

# Sympathetic Stimulation of the Heart

## Review Questions (Answers on next page)

1. Where do sympathetic action potentials that stimulate the heart originate from?
2. Where is the “pacemaker” of the heart located?
3. What region of the spinal cord do the sympathetic motor neurons that go to the heart originate from?
4. Which neurotransmitter do sympathetic motor neurons release onto the heart?
5. What are synaptic vesicles?
6. What is an axon terminal?
7. What kind of receptors does NE bind to on the pacemaker cells?
8. What is the effect of NE stimulation of cardiac pacemaker cells?
9. What is the effect of NE stimulation of contractile cardiac muscle cells?
10. How do Beta Blockers work?
11. What are some conditions that Beta Blockers may be prescribed for?

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## Answers

1. Where do sympathetic action potentials that stimulate the heart originate from?  
**The SPINAL CORD**
2. Where is the “pacemaker” of the heart located?  
**The SINOATRIAL (SA) node is located in the upper right atrium.**
3. What region of the spinal cord do the sympathetic motor neurons that go to the heart originate from?  
**The THORACIC REGION**
4. Which neurotransmitter do sympathetic motor neurons release onto the heart?  
**Norepinephrine (NE)**
5. What are synaptic vesicles?  
**Small membrane sacs that contain neurotransmitters.**
6. What is an axon terminal?  
**The end of a neuron. The action potential arrives there, and then causes synaptic vesicles to exocytosis their neurotransmitters so that the signal can “jump” across to the next cell. In this case, the next cell is cardiac cell.**
7. What kind of receptors does NE bind to on the pacemaker cells?  
**B1 adrenergic receptors**
8. What is the effect of NE stimulation of cardiac pacemaker cells?  
**It increases the generation of action potentials, which increases heart rate because the signal spreads throughout the whole heart.**
9. What is the effect of NE stimulation of contractile cardiac muscle cells?  
**It increases calcium availability, which helps the contractile cells increase their force of contraction.**
10. How do Beta Blockers work?  
**The prevent NE from properly binding to B1 adrenergic receptors on the heart cells. This lowers heart rate and decreases force of contraction.**
11. What are some conditions that Beta Blockers may be prescribed for?  
**Congestive heart failure, hypertension, sometimes anxiety or even “stage fright” for actors. It eases the strain on failing hearts and lowers blood pressure.**