

# 454 Disorders of the Autonomic Nervous System

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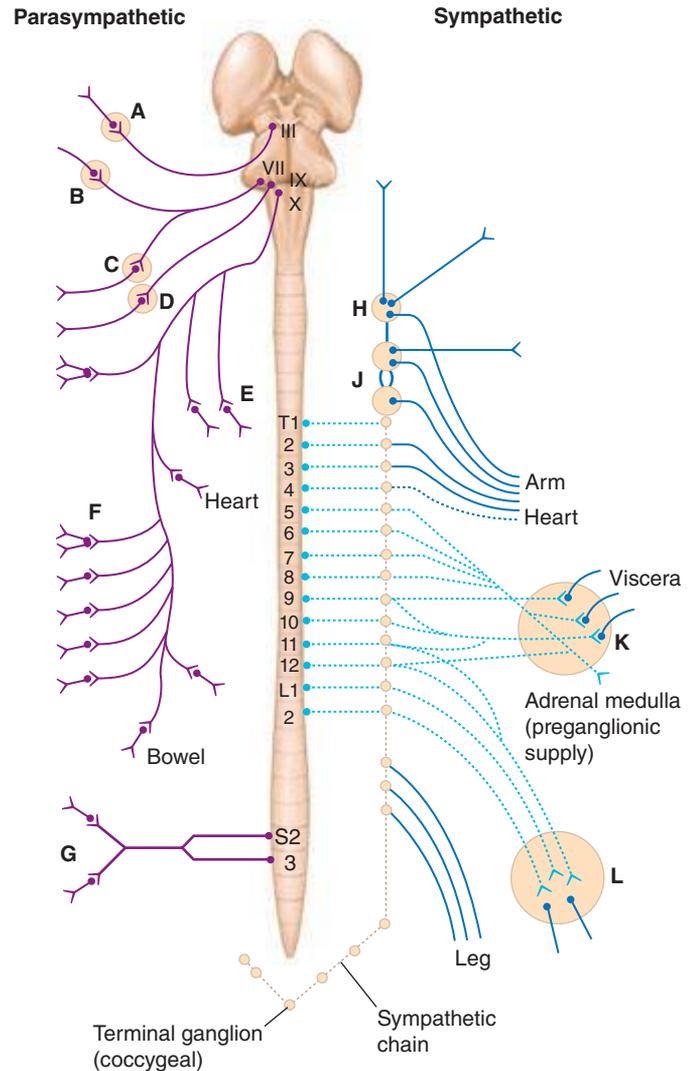
The autonomic nervous system (ANS) innervates the entire neuraxis and influences all organ systems. It regulates blood pressure (BP), heart rate, sleep, and bladder and bowel function. It operates automatically; its full importance becomes recognized only when ANS function is compromised, resulting in dysautonomia. **Hypothalamic disorders that cause disturbances in homeostasis are discussed in Chaps. 23 and 401e.**

## ANATOMIC ORGANIZATION

The activity of the ANS is regulated by central neurons responsive to diverse afferent inputs. After central integration of afferent information, autonomic outflow is adjusted to permit the functioning of the major organ systems in accordance with the needs of the whole organism. Connections between the cerebral cortex and the autonomic centers in the brainstem coordinate autonomic outflow with higher mental functions.

The preganglionic neurons of the parasympathetic nervous system leave the central nervous system (CNS) in the third, seventh, ninth, and tenth cranial nerves as well as the second and third sacral nerves, while the preganglionic neurons of the sympathetic nervous system exit the spinal cord between the first thoracic and the second lumbar segments (Fig. 454-1). These are thinly myelinated. The postganglionic neurons, located in ganglia outside the CNS, give rise to the postganglionic unmyelinated autonomic nerves that innervate organs and tissues throughout the body. Responses to sympathetic and parasympathetic stimulation are frequently antagonistic (Table 454-1), reflecting highly coordinated interactions within the CNS; the resultant changes in parasympathetic and sympathetic activity provide more precise control of autonomic responses than could be achieved by the modulation of a single system.

Acetylcholine (ACh) is the preganglionic neurotransmitter for both divisions of the ANS as well as the postganglionic neurotransmitter



**Parasympathetic system**  
from cranial nerves III, VII, IX, X  
and from sacral nerves 2 and 3

**Sympathetic system**

from T1-L2  
Preganglionic fibers .....  
Postganglionic fibers ———

- A Ciliary ganglion
- B Sphenopalatine (pterygopalatine) ganglion
- C Submandibular ganglion
- D Otic ganglion
- E Vagal ganglion cells in the heart wall
- F Vagal ganglion cells in bowel wall
- G Pelvic ganglia

- H Superior cervical ganglion
- J Middle cervical ganglion and inferior cervical (stellate) ganglion including T1 ganglion
- K Coeliac and other abdominal ganglia
- L Lower abdominal sympathetic ganglia

**FIGURE 454-1** Schematic representation of the autonomic nervous system. (From M Moskowitz: *Clin Endocrinol Metab* 6:77, 1977.)

of the parasympathetic neurons; the preganglionic receptors are nicotinic, and the postganglionic are muscarinic in type. Norepinephrine (NE) is the neurotransmitter of the postganglionic sympathetic neurons, except for cholinergic neurons innervating the eccrine sweat glands.

## CLINICAL EVALUATION

### CLASSIFICATION

Disorders of the ANS may result from pathology of either the CNS or the peripheral nervous system (PNS) (Table 454-2). Signs and symptoms may result from interruption of the afferent limb, CNS