Threshold

Action potentials occur only when the membrane in stimulated (depolarized) enough so that sodium channels open completely. The minimum stimulus needed to achieve an action potential is called the **threshold.**

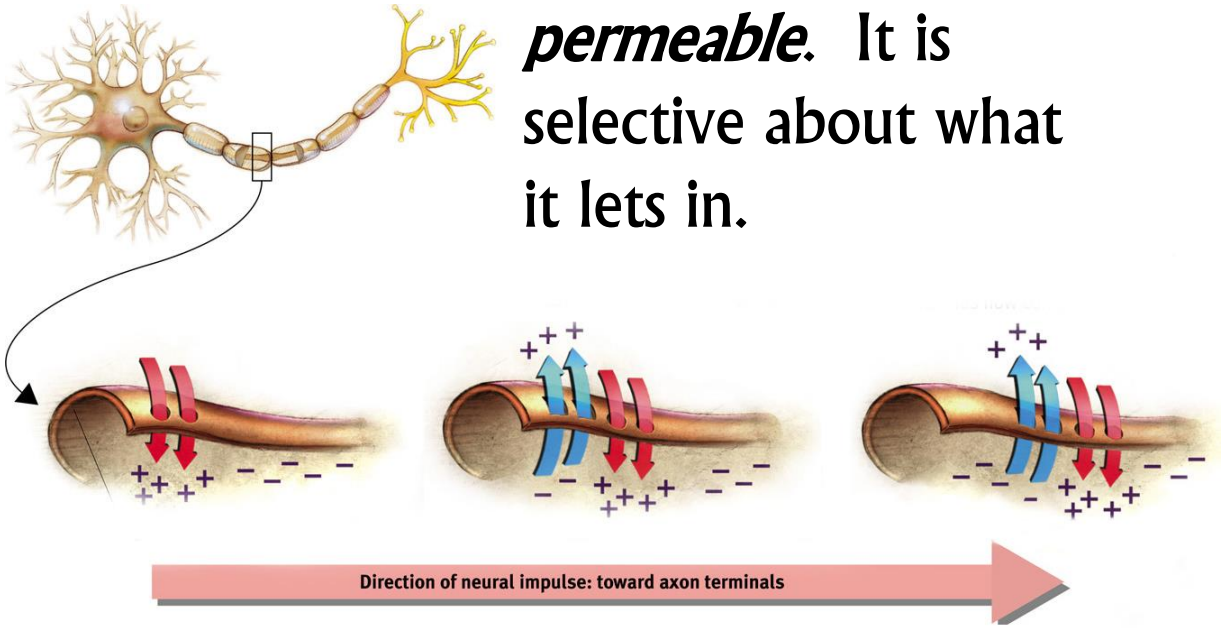
The **threshold** is reached when excitatory ("Fire!") signals outweigh the inhibitory ("Don't fire!") signals by a certain amount.

Action Potential

1. A neural impulse. A brief electrical charge that travels down an axon and is generated by the movement of positively charged atoms in and out of channels via the ***sodium /potassium pump*** in the axon's membrane.

2. This happens during ***depolarization***.

3. The axon's surface is ***selectively permeable***. It is selective about what it lets in.



Neural impulses

- Neural firing and a toilet……

- 1. Like a neuron, a toilet has an "***action potential***". When you flush and threshold is reached, an "impulse" is sent down a sewer pipe. *(Na flows in, K flows out, and an impulse is sent down the axon)*
- 2. Like a neuron, a toilet has a ***refractory period***. There is a short delay after flushing when the toilet cannot be flushed again because the tank is being refilled. *(While ions are shifting, the neuron cannot fire again.)*
- 3. Like a neuron, a toilet has a ***resting potential***. The toilet is "charged" when the tank is full and it is capable of being flushed again. *(When Na and K atoms are back in place)*

Neural impulses

- Neural firing and a toilet……

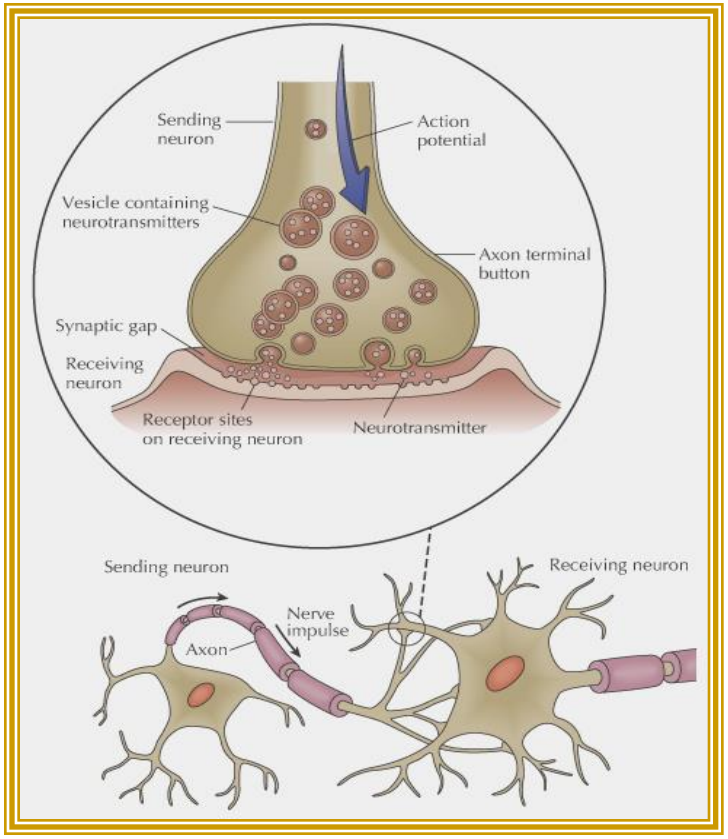
- 4. Like a neuron, a toilet operates on an ***all-or-none principle***. It always flushes with the same intensity, no matter how much force you apply to the handle. (The intensity of the movement does not decrease. It fires or it doesn't.)
- Q: So how can we tell the difference between a love tap and a punch??
- A: Because the NUMBER of neurons that fire depend on the intensity of the stimulation. So, the intensity is based on how many neurons fire. They all fire at the same intensity.

Terms you need to know to this point

- neurons
- neural impulse
- dendrites
- axon
- myelin sheath
- soma
- cell body (soma)
- terminal branches
- action potential
- resting potential
- refractory period
- depolarization
- selectively permeable
- Sodium
- Potassium
- Negative
- Positive
- Sodium/potassium pump

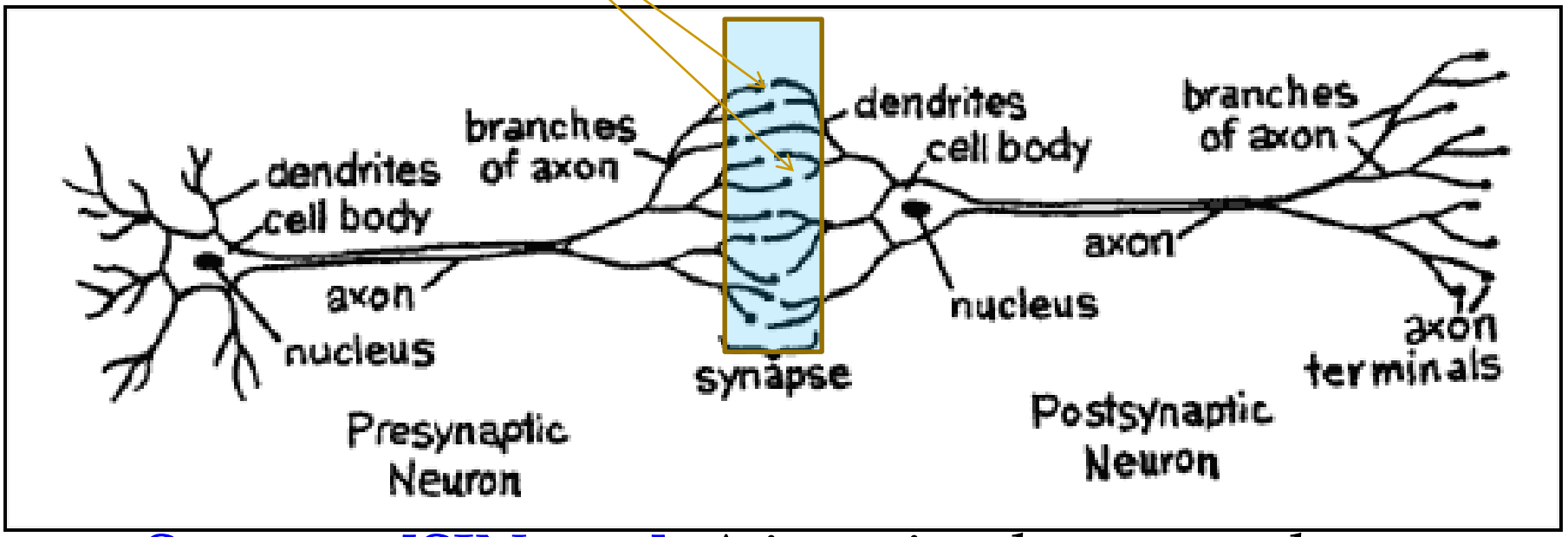
Neural Bases of Psychology: Neural Communication (Continued)

- *Between* neurons, communication occurs through transmission of neural information across a **synapse** by **neurotransmitters** (chemicals released by neurons that alter activity in other neurons).



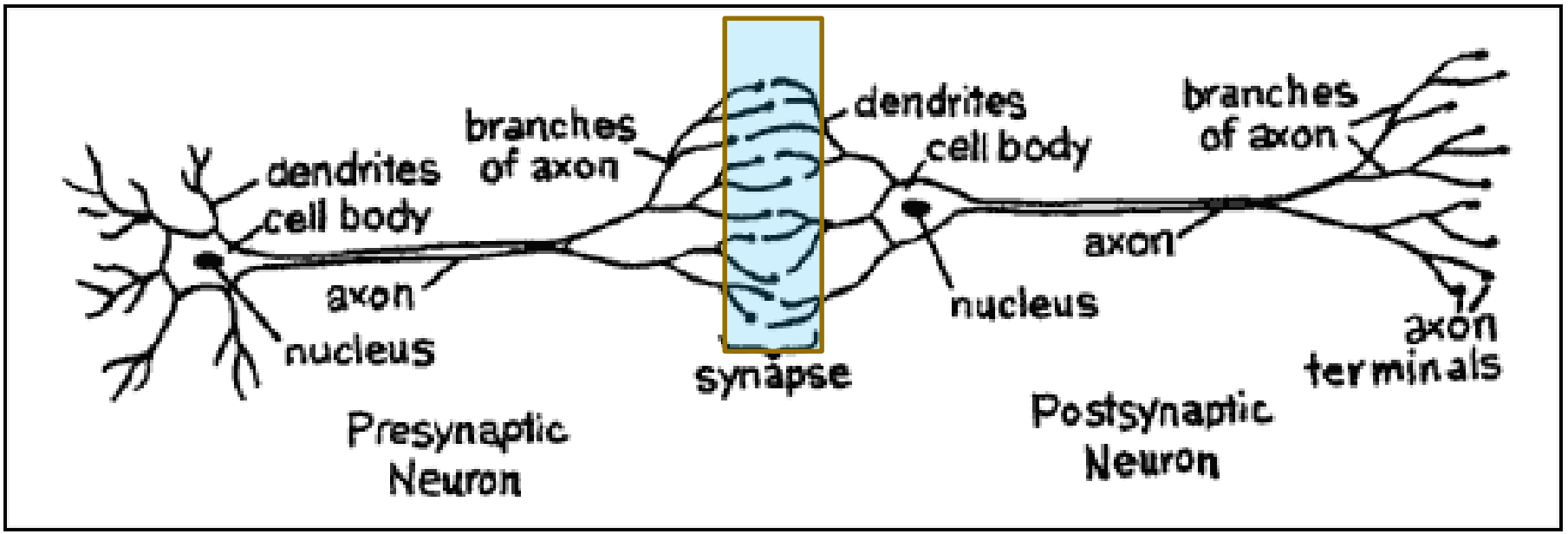
Transmission between neurons

Synaptic gap – less than 1 millionth of an inch wide



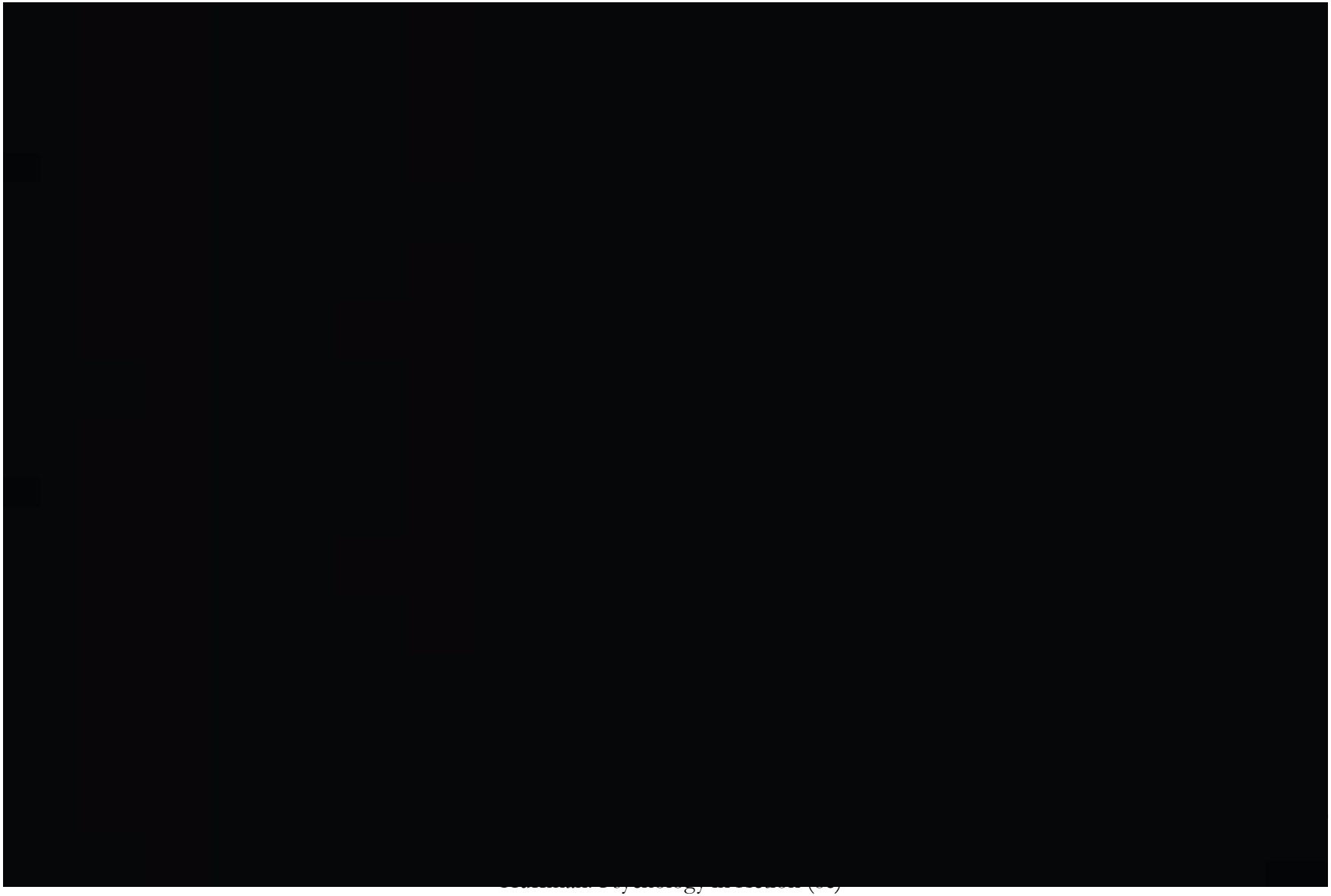
Synapse [SIN-aps] A junction between the axon tip of the sending neuron and the dendrite or cell body of the receiving neuron. This tiny gap is called the *synaptic gap* or *cleft*.

Transmission between neurons



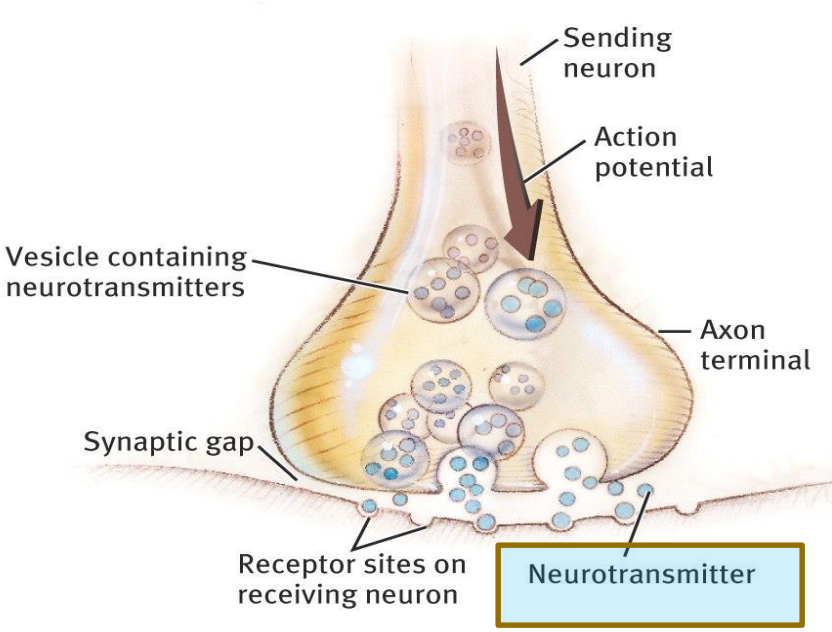
Neurons transmit information to other neurons. Information passes from the axon of the presynaptic neuron to the dendrites of the postsynaptic neuron.

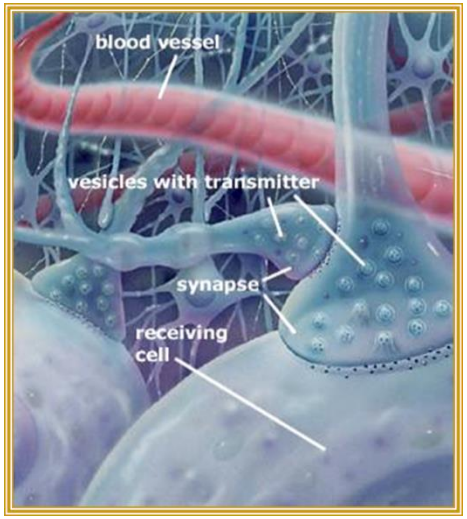
Neurons and Neurotransmitters



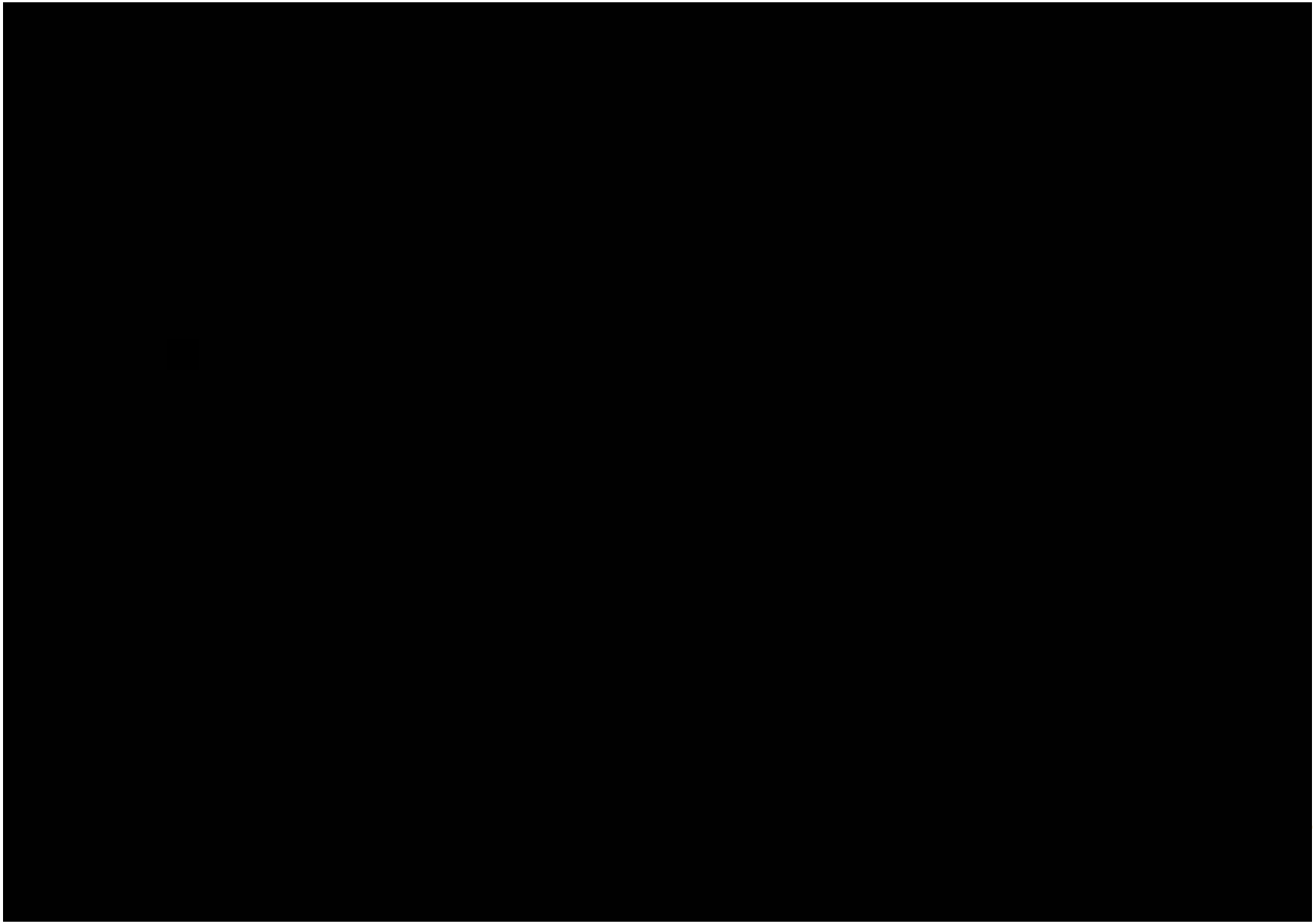
Neurotransmitters

(chemicals) released from the sending neuron travel across the synapse and bind to receptor sites on the receiving neuron, thereby influencing it to generate an action potential.





Neurotransmitters and ADHD

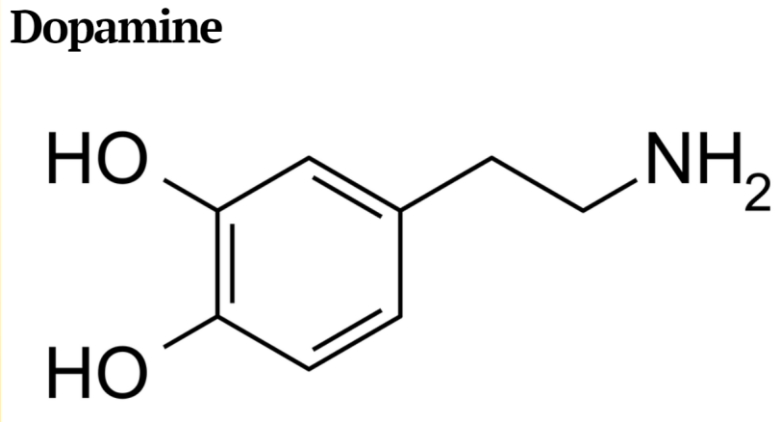


Neurotransmitters

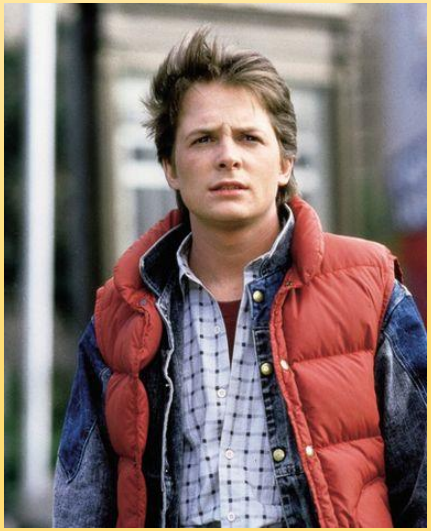
- Dopamine (NT): excessive levels in the brain associated with schizophrenia and low levels associated with Parkinson's disease

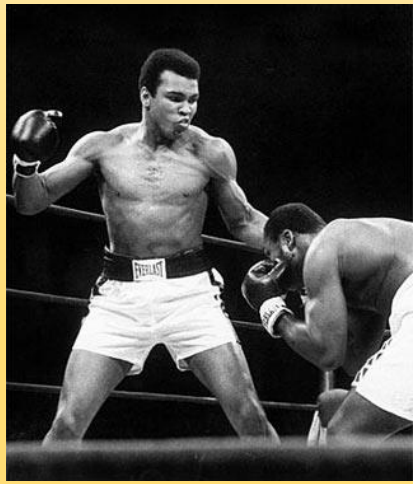
Parkinson's Disease and Neurotransmitters

1. When people are diagnosed with Parkinson's disease, they have usually lost approximately 50-60% of the dopamine neurons in an area of the brain called the substantia nigra.
2. The loss of dopamine causes the nerve cells of the basal ganglia to fire out of control, leaving patients unable to direct or control their movements in a normal manner.



WELL-KNOWN PEOPLE WITH PARKINSON"S DISEASE





Dr. Oliver Sacks

Parkinson's Disease shares some features with another disease that was prevalent in the US in the early 20th century. When people became afflicted they lost their ability to move at all. A treatment used with these patients demonstrated the importance of neurotransmitters.

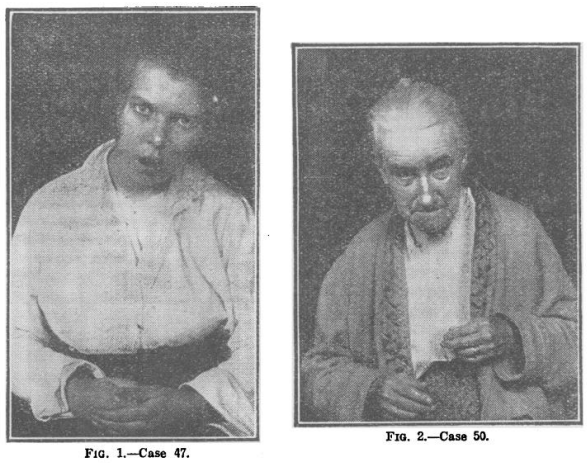


FIG. 1.—Case 47.

FIG. 2.—Case 50.

Two patients with encephalitis lethargica and Parkinson's symptoms (woman aged 21 and woman aged 67)

From Gullan (1925) *British Medical Journal*

- Dr. Oliver Sacks documented one patient.
- The patient would move his arm so slowly, it was virtually undetectable.
- AM – hand on knee
- Noon – Hand halfway to face
- Evening – at his nose
- After administering L-Dopa, patient told Sacks "I was merely wiping my nose."