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The hope is this organization will become a staple of the Brody student body, exemplifying the unique collaborative community that Brody offers. If this is a mission that aligns with your goals and you have the desire to help those that will come behind you, as well as a goal to leave your mark on Brody as a whole, we invite you to join the team!

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Coursepack Practice Questions

**Autonomic Nervous System**

*Quashawn Chadwick - BSOM class of 2025*

*Ryan Dickerson - BSOM Class of 2025*

Quiz Level

1. The autonomic nervous system is a part of the peripheral nervous system that regulates uncontrolled visceral motor functions, via preganglionic and postganglionic neurons. All cell bodies of preganglionic neurons are located in which of the following anatomical locations?

A) Within the falls of the organs they innervate.

B) Within prevertebral ganglia

C) Within the sympathetic trunks

D) Within the brainstem and spinal cord

E) All of the above

2. The sympathetic ganglia are divided into two sections, paravertebral and prevertebral. Which of the following statements is most true regarding preganglionic sympathetic axons of the prevertebral ganglia?

A) They are closely associated with spinal cord levels T1 to L2.

B) They are unmyelinated

C) They are myelinated

D) They are adrenergic (produce norepinephrine)

E) They do not travel through the sympathetic trunk

3. The parasympathetic nervous system is the branch of the autonomic nervous system responsible for increasing gut motility and facilitating micturition (urination). Parasympathetic nerve fibers contribute to which of the following abdominal structures?

A) Aorticorenal ganglion

B) Celiac ganglion

C) Lumbar splanchnic nerves

D) Pelvic splanchnic nerves

E) Sacral splanchnic nerves

4. Sympathetic fibers that distribute to the body via the paired chain ganglia just lateral to the vertebral column must enter this structure via which of the following?

A) Dorsal root ganglion

B) Anterior ramus

C) White rami communicantes

D) Splanchinic nerve

E) Grey rami communicantes

5. Which of the following best describes the parasympathetic and sympathetic nervous systems respectively?

A) Both have short pre-ganglionic nerves and long post- ganglionic nerves

B) The parasympathetic system has long pre-ganglionic and post ganglionic nerves while the sympathetic system has short pre-/post-ganglionic nerves

C) The parasympathetic system has long pre-ganglionic nerves and short post ganglionic nerves while the sympathetic system has short pre-ganglionic nerves and long post-ganglionic nerves

D) Neither system has noticeable differences in the length of pre-/post-ganglionic nerves

E) The parasympathetic system has short pre-ganglionic nerves and long post ganglionic nerves while the sympathetic system has long pre-ganglionic nerves and short post-ganglionic nerves

**Test Level**

6. A 38-year-old patient presents with a complaint of recurrent episodes of color changes in their fingers and toes upon exposure to cold temperatures or emotional stress. During these episodes, the affected areas become pale, followed by cyanosis, and eventually turn red with associated pain and numbness. Which of the following mechanisms best explains the pathophysiology underlying this condition?

A) Arteriolar dilation due to increased sympathetic vasodilation to the extremities

B) Arteriolar constriction due to decreased sympathetic vasoconstriction to the extremities

C) Arteriolar dilation due to increased parasympathetic vasodilation to the extremities

D) Arteriolar constriction due to increased sympathetic vasoconstriction to the extremities

E) Arteriolar constriction due to decreased parasympathetic vasoconstriction to the extremities

7. A 55-year-old patient presents with a variety of symptoms, including dry mouth, decreased tearing, and impaired digestion. Further evaluation reveals disruption to nervous tissue. The cell bodies for the damaged neurons are most likely located where?

A) Intermedialateral cell column, T1-L2

B) Sympathetic trunk

C) Brainstem, CN 3, 7, 9, 10

D) Anterior horn

E) Sacral region, S2-4

8. A 40-year-old patient presents with symptoms of urinary retention, fecal incontinence, and erectile dysfunction. Which region of the spinal cord/brainstem is primarily associated with the nervous control of the affected structures in this case?

A) Brainstem, CN 3,7,9,10

B) Thoracic region (T1-T12)

C) Lumbar region (L1-L5)

D) Sacral region (S2-S4)

E) Coccygeal region (Co1)

9. A 25-year-old patient presents with ptosis (drooping eyelid), miosis (constricted pupil), anhidrosis (absence of sweating), and apparent enophthalmos (sunken appearance of the eye). These symptoms are suggestive of disruption to the autonomic nervous system division best described by short pre-ganglionic nerves . Which anatomical structure is most likely damaged in this case?

A) Cranial nerve 3 (Oculomotor nerve)

B) Cranial nerve 7 (Facial nerve)

C) Cranial nerve 9 (Glossopharyngeal nerve)

D) Cranial nerve 10 (Vagus nerve)

E) Sympathetic trunk (sympathetic chain)

10. A 45-year-old patient presents with symptoms of disrupted autonomic outflow, such as decreased blood pressure, impaired sweating, and vasodilation. Which anatomical structure is most likely affected in this case?

A) Anterior horn cells

B) Dorsal root ganglia

C) Intermediolateral cell column

D) Splanchinc nerves

E) CN 3, 7, 9, 10

Answer Key

1. **Answer D: Within the brainstem and spinal cord**

Though the autonomic nervous system is considered a branch of the peripheral nervous system, all cell bodies associated with preganglionic neurons are located within the brainstem and spinal cord. A: Postganglionic neuron cell bodies of the parasympathetic branch of the autonomic nervous system can be found within the walls of the organs they innervate. B: prevertebral ganglia are peripheral ganglia associated with the stomach and aorta and are conduits for sympathetic innervation. C: The sympathetic trunk is home to postganglionic cell bodies of sympathetic neurons associated with spinal cord levels T1 to L2. E: there is only 1 correct answer.

2. **Answer C: They are myelinated**

All preganglionic fibers of the sympathetic nervous system leave the spinal cord with somatic motor fibers as a spinal nerve then separate from the spinal nerve and enter the sympathetic chain ganglion via white rami communicantes between the levels of T1 and L2. The white rami communicantes are myelinated fibers. A: The prevertebral ganglia are not associated with the sympathetic trunk unlike other sympathetic fibers. B: The fibers are myelinated, as stated above. D: preganglionic fibers of the autonomic nervous system are always cholinergic. E: Despite not synapsing in the sympathetic chain ganglia, the splanchnic nerves do in fact pass through the sympathetic trunk as they migrate to the prevertebral ganglia.

3. **Answer D: Pelvic Splanchnic Nerves**

Pelvic splanchnic nerves contain parasympathetic fibers from spinal segments S2-S4. All of the other answer choices are constituted by sympathetic nerve fibers or sympathetic neuron cell bodies.

4. **The correct answer is C) White rami communicantes.**

Sympathetic fibers that distribute to the body via the paired chain ganglia, also known as sympathetic trunk ganglia, enter these ganglia through the white rami communicantes. The sympathetic nervous system is responsible for the "fight or flight" response and helps regulate various physiological processes. The sympathetic fibers originate in the intermediolateral cell column of the spinal cord at specific levels. From there, they exit the spinal cord through the ventral root and then immediately enter the white rami communicantes. The white rami communicantes are structures that connect the spinal nerve to the sympathetic chain ganglia. They contain preganglionic sympathetic fibers, which are myelinated and pass through these rami to reach the ganglia located just lateral to the vertebral column. The other options are incorrect: A) Dorsal root ganglion: Dorsal root ganglia contain cell bodies of sensory neurons, not sympathetic efferent fibers. B) Anterior ramus: Anterior rami of spinal nerves contain both sensory and motor fibers, but they do not specifically carry sympathetic fibers to the chain ganglia. D) Splanchnic nerve: Splanchnic nerves are responsible for carrying sympathetic fibers to the prevertebral ganglia, not the chain ganglia. E) Grey rami communicantes: Grey rami communicantes carry postganglionic sympathetic fibers from the chain ganglia to the spinal nerves, but they do not serve as the entry point for sympathetic fibers into the chain ganglia.

5. **The correct answer is C) The parasympathetic system has long pre-ganglionic nerves and short post-ganglionic nerves, while the sympathetic system has short pre-ganglionic nerves and long post-ganglionic nerves.**

The autonomic nervous system is divided into two main branches: the parasympathetic nervous system and the sympathetic nervous system. These two branches have different anatomical characteristics, including the length of their pre- and post-ganglionic nerves. In the parasympathetic system, the preganglionic fibers originate from specific cranial nerves (cranial outflow) or from the sacral spinal cord segments (sacral outflow). The preganglionic fibers are relatively long and extend from the central nervous system (CNS) to ganglia located close to or within the target organs. From these ganglia, short postganglionic fibers then innervate the target tissues or organs. This is why the parasympathetic system is described as having long pre-ganglionic nerves and short post-ganglionic nerves. In contrast, the sympathetic system has its preganglionic fibers originating from the thoracic and lumbar segments of the spinal cord (thoracolumbar outflow). The preganglionic fibers are relatively short and form synapses in the sympathetic chain ganglia, which are located close to the vertebral column. From these ganglia, long postganglionic fibers extend to innervate various target tissues or organs. This is why the sympathetic system is described as having short pre-ganglionic nerves and long post-ganglionic nerves.

6. **The correct answer is D) Arteriolar constriction due to increased sympathetic vasoconstriction to the extremities.**

The clinical presentation described is consistent with Raynaud's syndrome, which is characterized by episodic color changes in the fingers and toes due to vasospasm of the arterioles. During episodes triggered by cold temperatures or emotional stress, there is increased sympathetic nervous system activity leading to excessive vasoconstriction of the small arteries and arterioles supplying the extremities. This results in decreased blood flow, causing the pallor, cyanosis, and subsequent reactive hyperemia observed. Raynaud's syndrome is a disorder characterized by episodes of vasoconstriction in response to cold exposure or emotional stress. The underlying pathophysiology involves exaggerated sympathetic vasoconstrictor responses to these triggers, resulting in spasms of the arterioles and reduced blood flow to the extremities. The initial arteriolar constriction causes pallor (pale color), followed by cyanosis (bluish discoloration) due to decreased oxygenation, and finally reactive hyperemia (red color) as the vessels dilate after the spasm resolves. Recognizing the dysregulation of sympathetic vasoconstriction in Raynaud's syndrome helps in understanding the mechanisms responsible for the characteristic color changes and associated symptoms.

**7. The correct answer is C) Brainstem, CN 3, 7, 9, 10.**

The patient in the scenario is experiencing symptoms related to decreased or impaired function of autonomic fibers, which are responsible for involuntary actions of organs and glands. These symptoms, such as dry mouth, decreased tearing, and impaired digestion, are characteristic of dysfunction in the parasympathetic nervous system. The parasympathetic nervous system, also known as the craniosacral division, includes the cranial nerves (CN) 3 (oculomotor), 7 (facial), 9 (glossopharyngeal), and 10 (vagus). These cranial nerves contain the cell bodies of parasympathetic preganglionic neurons, which are located in the brainstem. CN 3 innervates the smooth muscles of the eye, CN 7 innervates the salivary glands and tear glands, CN 9 innervates the parotid salivary gland, and CN 10 innervates various organs and glands in the thoracic and abdominal cavities. Disruption or damage to the cell bodies of these preganglionic neurons in the brainstem can lead to dysfunction of the parasympathetic nervous system and result in symptoms like those described in the scenario. The other options are incorrect:

A) Intermediolateral cell column, T1-L2: This option refers to the location of the cell bodies of sympathetic preganglionic neurons, not parasympathetic preganglionic neurons. B) Sympathetic trunk: This option refers to the location of sympathetic ganglia, which contain the cell bodies of postganglionic sympathetic neurons, not parasympathetic preganglionic neurons. D) Anterior horn: This option refers to the location of motor neuron cell bodies involved in voluntary motor control, not parasympathetic preganglionic neurons. E) Sacral region, S2-4: This option refers to the location of cell bodies of parasympathetic preganglionic neurons that innervate pelvic organs, not the symptoms described in the scenario.

**8. The correct answer is D) Sacral region (S2-S4).**

The patient in this scenario is experiencing symptoms related to the dysfunction of structures controlled by the autonomic nervous system, specifically the parasympathetic division. The parasympathetic nervous system is responsible for regulating various involuntary functions, including urinary and bowel control, as well as sexual functions. The nerves that control these functions arise from the sacral region of the spinal cord, specifically spinal segments S2-S4. These spinal segments give rise to the parasympathetic preganglionic fibers that innervate the pelvic organs, including the bladder, rectum, and sexual organs. Dysfunction or damage in this region can result in symptoms such as urinary retention, fecal incontinence, and erectile dysfunction, as described in the scenario. The other options are incorrect: A) Brainstem, CN 3, 7, 9, 10: This option refers to the cranial nerves associated with the parasympathetic division, which primarily control functions related to the head and neck, not the symptoms described in the scenario. B) Thoracic region (T1-T12): The thoracic region is primarily associated with the sympathetic nervous system, which is responsible for the "fight or flight" response, not the parasympathetic control of the affected structures in this case.C) Lumbar region (L1-L5): The lumbar region primarily innervates the lower extremities, and although it does contribute to autonomic control, it is not the region primarily associated with the symptoms described in the scenario. E) Coccygeal region (Co1): The coccygeal region is not primarily associated with the nervous control of the affected structures described in the scenario.

9**. The correct answer is E) Sympathetic trunk (sympathetic chain).**

The patient in this case is presenting with a combination of symptoms known as Horner's syndrome, which is characterized by ptosis (drooping eyelid), miosis (constricted pupil), anhidrosis (absence of sweating), and apparent enophthalmos (sunken appearance of the eye). Horner's syndrome is typically caused by disruption or damage to the sympathetic pathway that innervates the head and neck region. The sympathetic pathway responsible for these symptoms includes the preganglionic sympathetic fibers that originate in the intermediolateral cell column of the spinal cord at levels T1-T3. These preganglionic fibers then ascend through the sympathetic trunk (sympathetic chain) without synapsing until they reach the superior cervical ganglion. From there, postganglionic sympathetic fibers travel along blood vessels and other structures to reach various targets, including the eye, eyelid, pupil, and sweat glands.Damage or disruption to the sympathetic trunk, particularly in the region of the superior cervical ganglion, can result in the classic symptoms of Horner's syndrome observed in the patient, including ptosis, miosis, anhidrosis, and apparent enophthalmos. The other options are incorrect:

A) Cranial nerve 3 (Oculomotor nerve): Cranial nerve 3 is primarily responsible for the innervation of the extraocular muscles that control eye movements and pupillary constriction but is not directly involved in the symptoms described in the case. B) Cranial nerve 7 (Facial nerve): Cranial nerve 7 primarily controls the muscles of facial expression and is not directly responsible for the symptoms seen in Horner's syndrome. C) Cranial nerve 9 (Glossopharyngeal nerve): Cranial nerve 9 is involved in functions such as taste sensation and swallowing and is not directly associated with the symptoms seen in Horner's syndrome. D) Cranial nerve 10 (Vagus nerve): Cranial nerve 10, the vagus nerve, has widespread autonomic functions but is not primarily involved in the symptoms described in the case.

10. **The correct answer is C) Intermediolateral cell column.**

The patient in this case is presenting with symptoms of disrupted autonomic outflow, including decreased blood pressure, impaired sweating, and vasodilation. These symptoms suggest an impairment of sympathetic nervous system function, as these are characteristic signs of sympathetic dysfunction. The sympathetic preganglionic neurons responsible for autonomic outflow are located in the intermediolateral cell column (also known as the intermediolateral nucleus) of the spinal cord. This region spans from the first thoracic (T1) to the second lumbar (L2) segments of the spinal cord. The preganglionic sympathetic fibers originate from the cell bodies in this region and form connections with the sympathetic ganglia located in the sympathetic trunk (sympathetic chain) alongside the vertebral column. In this case, the disruption or damage to the intermediolateral cell column would result in a compromised sympathetic outflow, leading to the observed symptoms of decreased blood pressure, impaired sweating, and vasodilation. The other options are incorrect: A) Anterior horn cells: Anterior horn cells are involved in the motor control of skeletal muscles, not autonomic function. B) Dorsal root ganglia: Dorsal root ganglia contain the cell bodies of sensory neurons responsible for transmitting sensory information to the spinal cord, and they are not directly involved in autonomic outflow. D) Splanchinic nerves: The splanchnic nerves are responsible for conveying preganglionic sympathetic fibers to specific abdominal and pelvic organs, but they are not the primary site of disruption in the case described. E) CN 3, 7, 9, 10: Cranial nerves 3, 7, 9, and 10 are primarily involved in the innervation of various structures and functions in the head and neck region, but they are not directly responsible for the symptoms described in this case.