

TOPIC: SYMPATHETIC NERVOUS SYSTEM

Function of the Sympathetic Nervous System

- Prepares body to engage in physical activity or perform under stress.
- Examples of sympathetic effects:

Structure		Effect of Sympathetic Nervous System
Cardiac Muscle		_____ heart rate.
Bronchioles of the Lungs		Dilates bronchioles.
Liver		Stimulates release of glucose into blood.
Arrector Pili Muscles		Contracts arrector pili (tiny muscles surrounding hair follicles) - causing goosebumps.
Gastrointestinal Tract		Decreases activity.
Blood Vessels		Vasoconstriction in visceral vessels. Vasodilation in _____ muscles.
Pupils		_____ pupils.
Sweat Glands		Stimulates sweat glands.

EXAMPLE: Why does the sympathetic nervous system shunt blood to skeletal muscles?

- To conserve energy for when the fight or flight response is needed.
- To prepare the body for intense physical activity.
- To facilitate digestion and nutrient absorption.
- All of the above.

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PRACTICE: Why does the sympathetic nervous system cause decreased activity in the digestive tract?

- a) Sympathetic activation stimulates the release of digestive hormones.
- b) Sympathetic activation reduces the sensitivity of the digestive tract.
- c) During sympathetic activation, energy is required elsewhere in the body for more “essential” functions.
- d) The sympathetic nervous system does not innervate the digestive tract.

PRACTICE: Which of the following statements is true?

- a) The sympathetic nervous system increases secretion from digestive glands.
- b) The parasympathetic system causes us to get goosebumps.
- c) Sympathetic tone controls the heart rate when we are at rest.
- d) None of the above are true.

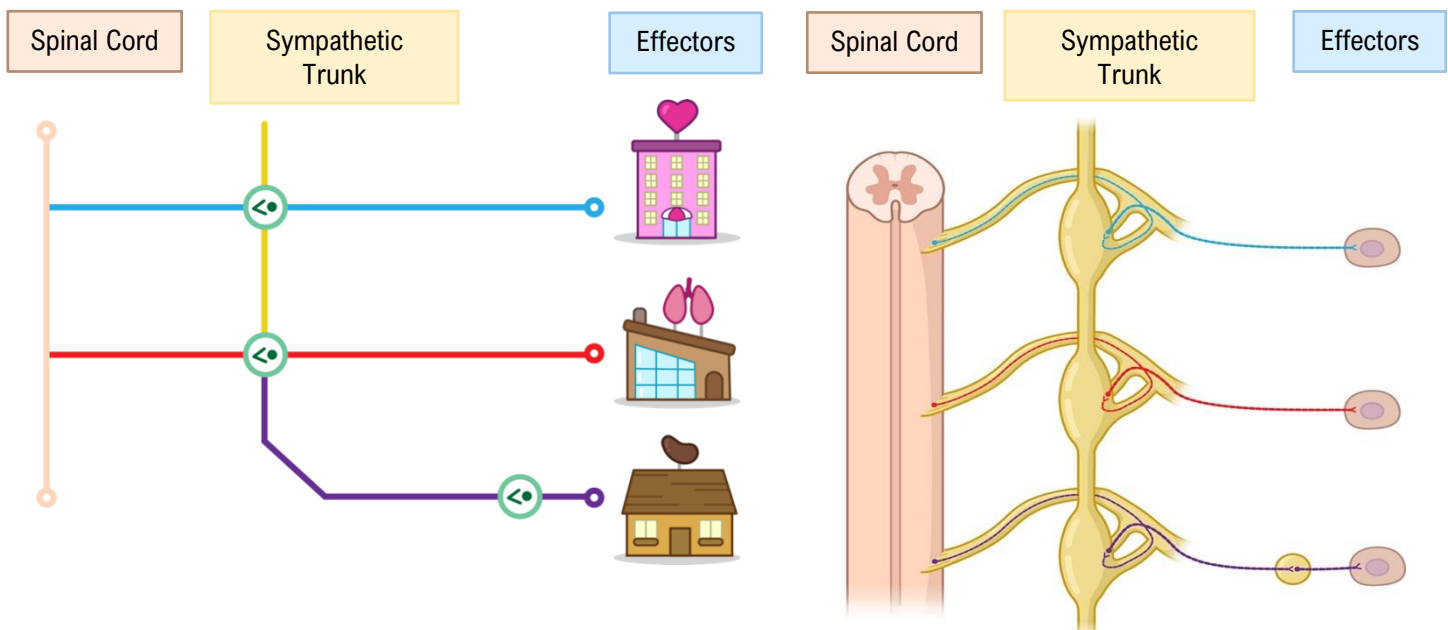
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The Sympathetic Subway

- You can think of the sympathetic division as a subway train system, where:



- **Nerve Impulses** = Trains travelling on the tracks.
- **Spinal Cord** = Central terminal where all the trains originate from.
- **Sympathetic Trunk** = _____ track that all trains use.
- **Ganglia** = Train stations – impulses can travel straight through them or _____ at them. 
 - Recall **Chemical Synapses**: Gap between neurons specialized for communication via neurotransmitters.
- **Effectors** = Destinations.



Note: All “journeys” from the spinal cord must “change trains” (synapse) **once**.

Therefore, each impulse will travel through exactly ____ fibers.

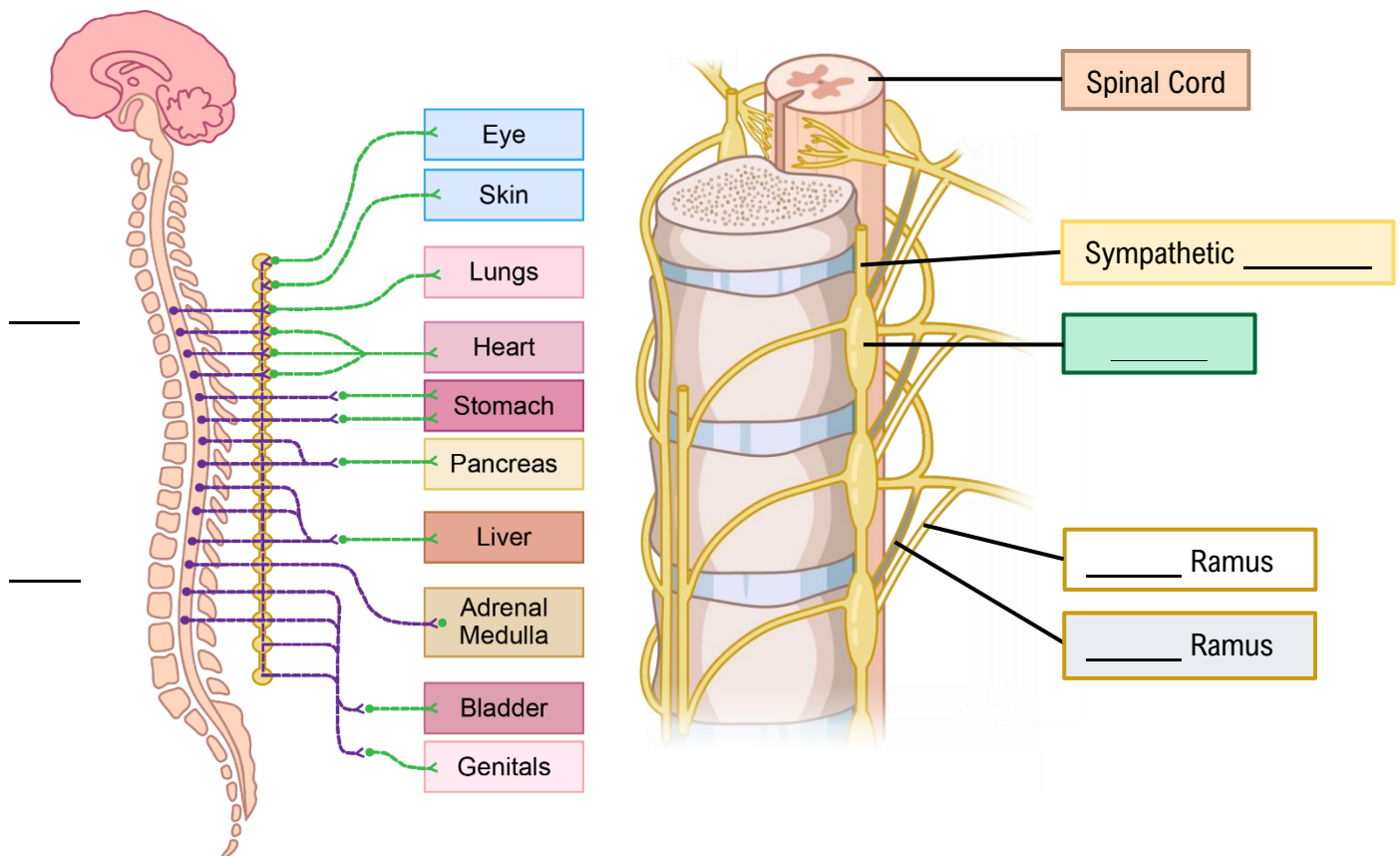
EXAMPLE: In the sympathetic nervous system, a ganglion is a place where:

- Impulses originate.
- Impulses are integrated.
- Neurons can synapse with each other.
- Efferent fibers move fastest through.

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Structure of the Sympathetic Nervous System

- Fibers arise in **spinal cord** segments _____ (*thoracolumbar division*).
- Sympathetic Trunk:** Bundle of _____ fibers that flanks both sides of the vertebral column.
 - Looks like a chain of beads - each "bead" is a sympathetic trunk _____.
- Many **preganglionic fibers** are _____.
- Many **postganglionic fibers** are _____.
- White Ramus Communicans:** Carry preganglionic fibers from spinal nerve to sympathetic ganglia.
- Gray Ramus Communicans:** Carry postganglionic fibers from sympathetic ganglia to spinal nerves.



EXAMPLE: Which of the following most accurately describes the pathway for an impulse in the sympathetic nervous system?

- Spinal cord > postganglionic fiber > ganglion > preganglionic fiber > effector
- Spinal cord > preganglionic fiber > ganglion > postganglionic fiber > effector
- Preganglionic fiber > spinal cord > ganglion > postganglionic fiber > effector
- Preganglionic fiber > ganglion > postganglionic fiber > spinal cord > effector

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PRACTICE: Why are many preganglionic fibers in the sympathetic nervous system short?

- a) Many preganglionic fibers in the sympathetic division synapse at the sympathetic trunk, which is close to the spinal cord.
- b) Many preganglionic fibers cannot carry signals long distances.
- c) Preganglionic fibers carry norepinephrine, which gets diminished over long distances.
- d) None of the above are true.

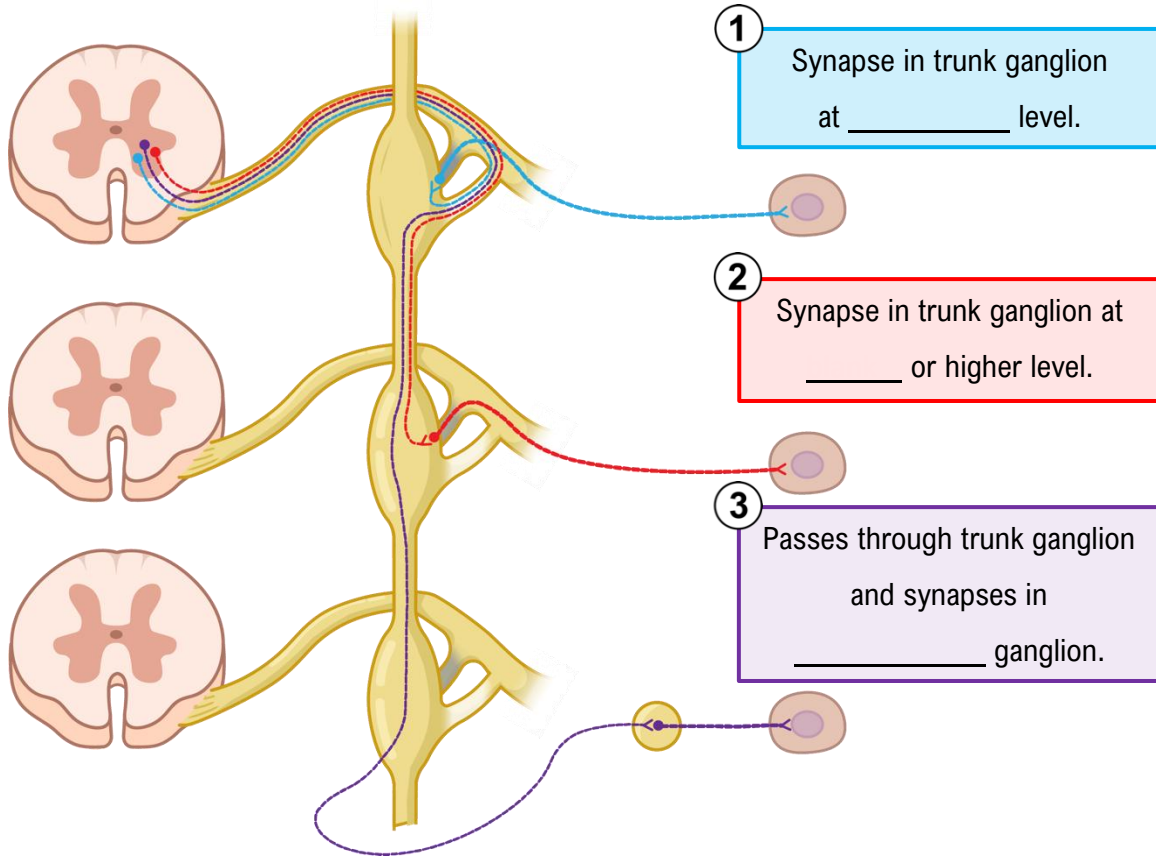
PRACTICE: Efferent neurons in the sympathetic nervous system will always arise in the _____. Then, they will pass through the sympathetic _____, where they will either synapse with another neuron, or continue towards the effector and synapse later on.

- a) Spinal cord, trunk.
- b) Spinal cord, fiber.
- c) Trunk, fiber.
- d) Spinal cord, communicans.

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Pathways of Sympathetic Innervation

- A preganglionic neuron can synapse with a postganglionic neuron in one of _____ ways:



EXAMPLE: Which of the following statements about pathways of sympathetic innervation is **FALSE**?

- A preganglionic and postganglionic neuron can synapse in trunk ganglion at the same level.
- A preganglionic and postganglionic neuron can synapse in trunk ganglion at a higher level.
- A preganglionic and postganglionic neuron can synapse in the ventral horn of the spinal cord.
- A preganglionic and postganglionic neuron can synapse in a collateral ganglion.

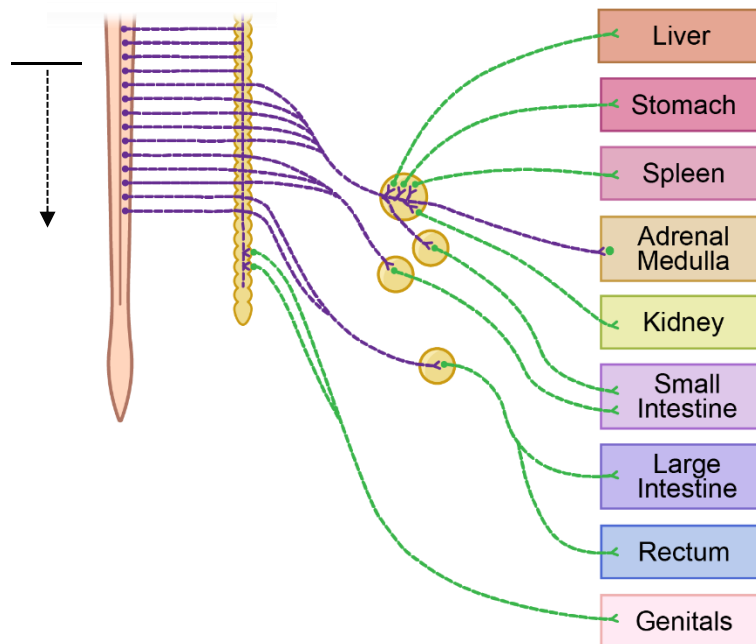
PRACTICE: A preganglionic fiber arriving at the sympathetic trunk could do any of the following **EXCEPT**:

- Synapsing with a postganglionic fiber at the same level of the sympathetic trunk.
- Synapsing with a postganglionic fiber at a different level of the sympathetic trunk.
- Pass through the sympathetic trunk without synapsing.
- Synapse with a parasympathetic fiber at the same level of the sympathetic trunk.

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Splanchnic Nerves and the Adrenal Medulla

- Most preganglionic fibers from T₅ down are splanchnic nerves.
- **Splanchnic Nerves:** Synapse with a collateral ganglion, bypassing the sympathetic _____.
 - Innervate visceral structures in the abdomen.
 - Preganglionic fibers are _____, postganglionic fibers are _____.
- **Adrenal Medulla:** When stimulated, secretes epinephrine and norepinephrine.
 - Located in the _____ gland.
 - Can be considered a modified sympathetic _____; *only* innervated by the sympathetic division.



EXAMPLE: Collateral ganglia contain which type of cell bodies?

- a) Preganglionic parasympathetic.
- b) Postganglionic parasympathetic.
- c) Preganglionic sympathetic.
- d) Postganglionic sympathetic.

PRACTICE: Which of the following structures would not be innervated by splanchnic nerves?

- a) Liver.
- b) Spleen.
- c) Heart.
- d) Adrenal Medulla.