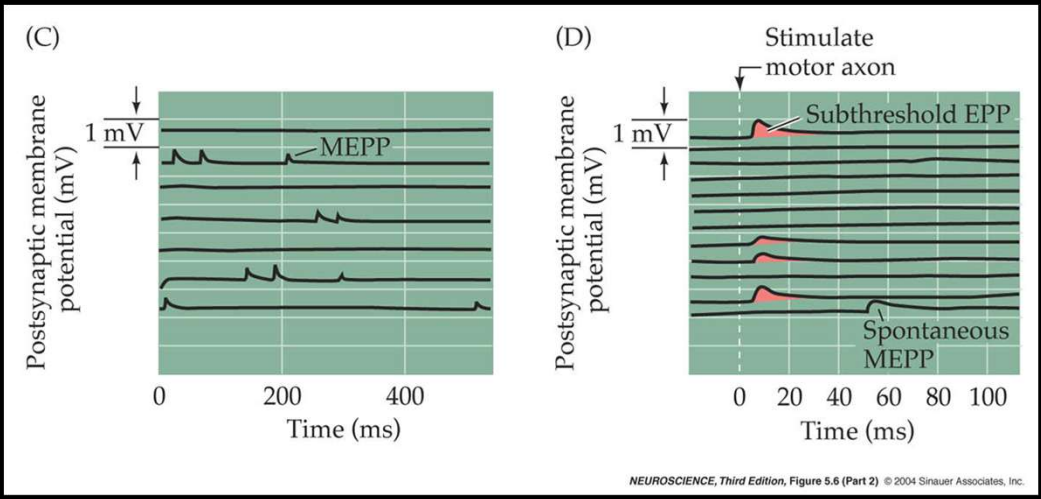
Measure Voltage



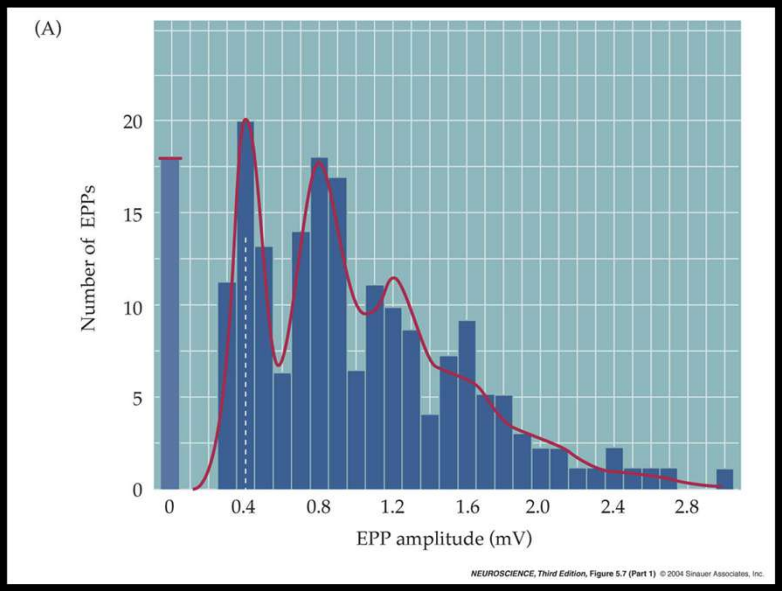
Neuromuscular Junction: Model for Synaptic Function



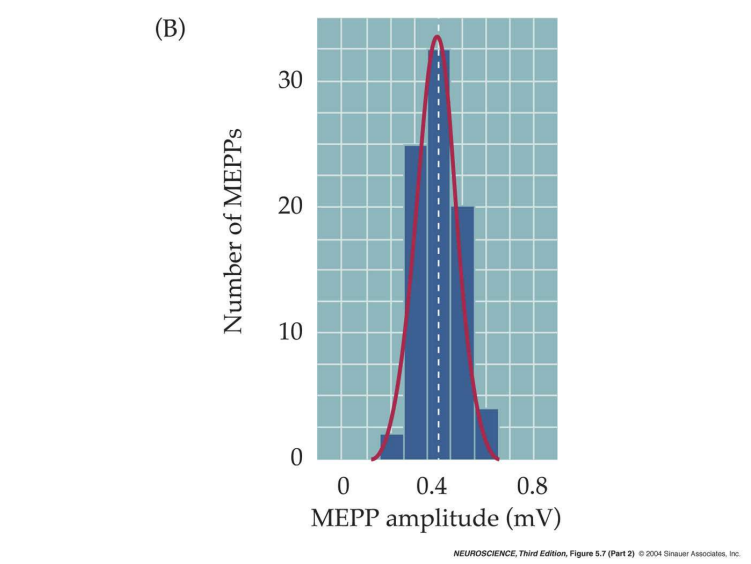
Muscle Recordings



Distribution of EPP Amplitudes

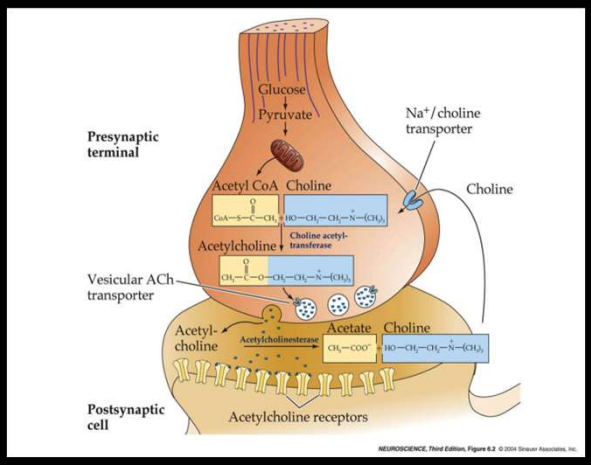


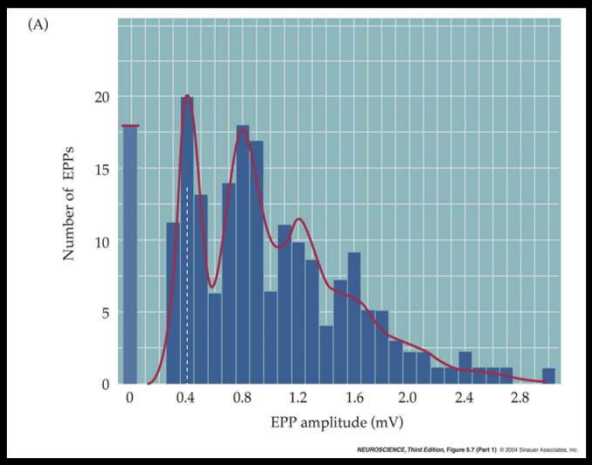
Quantal Transmission



NEUROSCIENCE, Third Edition, Figure 5.7 (Part 2) © 2004 Sinauer Associates, Inc.

Quanta Represent Single Vesicles



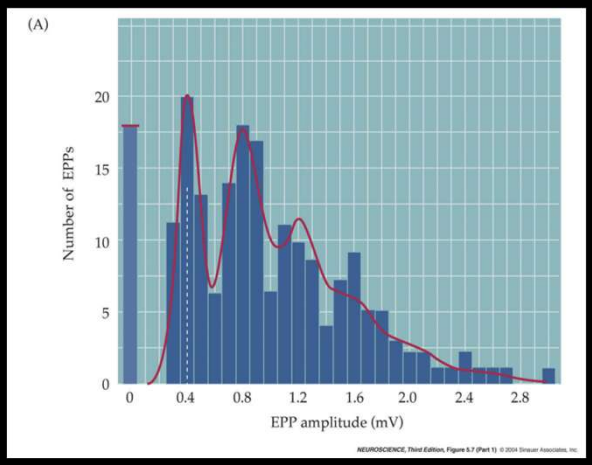


Quanta Represent Single Vesicles

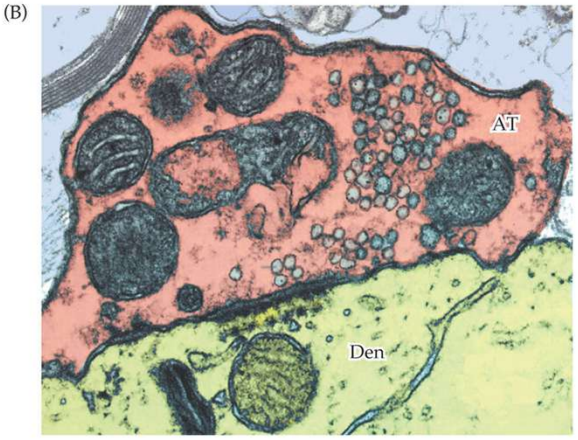
Vesicular release is just
like ion channel activity…

one
channel

a few
channels



Vesicles at a Real Synapse



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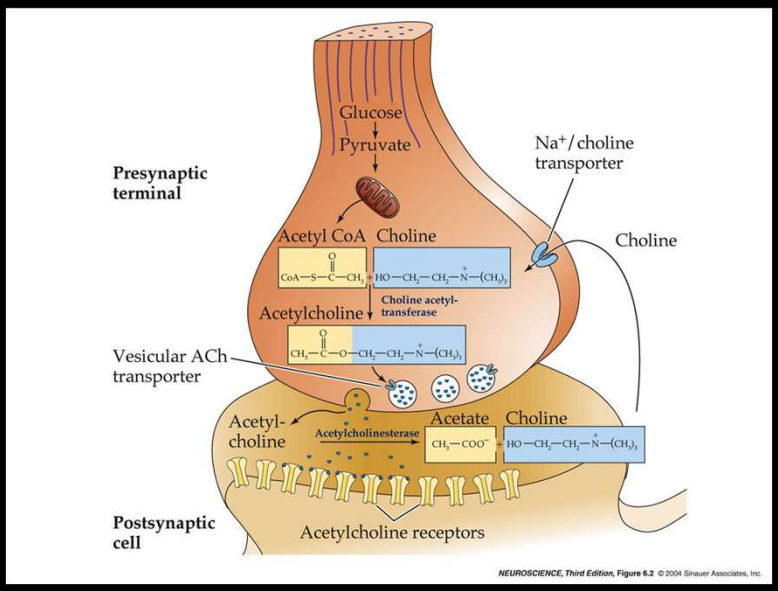
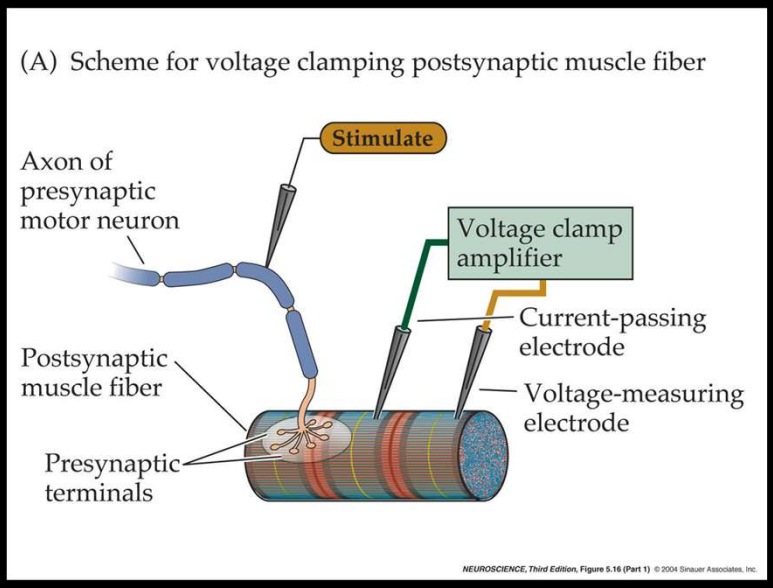
Cholinergic Synapse

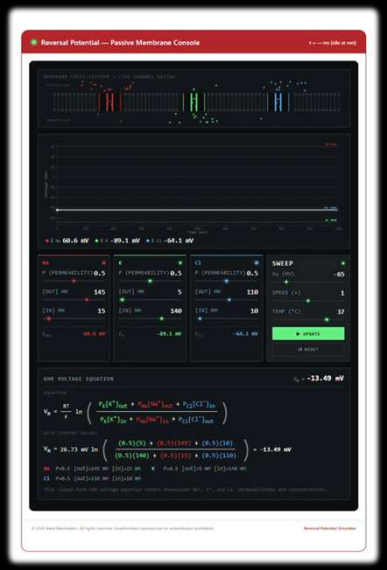


Recording Synaptic Currents

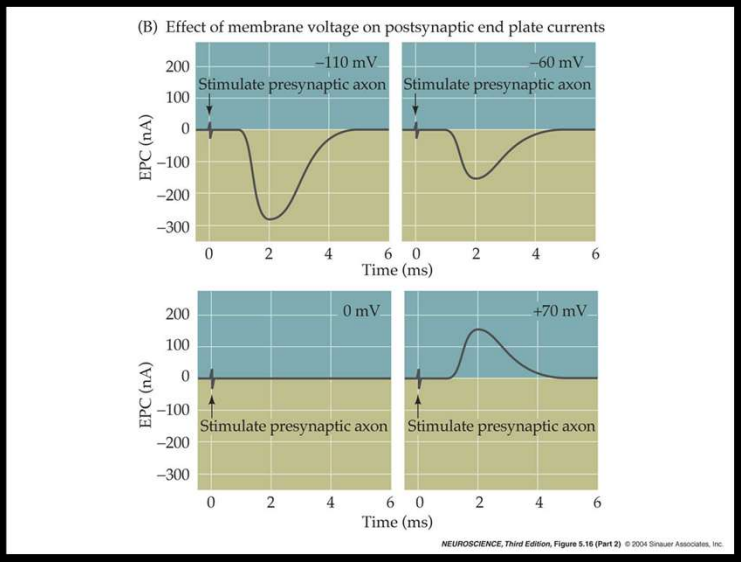


Excitatory & Inhibitory Currents

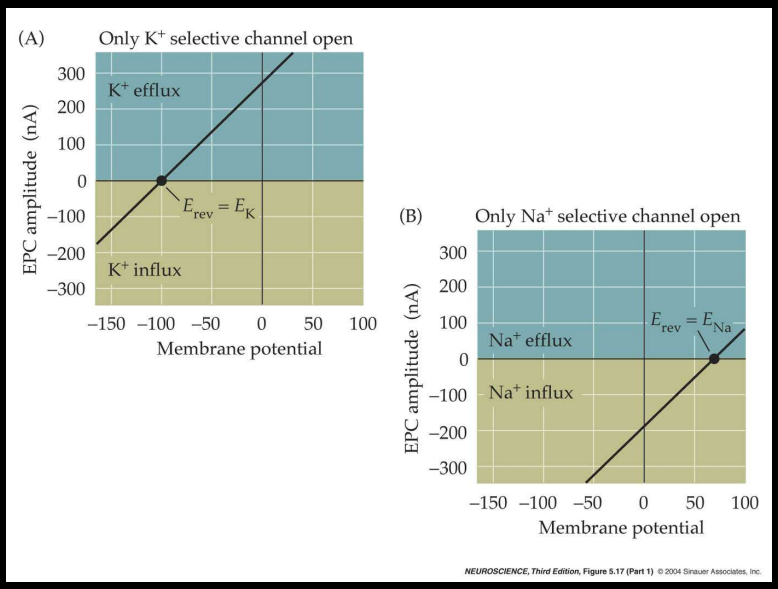
Always comes back to reversal potentials…



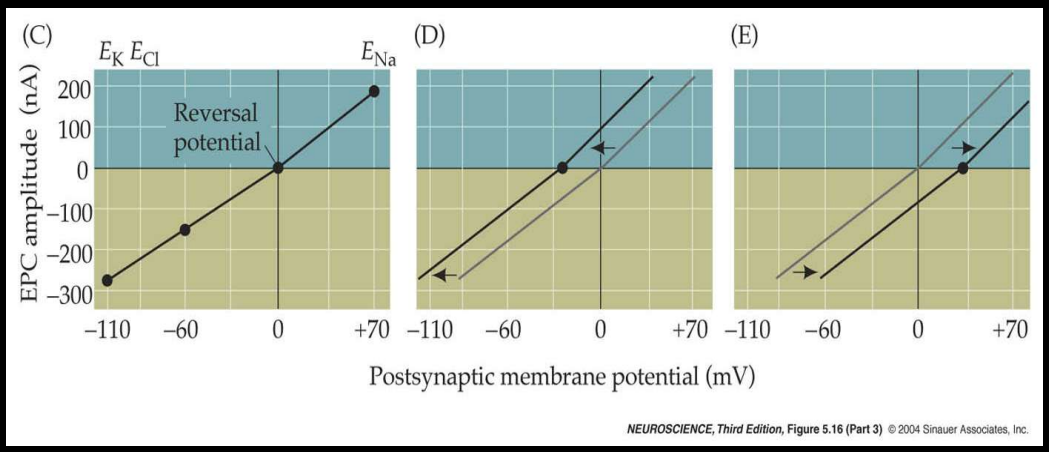
Membrane Potential Determines Current Flow



Equilibrium Potentials



Test Your Hypothesis



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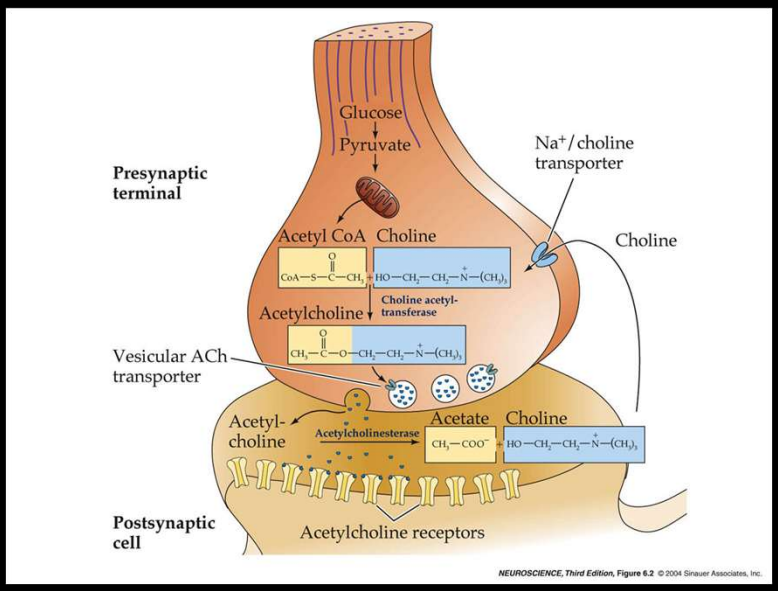
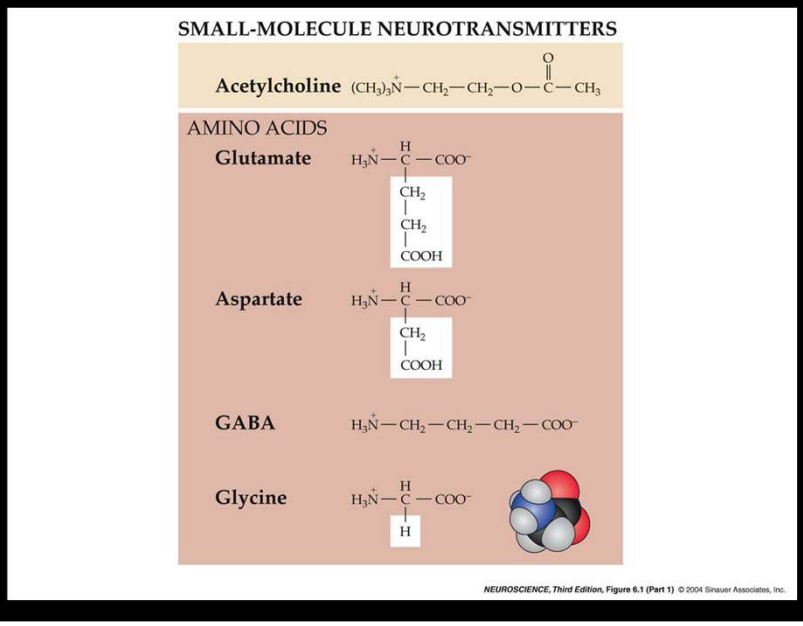
Cholinergic Synapse



Neurotransmitters



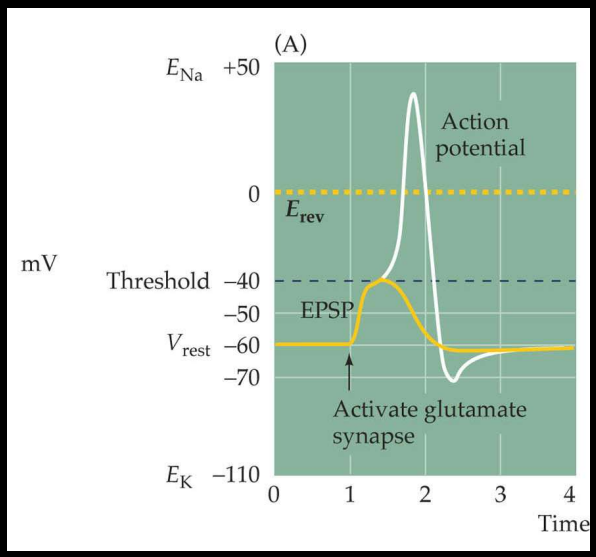
Neurotransmitters

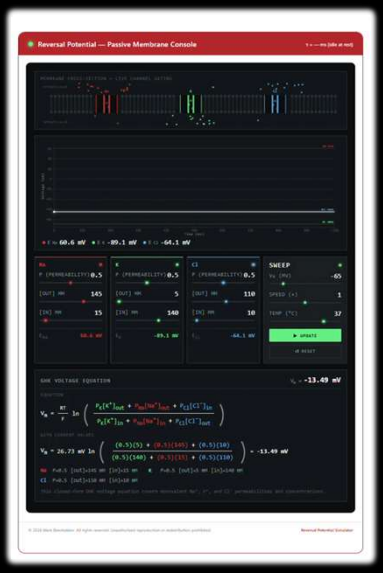
(C)

Receptor	AMPA	NMDA	Kainate	GABA	Glycine	nACh	Serotonin	Purines
Subunits	Glu R1	NR1	Glu R5	α_{1-7}	α1	α_{2-9}	5-HT_3	P_{2X1}
	Glu R2	NR2A	Glu R6	β_{1-4}	α2	β_{1-4}		P_{2X2}
	Glu R3	NR2B	Glu R7	γ_{1-4}	α3	γ		P_{2X3}
	Glu R4	NR2C	KA1	δ	α4	δ		P_{2X4}
		NR2D	KA2	ε	β			P_{2X5}
				ρ_{1-3}				P_{2X6}
								P_{2X7}

NEUROSCIENCE, Third Edition, Figure 6.4 (Part 2)

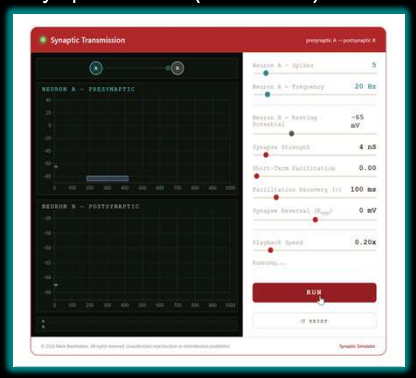
Excitatory & Inhibitory Currents





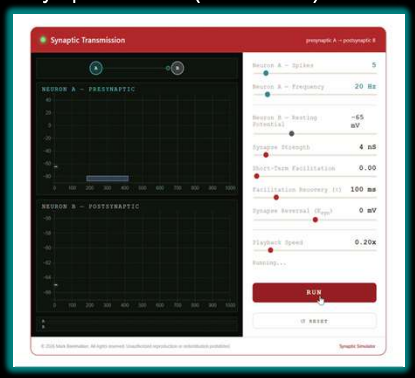
Excitatory & Inhibitory Currents

A. Synaptic Excitation (sub-threshold)



Excitatory & Inhibitory Currents

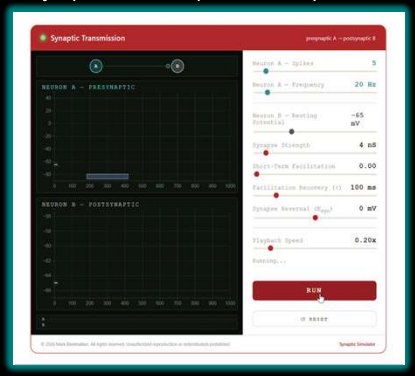
A. Synaptic Excitation (sub-threshold)



B. Synaptic Excitation (supra-threshold)

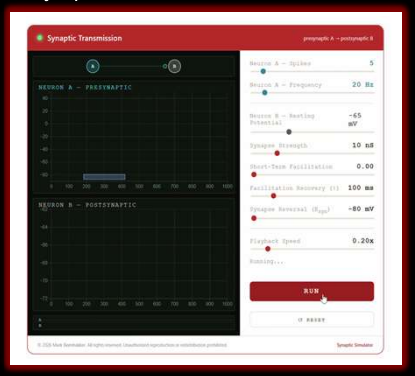
Excitatory & Inhibitory Currents

A. Synaptic Excitation (sub-threshold)

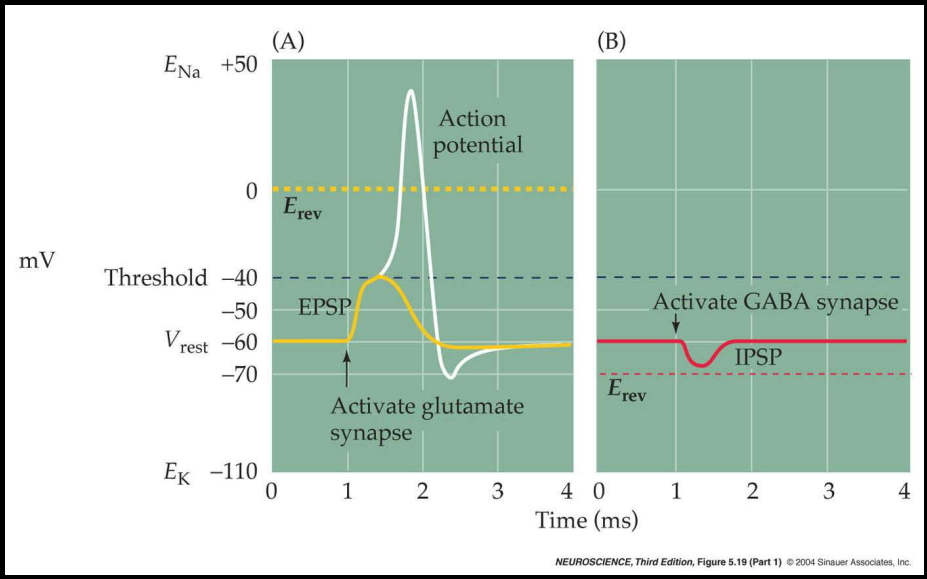


B. Synaptic Excitation (supra-threshold)

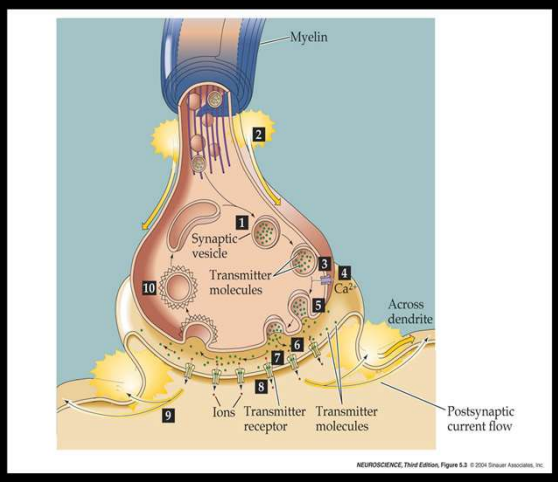
C. Synaptic Inhibition

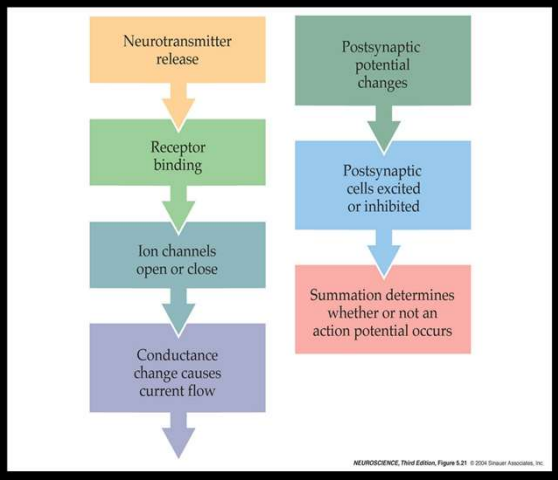


Excitatory & Inhibitory Currents

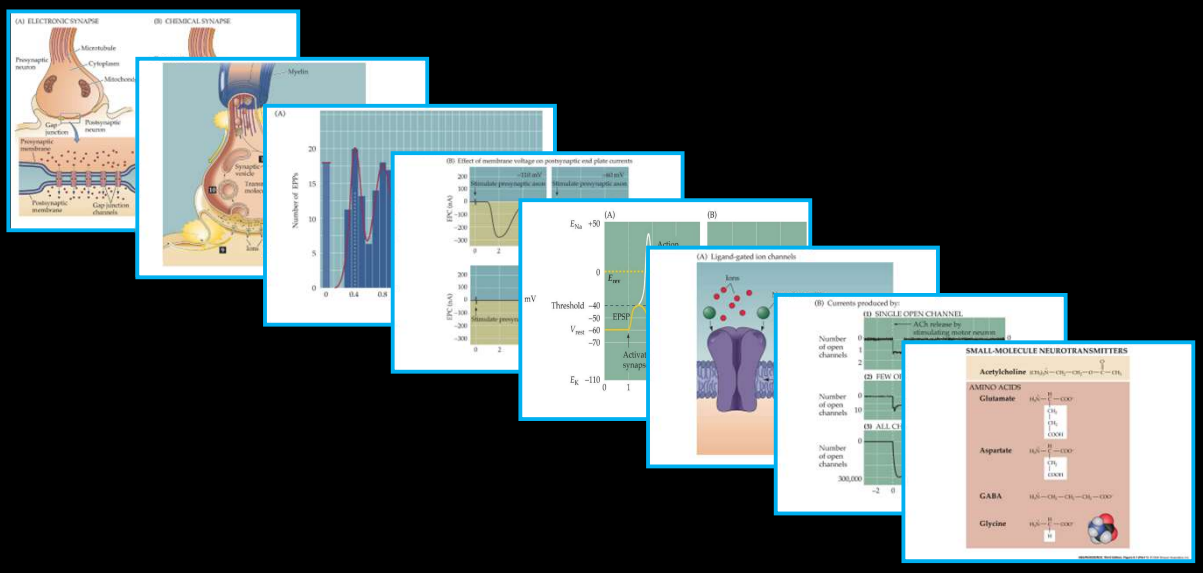


Excitatory & Inhibitory Currents





Summary


(A) ELECTRONIC SYNAPSE
(B) CHEMICAL SYNAPSE
Presynaptic neuron
Microtubule
Cytoplasm
Mitochondrion
Gap junction
Postsynaptic neuron
Presynaptic membrane
Postsynaptic membrane
Gap junction channels
Myelin
Synaptic vesicle
Ions
(A)
Number of EPPs
(B) Effect of membrane voltage on postsynaptic end plate currents
−110 mV
−60 mV
Stimulate presynaptic axon
EPC (nA)
mV
(A)
(B)
E_{Na} +50
0
E_{rev}
Threshold −40
−50
V_{rest} −60
−70
E_K −110
EPSP
Action
Activat
synaps
(A) Ligand-gated ion channels
Ions
(B) Currents produced by:
(1) SINGLE OPEN CHANNEL
ACh release by stimulating motor neuron
Number of open channels
(2) FEW CH
(3) ALL CH
300,000
SMALL-MOLECULE NEUROTRANSMITTERS
Acetylcholine
AMINO ACIDS
Glutamate
Aspartate
GABA
Glycine

Ion Channels & Cellular Electrophysiology