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		Vasoconsriction 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?

a) To conserve energy for when the fight or flight response is needed.

b) To prepare the body for intense physical activity.

c) To facilitate digestion and nutrient absorption.

d) All of the above.

TOPIC: SYMPATHETIC NERVOUS SYSTEM

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.

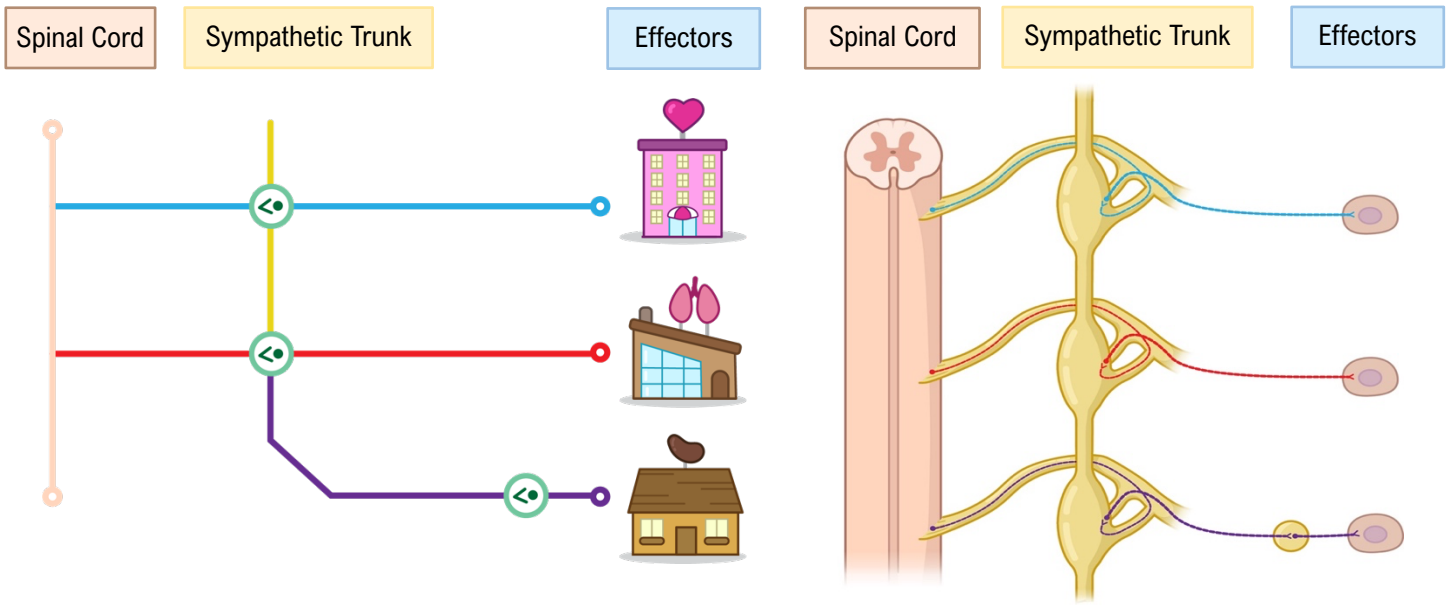
c) Sympathetic tone controls the heart rate when we are at rest.

d) None of the above are true.

TOPIC: SYMPATHETIC NERVOUS SYSTEM

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 speciailzed 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:

a) Impulses originate.

b) Impulses are integrated.

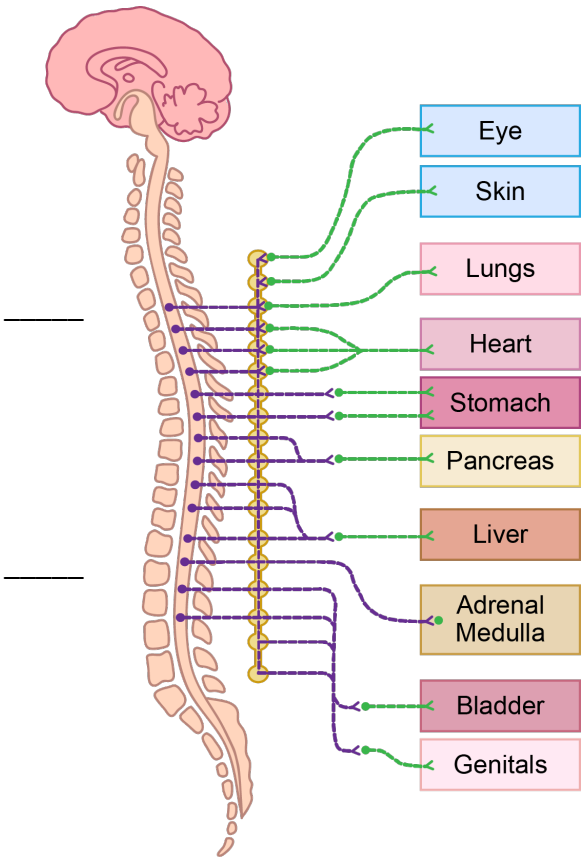
c) Neurons can synapse with each other.

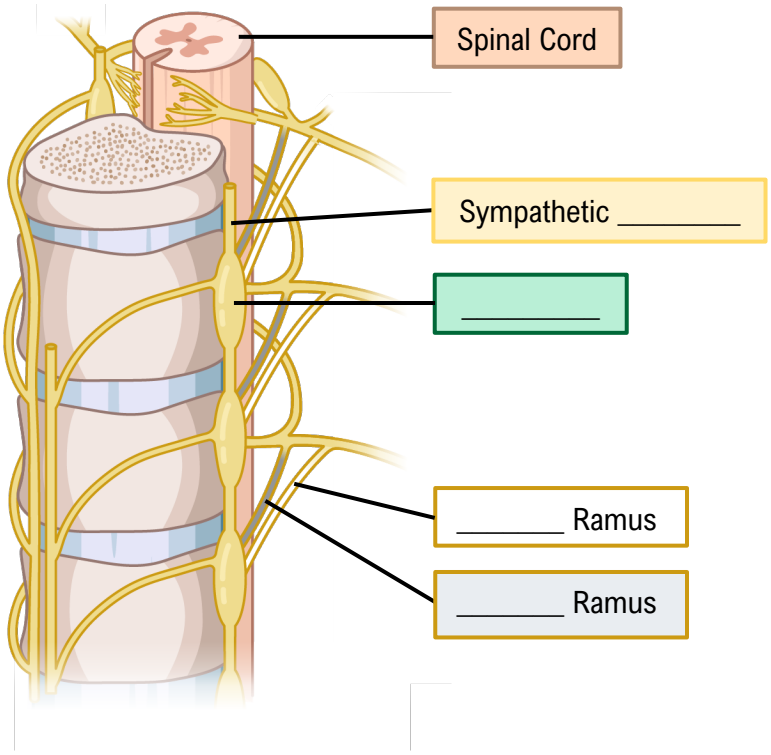
d) Efferent fibers move fastest through.

TOPIC: SYMPATHETIC NERVOUS SYSTEM

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?

a) Spinal cord > postganglionic fiber > ganglion > preganglionic fiber > effector

b) Spinal cord > preganglionic fiber > ganglion > postganglionic fiber > effector

c) Preganglionic fiber > spinal cord > ganglion > postganglionic fiber > effector

d) Preganglionic fiber > ganglion > postganglionic fiber > spinal cord > effector

TOPIC: SYMPATHETIC NERVOUS SYSTEM

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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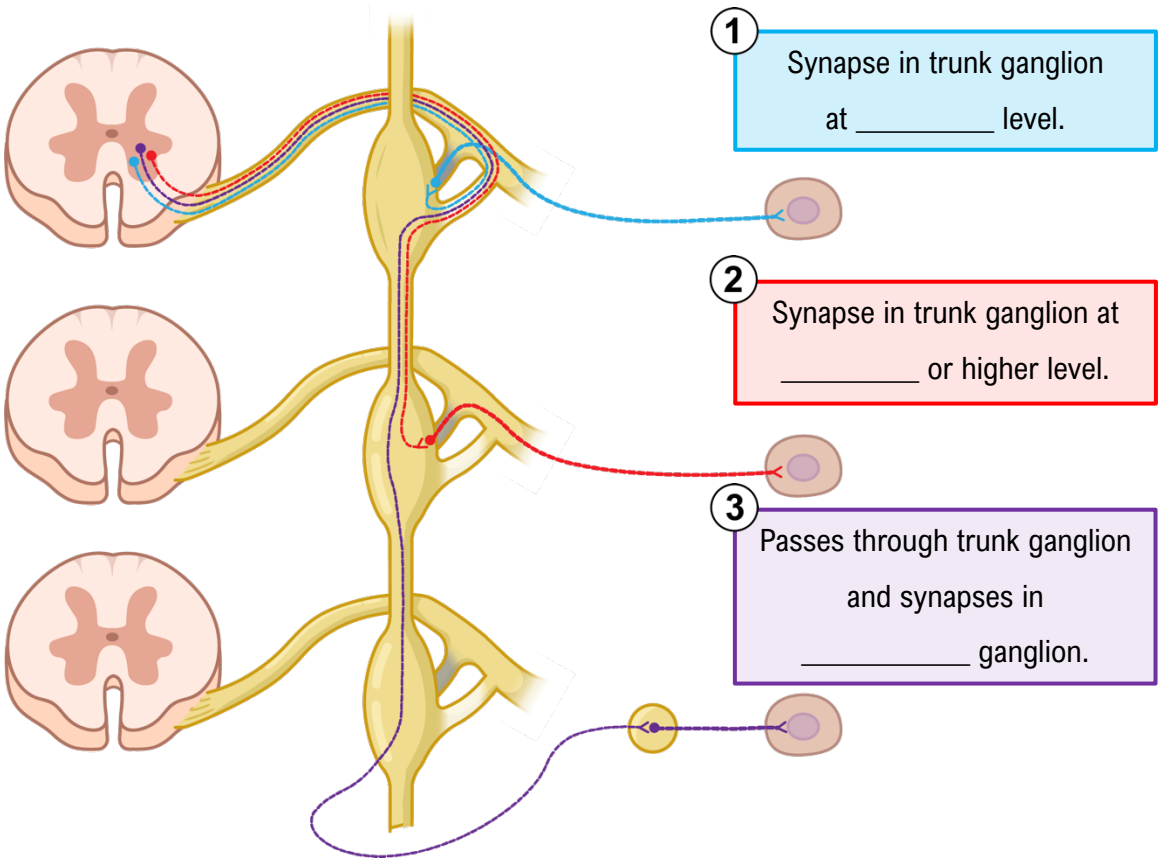
Pathways of Sympathetic Innervation

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

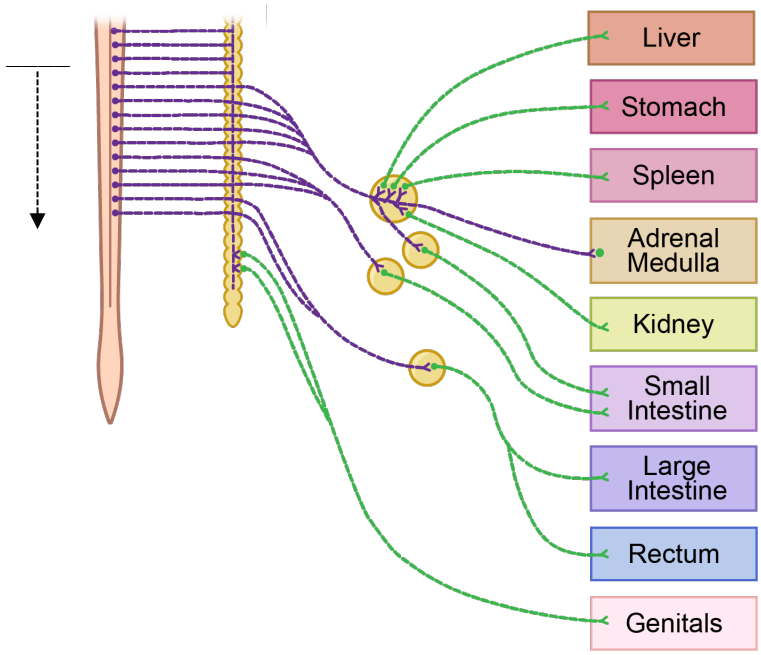
PRACTICE: A preganglionic fiber arriving at the sympathetic trunk could do any of the following **EXCEPT**:

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

TOPIC: SYMPATHETIC NERVOUS SYSTEM

Splanchnic Nerves and the Adrenal Medulla

- Most preganglionic fibers from T_5 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.