

CHAPTER EIGHTEEN

Answers to WHAT DID YOU LEARN?

1. The autonomic motor pathway involves a series of two neurons in the motor transmission of impulses, while the somatic motor system transmits impulses along a single axon from the spinal cord to the effector cell.
2. The ANS innervates smooth muscle fibers, cardiac muscle fibers, and glands.
3. The cell body of a ganglionic neuron is located in an autonomic ganglion.
4. In the parasympathetic division, the postganglionic axons are relatively short, whereas in the sympathetic division the postganglionic axons are relatively long. They are unmyelinated in both divisions.
5. The preganglionic neurons in the parasympathetic division are housed within nuclei in the brainstem or within the gray matter of spinal cord segments S2–S4.
6. The ganglia in the parasympathetic division are called either terminal ganglia or intramural ganglia. Terminal ganglia are located near the organ being innervated; intramural ganglia are within the wall of the target organ.
7. The cranial nerves involved in cranial outflow from the parasympathetic division of the ANS include the oculomotor (CN III), facial (CN VII), glossopharyngeal (CN IX), and vagus (CN X) nerves.
8. Some of the effects of parasympathetic stimulation include increased secretion of digestive system glands, increased motility (smooth muscle contraction/movement) in digestive tract organs, stimulation of defecation, stimulation and coordination of urination, decreased heart rate, constriction of the pupil of the eye, and erection of the penis or clitoris.
9. The sympathetic preganglionic neurons originate in the lateral horn of the T1–L2 regions of the spinal cord.
10. The bilaterally symmetrical, paired sympathetic chain (paravertebral) ganglia are found anterolateral to the vertebral column. The chain is composed of 3 cervical, 11 thoracic, 4 lumbar, 5 sacral, and 1 coccygeal sympathetic ganglia. Bundles of axons link individual ganglia into long sympathetic chain ganglia (sympathetic trunks), which extend inferiorly from the neck to the coccyx. The prevertebral ganglia, also termed the collateral ganglia, are variable in appearance and located on the external anterior and anterolateral surface of the descending aorta. They differ from the sympathetic chain ganglia in that they (1) are single structures, not paired; (2) are located anterior to the vertebral column on the anterior surface of the aorta; and (3) are located only in the abdominopelvic cavity.
11. White rami communicantes carry preganglionic sympathetic axons (which are myelinated) from the T1–L2 spinal nerves to the sympathetic trunk. The gray rami communicantes carry postganglionic sympathetic axons (which are unmyelinated) from the sympathetic trunk to the spinal nerve.
12. The sympathetic preganglionic axons branch extensively. This broad branching pattern allows the sympathetic nervous system to display great divergence in innervation transmission. A single preganglionic axon innervates as many as 20 or more ganglionic neurons. A greater degree of divergence in this division provides the means to rapidly activate many visceral organs simultaneously. This results in mass activation of almost all the ganglionic sympathetic neurons.

13. The four main sympathetic pathways are the spinal nerve pathway, postganglionic sympathetic nerve pathway, splanchnic nerve pathway, and adrenal medulla pathway.
14. Splanchnic nerves are preganglionic axons that leave the sympathetic chain ganglia without synapsing. These splanchnic nerves exit the anterior side of the sympathetic chain ganglia and extend to prevertebral ganglia. Within the prevertebral ganglia, the preganglionic axon synapses with a ganglionic neuron, and the postganglionic axon travels to the effector organs. Most abdominal organs and some pelvic organs receive their sympathetic innervation via this pathway.
15. The adrenal medulla releases epinephrine and norepinephrine.
16. The sympathetic nerve pathway innervates the heart, esophagus, lungs, and thoracic blood vessels.
17. The structural components of the abdominal aortic plexus are the celiac plexus, superior mesenteric plexus, and inferior mesenteric plexus.
18. The neurotransmitters used in the ANS are acetylcholine (ACh) and norepinephrine (NE).
19. In dual innervation, an effector is innervated by both ANS divisions.
20. Autonomic reflexes maintain the body state known as homeostasis.
21. The hypothalamus is the integration and command center for autonomic functions. It contains nuclei that control visceral functions in both divisions of the ANS, and it communicates with other CNS regions, including the cerebral cortex, thalamus, brainstem, cerebellum, and spinal cord. The hypothalamus is the central brain structure involved in emotions and drives that act through the ANS. For example, the sympathetic nervous system fight-or-flight response originates in the sympathetic nucleus in this brain region.