

## 3.1 Synaptic transmission

**Cellular Mechanisms of Brain Function**

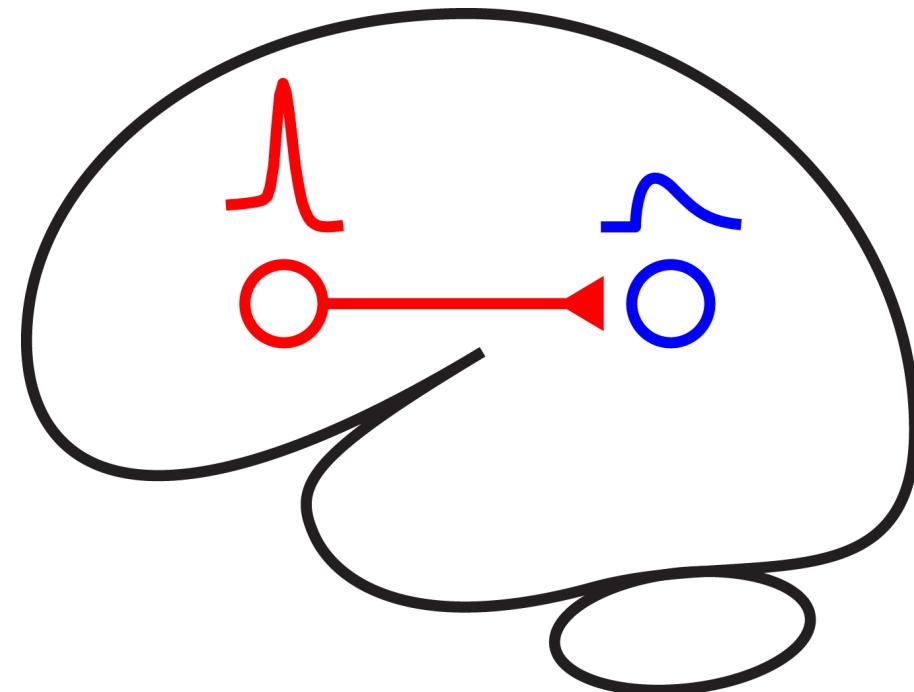
Prof. Carl Petersen

# Neuron-to-neuron communication



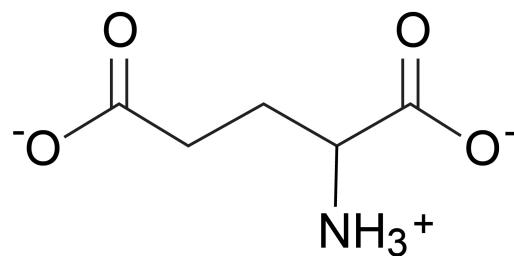
Cellular Mechanisms of Brain Function

# Synaptic transmission

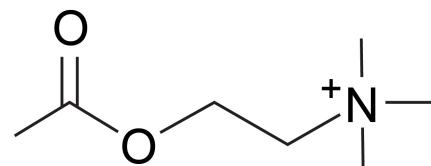


# Diverse neurotransmitters

Glutamate



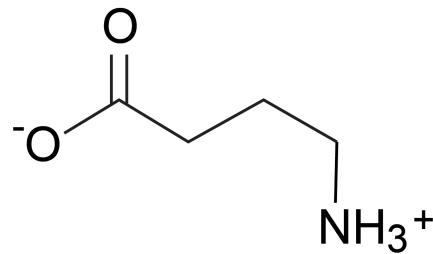
Acetylcholine



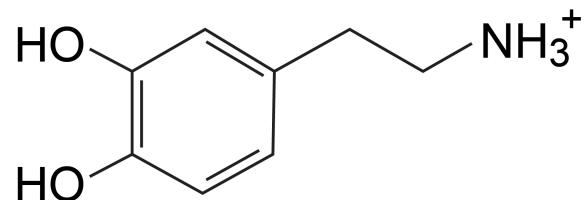
Met-enkephalin

*Tyr - Gly - Gly - Phe - Met*

$\gamma$ -aminobutyric acid



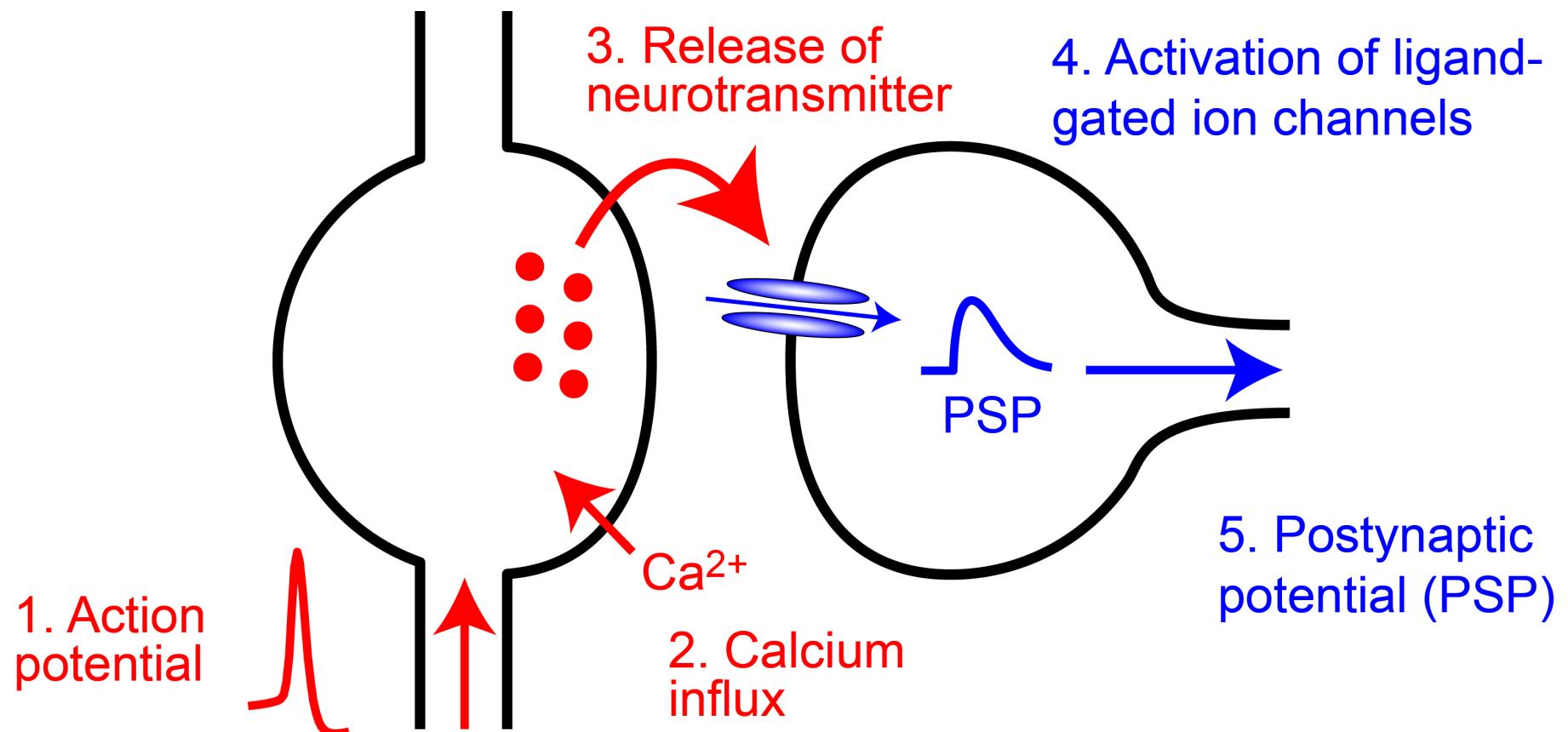
Dopamine



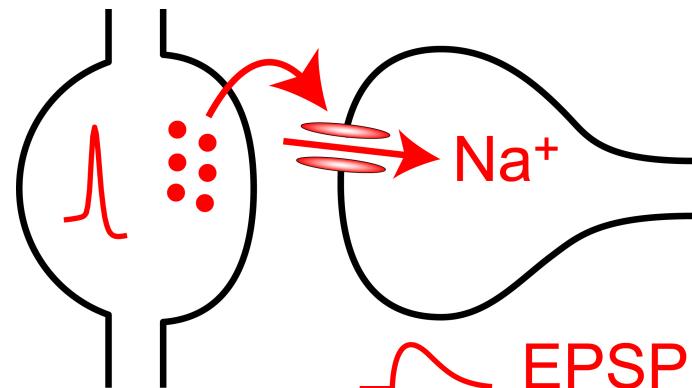
Oxytocin

*Cys - Tyr - Ile - Gln - Asn*  
*Gly - Leu - Pro - Cys*

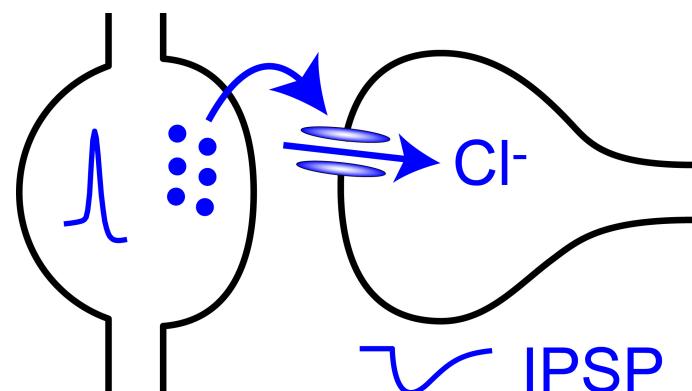
# Fast chemical synaptic transmission



# Excitatory and inhibitory synapses

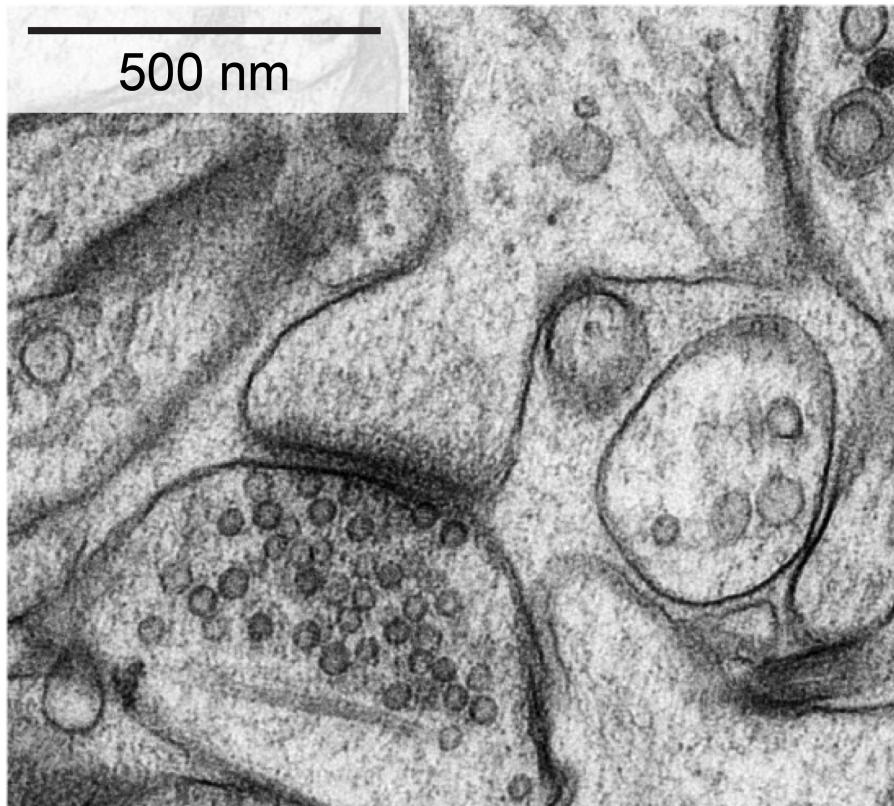


Glutamate activates postsynaptic ionotropic glutamate receptors permeable to  $\text{Na}^+$  and  $\text{K}^+$  with reversal potential  $\sim 0$  mV causing an excitatory postsynaptic potential (EPSP).

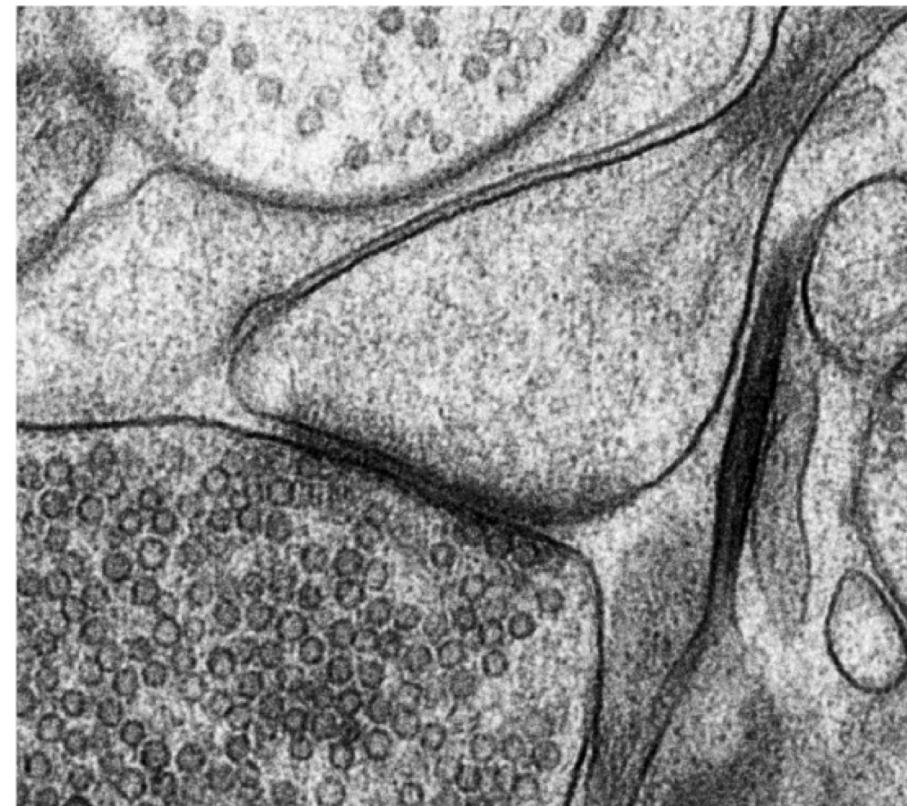


GABA activates postsynaptic ionotropic GABA receptors permeable to  $\text{Cl}^-$  with reversal potential  $\sim -70$  mV causing an inhibitory postsynaptic potential (IPSP).

# Electron microscopy of synaptic structure

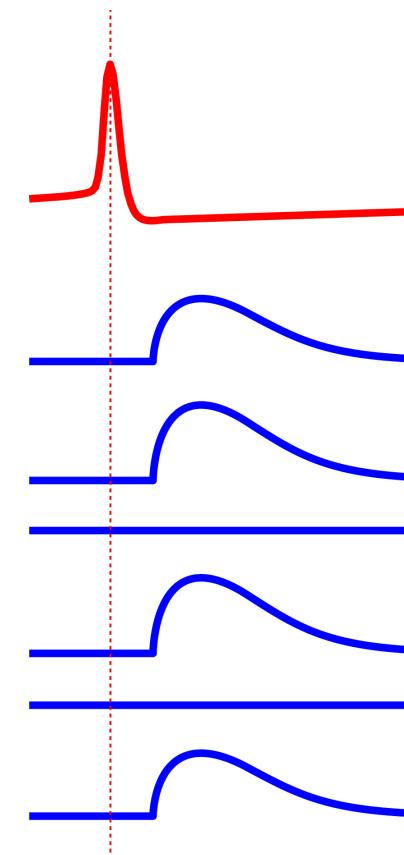
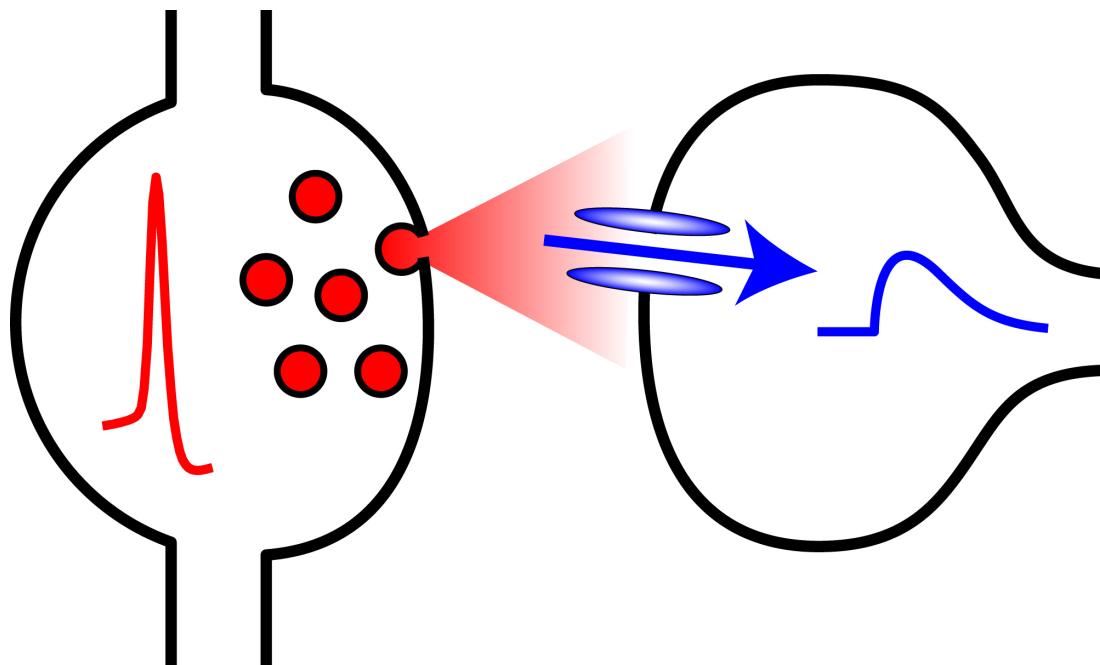


Korogod, Petersen and Knott



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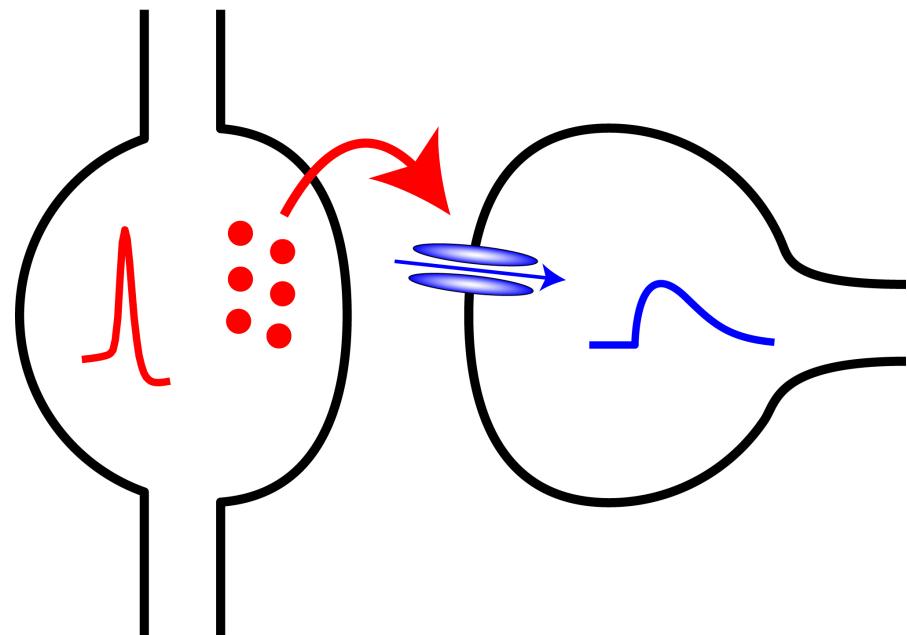
# Quantal release of neurotransmitter



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# Synaptic transmission

Action potential      Postsynaptic potential



# Electrical synapses



# Volume transmission



# Dendritic release of neurotransmitters



Cellular Mechanisms of Brain Function

# Synaptic transmission



- Neurons communicate with each other at specialised junctions called synapses.
- Action potentials evoke the exocytosis of synaptic vesicles filled with neurotransmitters.
- The released neurotransmitters activate specific receptors driving postsynaptic potentials.