



AP Bio

FRQ Fridays

2019 #4
Neurotransmitters and Signaling

FRQ Friday #18

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Acetylcholine is a neurotransmitter that can activate an action potential in a postsynaptic neuron (Figures 1 and 2). A researcher is investigating the effect of a particular neurotoxin that causes the amount of acetylcholine released from presynaptic neurons to increase.

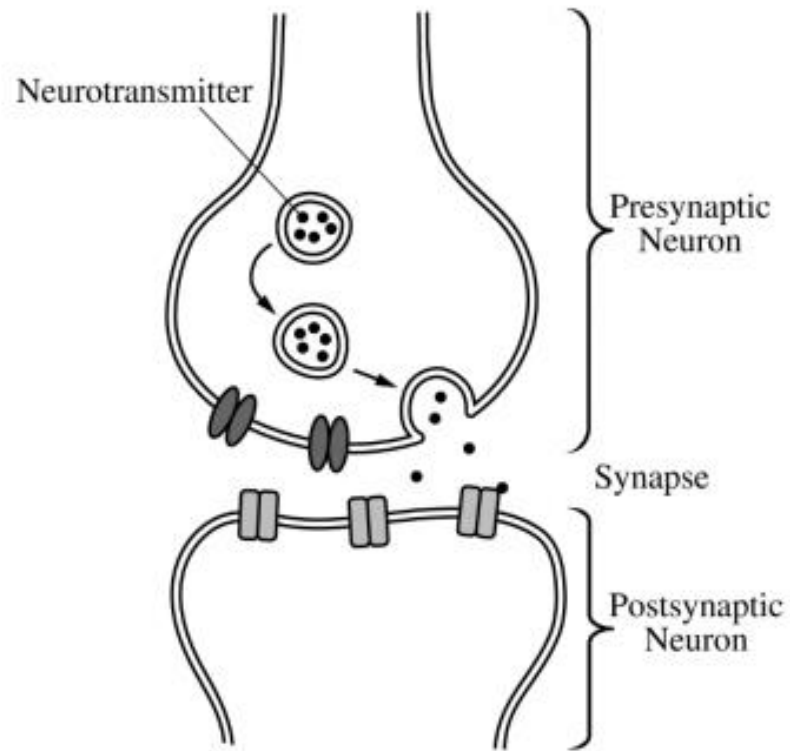


Figure 1. Release of neurotransmitters into the synapse in response to an action potential

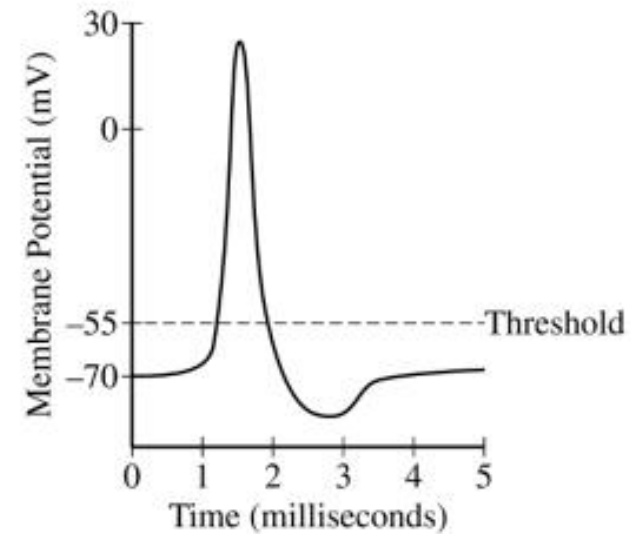


Figure 2. Model of a typical action potential in a neuron



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- (a) **Describe** the immediate effect of the neurotoxin on the number of action potentials in a postsynaptic neuron. **Predict** whether the maximum membrane potential of the postsynaptic neuron will increase, decrease, or stay the same.

Acetylcholine is a neurotransmitter that can activate an action potential in a postsynaptic neuron (Figures 1 and 2). A researcher is investigating the effect of a particular neurotoxin that causes the amount of acetylcholine released from presynaptic neurons to increase.

Description (1 point)

- It will increase the number of action potentials.

Prediction (1 point)

- It will stay the same.

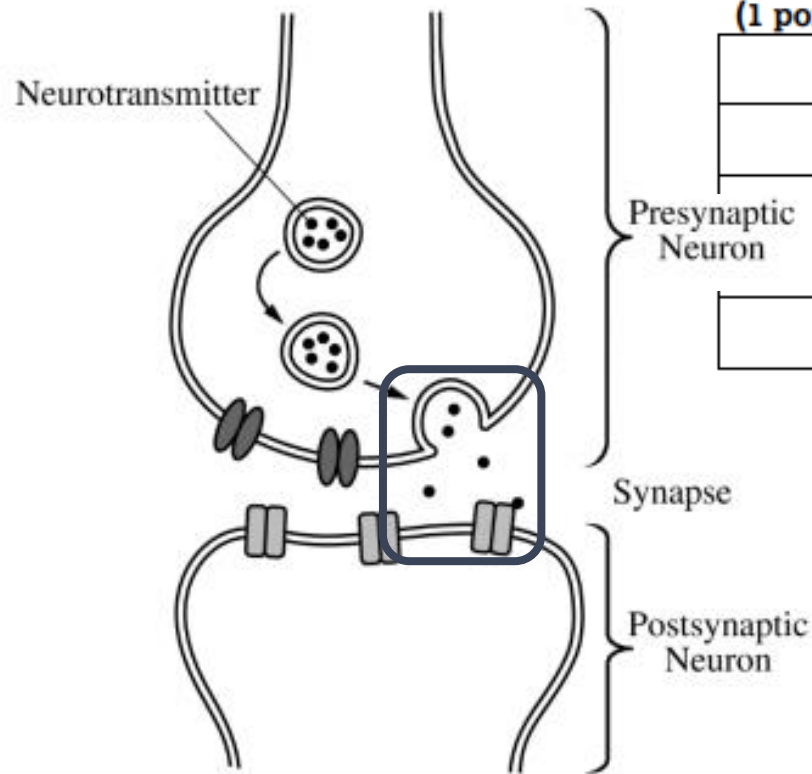
a) The number of action potentials will increase as a result of the neurotoxin as Acetylcholine will be increased and thus, bind to the receptors more frequently. The maximum membrane potential should remain the same however.



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(b) The researcher proposes two models, A and B, for using acetylcholinesterase (AChE), an enzyme that degrades acetylcholine, to prevent the effect of the neurotoxin. In model A, AChE is added to the synapse. In model B, AChE is added to the cytoplasm of the postsynaptic cell. Predict the effectiveness of EACH proposed model. Provide reasoning to support your predictions.



(1 point per row; 2 points max.)

	Prediction	Reasoning
Model A	Effective	Acetylcholine is in the synapse.
Model B	Not effective	Acetylcholine is not in the cytoplasm of the postsynaptic cell.

Figure 1. Release of neurotransmitters into the synapse in response to an action potential



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(1 point per row; 2 points max.)

	Prediction	Reasoning
Model A	Effective	Acetylcholine is in the synapse.
Model B	Not effective	Acetylcholine is not in the cytoplasm of the postsynaptic cell.

b) Model A will be effective in preventing the effects of the neurotoxin, as ~~it~~ will degrade AChE the Acetylcholine in the synaptic cleft, where it affects the action potential cascade. Model B will be ineffective as there is no Acetylcholine in the post-synaptic cell, so the AChE will not prevent the effects of the neurotoxin.

