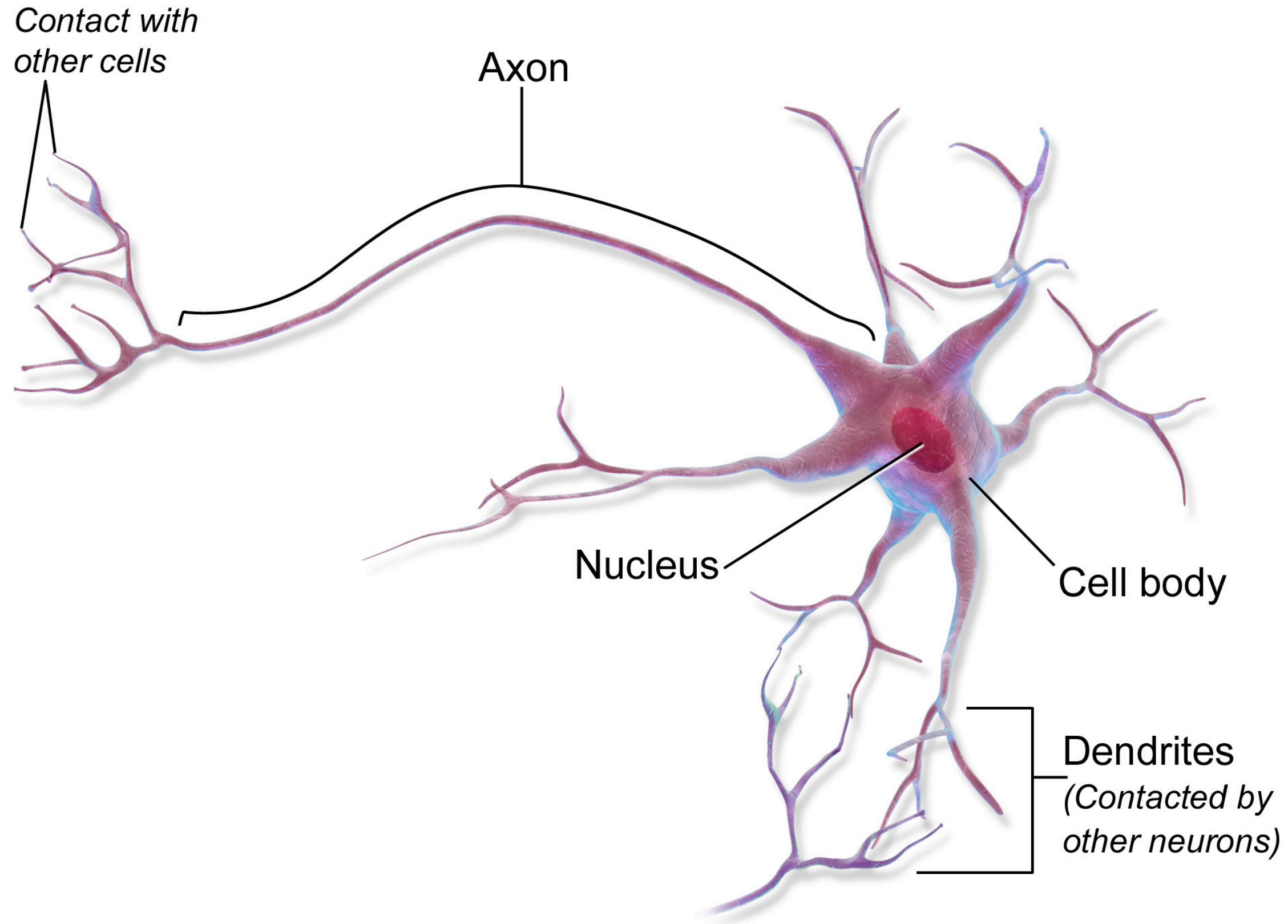


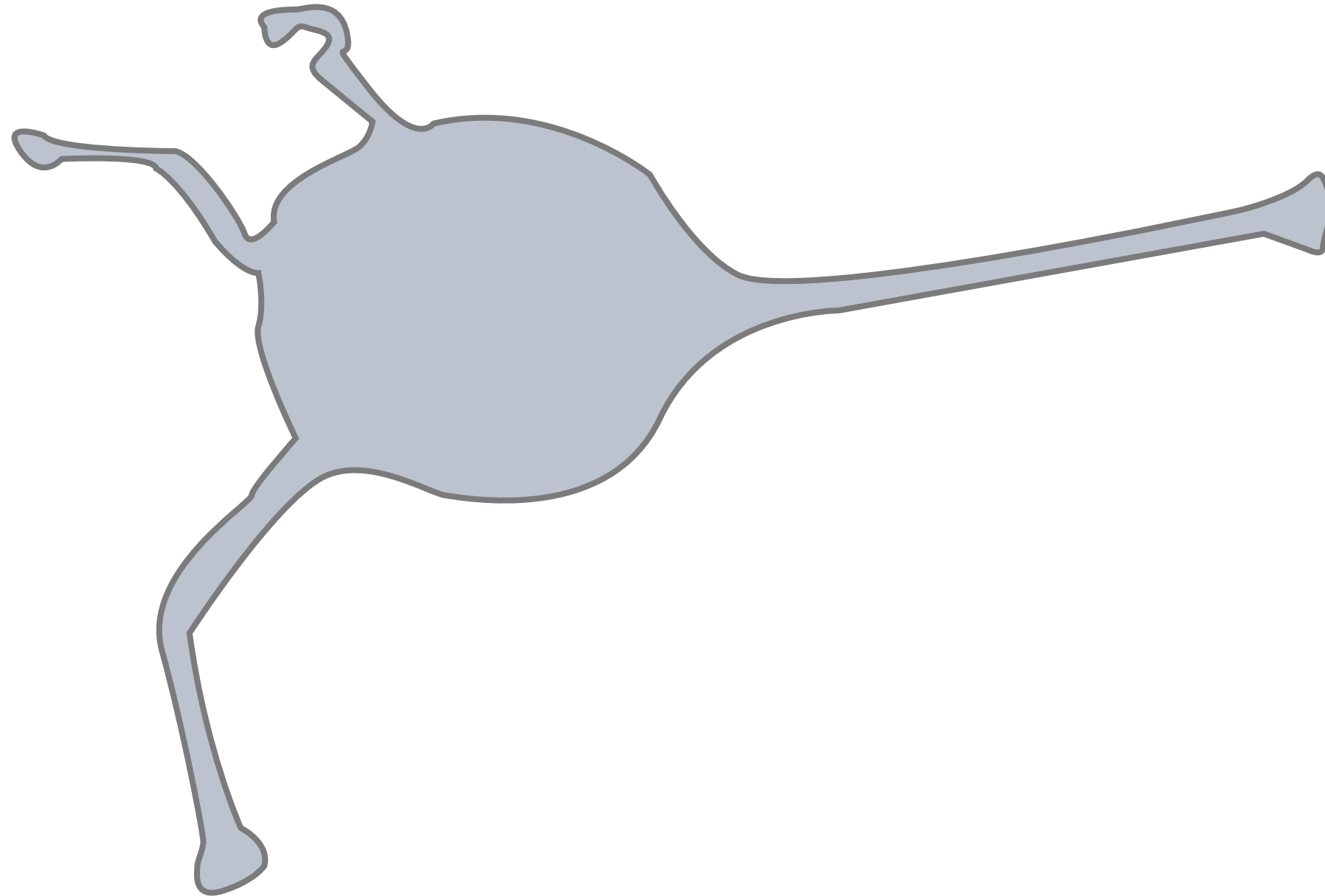
Postsynaptic Potentials (PSPs)



- Explain postsynaptic potentials (PSPs).
- Distinguish between excitatory and inhibitory PSPs.
- Describe the summation of PSPs.
- Describe where and how action potentials are generated.

Learning Goals

Next question: What can affect the resting membrane potential?



When a neurotransmitter molecule binds to a postsynaptic receptor, it can have one of two localized effects:

1. **Depolarize the membrane** (e.g., decrease membrane potential from -70 to -67).
2. **Hyperpolarize the membrane** (e.g., increase the membrane potential from -70 to -72).

Generation & Conduction of PSPs

When a neurotransmitter molecule binds to a postsynaptic receptor, it can have one of two localized effects:

1. Depolarize the membrane = **Excitatory postsynaptic potential (EPSP)**.
2. Hyperpolarize the membrane = **Inhibitory postsynaptic potential (IPSP)**.

Generation & Conduction of PSPs

When a neurotransmitter molecule binds to a postsynaptic receptor, it can have one of two localized effects:

1. Depolarize the membrane = EPSP = Increase likelihood that the postsynaptic neuron will fire an action potential (AP).
2. Hyperpolarize the membrane = IPSP = Decrease the likelihood that the postsynaptic neuron will fire an AP.

Generation & Conduction of PSPs

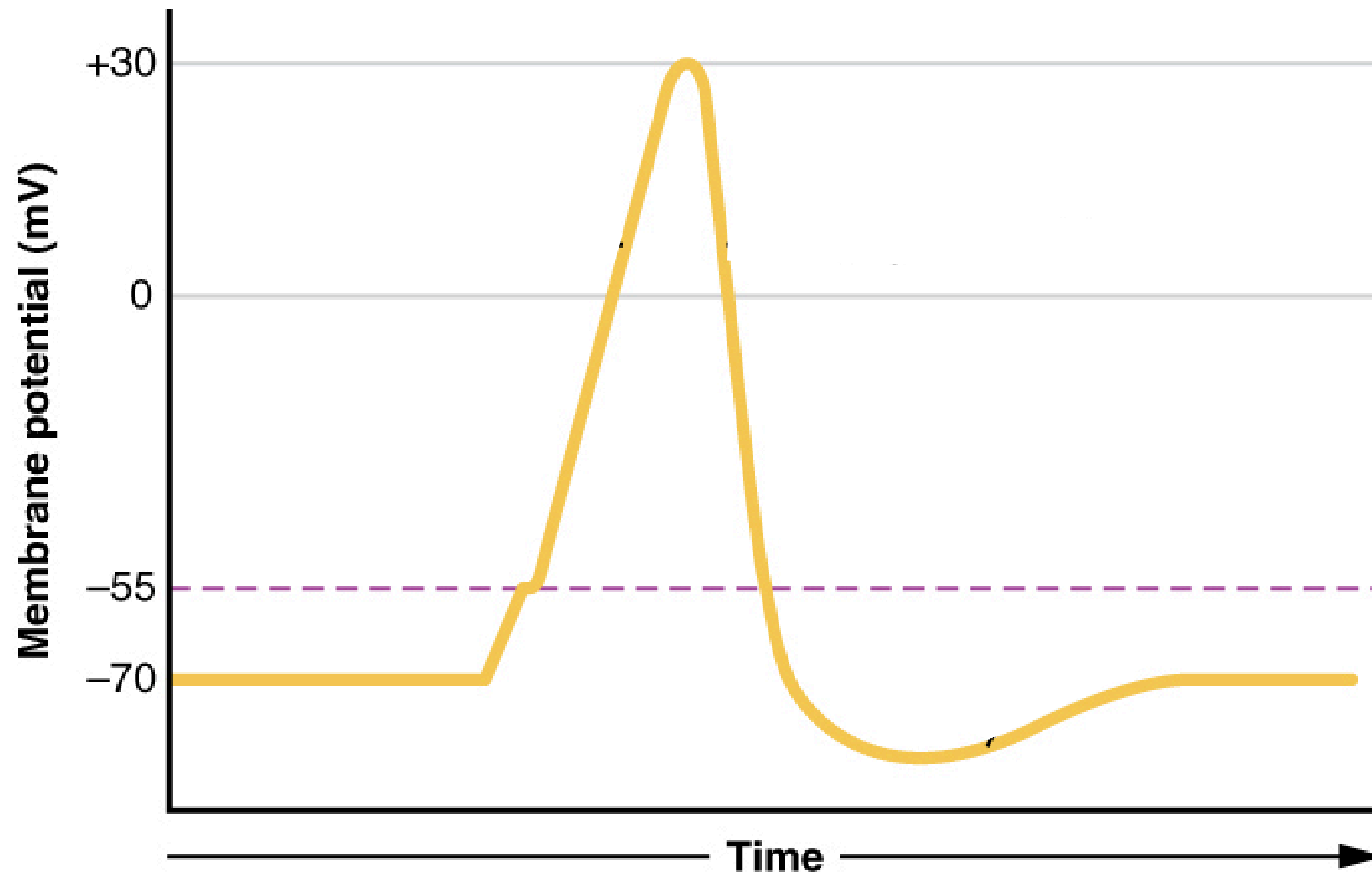
When a neurotransmitter molecule binds to a postsynaptic receptor, it can have one of two localized effects:

1. Depolarize the membrane = EPSP = Increase likelihood that the postsynaptic neuron will fire an action potential (AP).
2. Hyperpolarize the membrane = IPSP = Decrease the likelihood that the postsynaptic neuron will fire an AP.

The transmission of postsynaptic potentials (PSPs) is graded, rapid and decremental: PSPs travel like an electrical signal along an uninsulated wire.

Generation & Conduction of PSPs

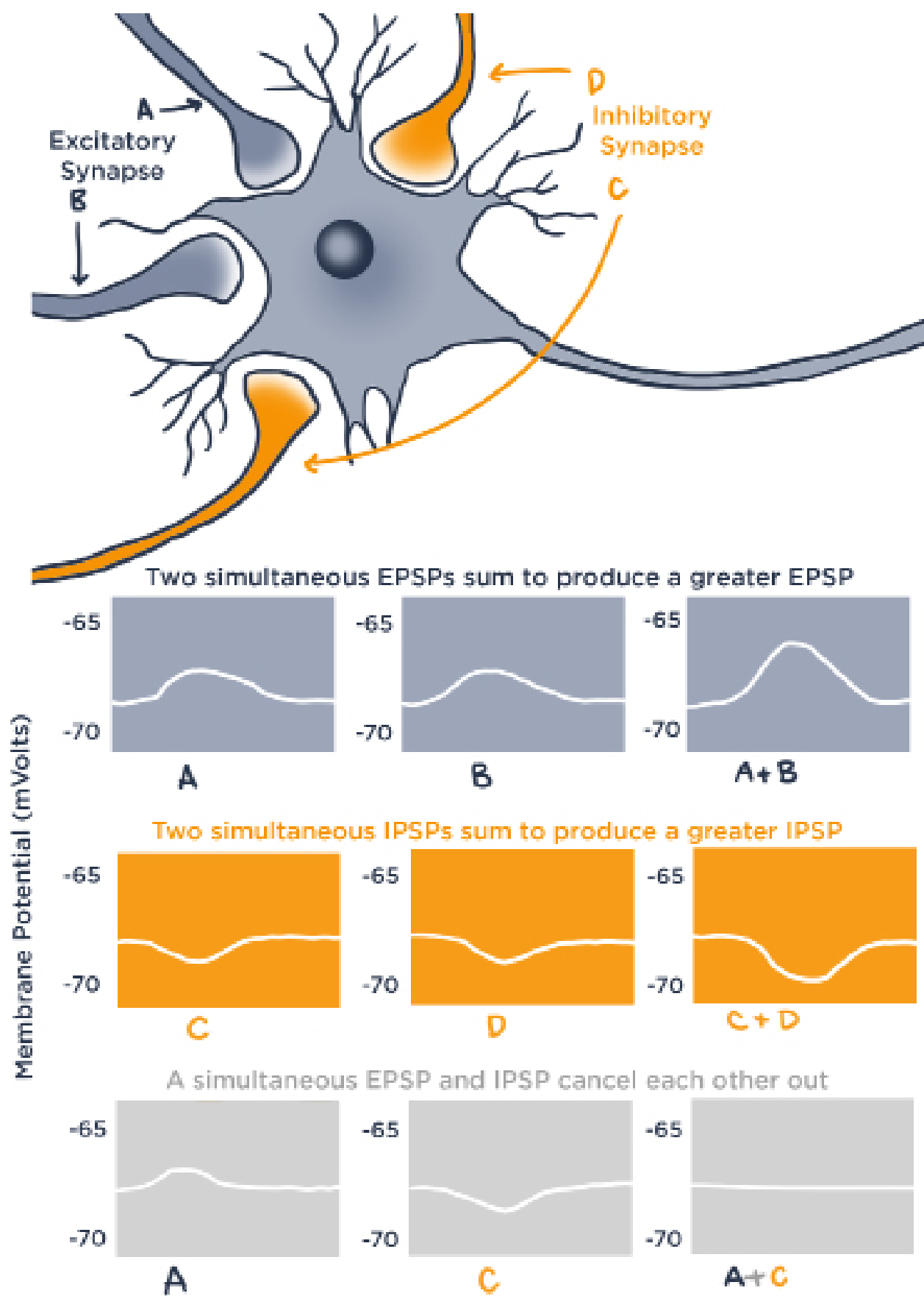
Once the membrane potential reaches a certain threshold, an **action potential** can be generated.



Generation & Conduction of PSPs

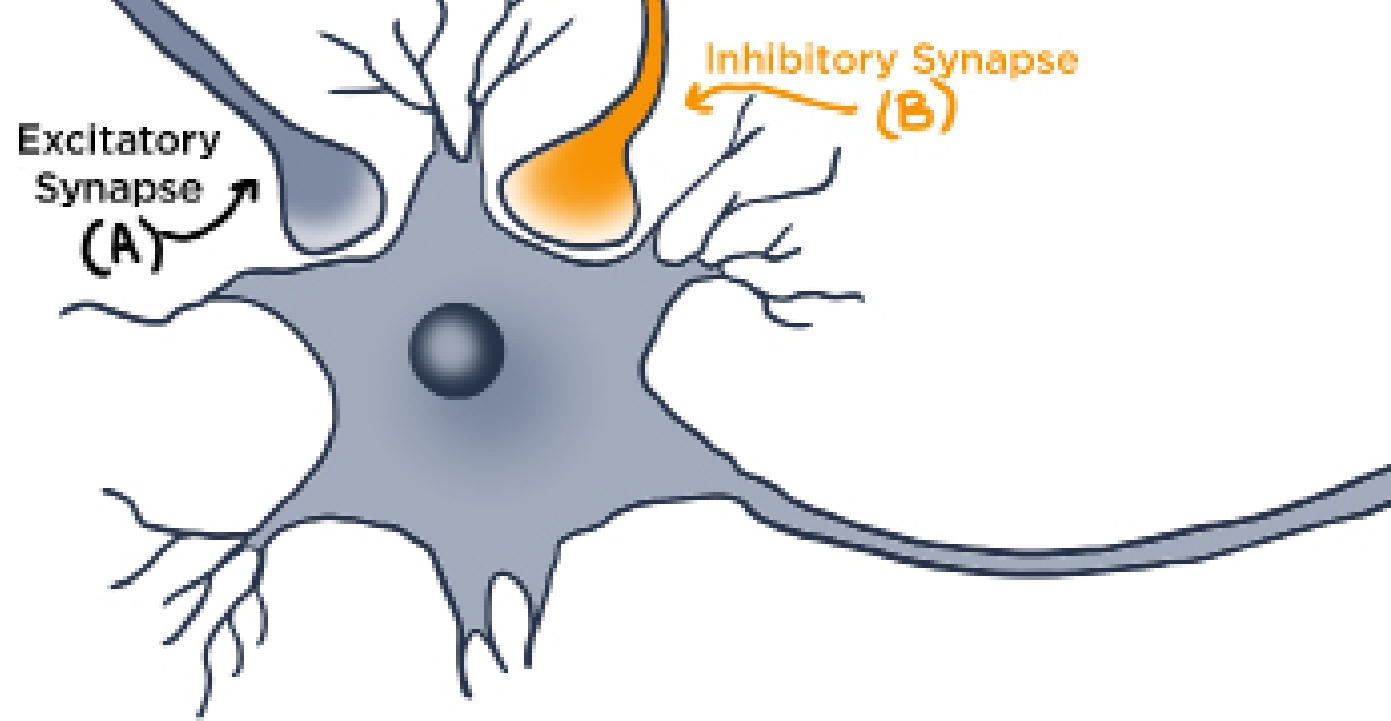
Spatial Summation

EPSPs and IPSPs sum both **spatially** and **temporally**.

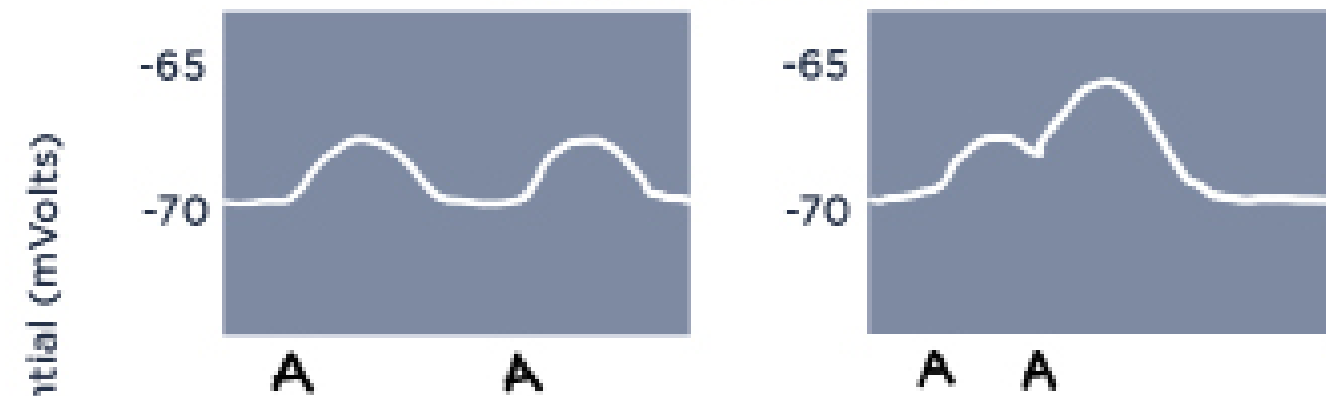


PSP Summation and AP Generation

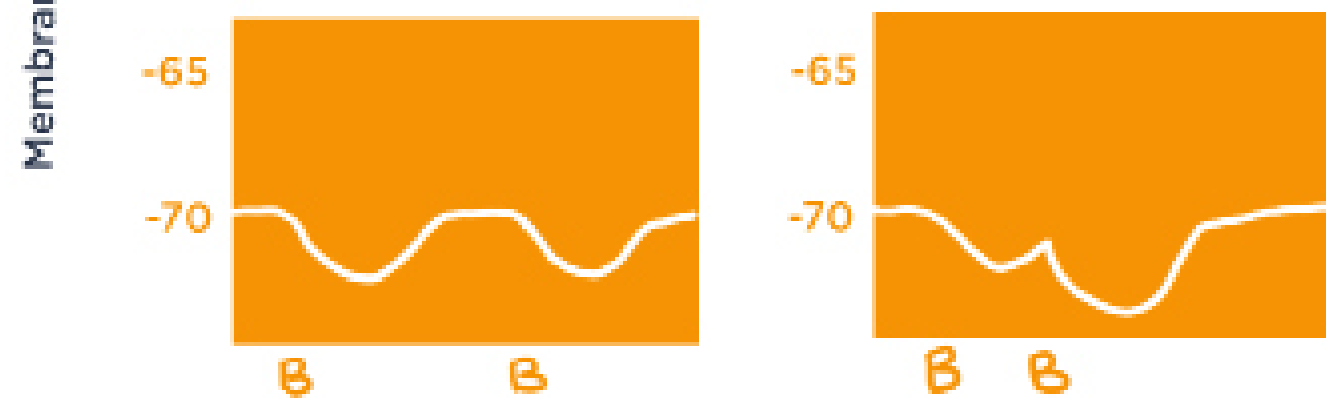
Temporal Summation



Two EPSPs in rapid succession synergize to produce a larger EPSP



Two IPSPs in rapid succession synergize to produce a larger IPSP



PSP Summation and AP Generation

AP Generation

If the sum of the EPSPs and IPSPs that reaches the **axon initial segment** is sufficient to depolarize the membrane there above its **threshold of excitation** (e.g., -65 mV) then an action potential (AP) is generated.

The AP is a massive momentary reversal of the membrane potential (e.g., from -70 to +55 mV).

PSP Summation and AP Generation

Types of Potentials

	PSP	AP
Graded	Yes	No
Decremental	Yes	No
Rapid	Yes	Less so

PSP Summation and AP Generation