Chapter 16: Autonomic Nervous System

I. Contrasting the Somatic and Autonomic Nervous Systems

A. Neurons

1. Somatic motor neurons innervate _____
2. Autonomic motor neurons innervate:
   a. _____
   b. _____
   c. _____

B. Pathways

1. Somatic neurons:
   a. Have cell bodies in _____
   b. Axons extend from _____ to _____
   c. The effect of somatic neurons on skeletal muscle is always _____
2. The ANS pathway has _____ in a series from _____ to _____
   a. The first neuron is called _____
      1. Their cell bodies are located in _____
      2. Their axons extend to _____ located _____
   b. The second neuron is called _____
      1. Their cell bodies are located in _____
      2. Their axons extend to _____ where _____
   c. The effect of autonomic neurons on target tissues can be:
      1. _____ or
      2. _____

II. Anatomy of the Autonomic Nervous System

A. Sympathetic Division

1. Cell bodies of preganglionic neurons are in _____ between _____ and the _____
   a. Therefore this division is sometimes also called _____
2. The axons exit through the ventral root and pass to the _____ ganglia

3. What is the “white ramus communicans”? _____
    a. Axons of which neurons are found here? _____
4. Sympathetic axons exit the sympathetic chain by four routes:
    a. Axons of postganglionic neurons pass through _____ and reenter a _____
        1. The axons project through the spinal nerve to _____
    b. The axons of postganglionic neurons form _____
    c. Preganglionic neurons pass through the sympathetic chain without synapsing and exit as _____
        1. These nerves extend to _____
        2. The preganglionic neurons synapse here with _____
        3. The postganglionic neurons form small nerves that _____
    d. Preganglionic neurons go to adrenal medulla without _____
        1. The cells of the adrenal medulla came from the same cells in the embryo that formed _____
            a. About 80% of these cells secrete _____
            b. About 20% of these cells secrete _____
        2. Stimulation of the adrenal medulla by preganglionic neurons results in _____
        3. Functionally these substances prepare the body for _____

B. Parasympathetic Division
1. Cell bodies of preganglionic neurons are located:
    a. Within _____ in the brainstem
    b. Within _____ from _____ to _____
    c. Therefore this division is sometimes called _____
2. Which cranial nerves contain parasympathetic preganglionic axons? _____
3. Where are the terminal ganglia located? _____
4. Postganglionic neurons extend from terminal ganglia to _____

C. Enteric Nervous System
1. The enteric nervous system consists of _____

2. The plexuses have contributions from:
    a. _____
    b. _____
    c. _____
3. Enteric sensory neurons _____
4. Enteric motor neurons _____
5. Enteric interneurons _____

D. The Distribution of Autonomic Nerve Fibers
1. Sympathetic Division
    a. What is an autonomic nerve plexus? _____
    b. Typically an autonomic nerve plexus is named for:
        1. _____ or
        2. _____
    c. Spinal nerves from all levels of the sympathetic chain:
        1. Postganglionic axons project through _____
        2. Axons extend to _____ by spinal nerves
        3. Supply:
            a. _____ in the skin
            b. _____ in skeletal and skin blood vessels
            c. _____ of the arrector pili
    d. Head and neck nerve plexuses:
        1. Derived from the _____
        2. Supply:
            a. _____ in the skin
            b. _____ in skeletal and skin blood vessels
            c. _____ of the arrector pili
        3. Axons from the plexuses also join the trigeminal nerve to supply:
            a. _____ of the face
            b. _____ glands
            c. _____ &
            d. _____ of the eye

e. Thoracic nerve plexuses:
    1. Derived from _____ & _____
    2. Postganglionic axons contribute to:
        a. _____ supplying the _____
        b. _____ supplying the _____
        c. and other thoracic plexuses
f. Abdominopelvic nerve plexuses:
    1. Derived from sympathetic chain ganglia from _____
    2. Postganglionic axons from the collateral ganglia innervate _____ & _____ in the abdominopelvic organs

2. Parasympathetic Division
    a. Cranial nerves supplying the head and neck:
        1. Oculomotor nerve supplies _____ & _____ of the eye
        2. Facial nerve supplies:
            a. _____ gland
            b. _____ of the nasal cavity and palate
            c. _____ & _____ gland
        3. Glossopharyngeal nerve supplies _____ gland
    b. The vagus nerve and thoracic nerve plexuses:
        1. Contribute to the _____ which supplies _____
        2. Contribute to the _____ which supplies _____
        3. Also forms the _____ plexus
    c. Abdominal nerve plexuses:
        1. What structures in the abdominopelvic cavity are supplied?

           _____
    d. Pelvic nerves and pelvic nerve plexuses:
        1. The cell bodies are in the _____ of the spinal cord
        2. What structures are supplied by the pelvic plexus? _____

           _____
        3. What structures are supplied by the hypogastric plexus? _____

           _____

III. Physiology of the Autonomic Nervous System

A. Neurotransmitters

1. What neurotransmitter is secreted by a “cholinergic neuron”? _____
2. What neurotransmitter is secreted by an “adrenergic neuron”? _____
3. Which three autonomic neurons are cholinergic?
    a. _____
    b. _____
    c. _____
4. Which autonomic neuron is adrenergic? _____
    a. An exception to this is neurons innervating _____

B. Cholinergic Receptors

1. List the two structural types of cholinergic receptors:
    a. _____
    b. _____
2. Which type of receptor is found on the membranes of all postganglionic neurons? _____
3. Which type of receptor is found on the membranes of effector cells that respond to acetylcholine? _____
4. When acetylcholine binds to nicotinic receptors it has an _____ because it results in _____ & _____
5. When acetylcholine binds to muscarinic receptors the cell's response is _____ through _____
    a. Depending on the target tissue the response will be _____

C. Adrenergic Receptors

1. What chemicals bind to adrenergic receptors? _____
2. Adrenergic postganglionic neurons of the sympathetic division release _____ as a neurotransmitter which diffuses across the synapse
3. What chemicals are released by the adrenal glands? _____
    a. These reach adrenergic receptors through _____
4. The response of adrenergic receptors is mediated through _____

5. List the four types of adrenergic receptors:
    a. _____
    b. _____
    c. _____
    d. _____
6. Which receptors normally create a stimulatory response? _____
7. Which receptors are generally found in the vicinity of sympathetic nerve terminals? _____
8. Which receptors generally are not near nerve terminals and therefore respond to secretions from the adrenal glands? _____

IV. Regulation of the Autonomic Nervous System

A. Autonomic Reflexes
    1. List the structural components of an autonomic reflex:
        a. _____
        b. _____
        c. _____
        d. _____
        e. _____
    2. Baroreceptors in the walls of large arteries detect _____
        a. What part of the brain integrates this information? _____
    3. A sudden increase in blood pressure initiates a _____ reflex that _____ & _____
    4. A sudden decrease in blood pressure initiates a _____ reflex which _____ & _____

B. Control Centers for Autonomic Reflexes
    1. What part of the brain is in overall control of the ANS? _____
        a. Which part produces sympathetic responses? _____
        b. Which part produces parasympathetic responses? _____
    2. Which system plays an important role in emotions? _____
        a. Pleasant thoughts generally stimulate _____ neurons

b. Emotions like anger generally stimulate _____ neurons

C. Enteric Nervous System

1. What supplies information to the CNS about intestinal contents? _____

_____

2. ANS neurons to the enteric plexuses effect _____

_____

3. Neurons of the enteric nervous system can operate independently of the CNS through _____

V. Functional Generalizations About the Autonomic Nervous System

A. Stimulatory Versus Inhibitory Effects

1. Does one division of the ANS produce only stimulatory effects? _____
2. Does one division of the ANS produce only inhibitory effects? _____

B. Dual Innervation

1. The term dual innervation refers to the fact that most organs are innervated by both the _____ & _____ division
2. Do all viscera have dual innervation from the ANS? _____
3. Does dual innervation mean equal control by both divisions? _____

C. Opposite Effects

1. Explain what "opposite effects" refers to if a single structure is innervated by both divisions of the ANS: _____

_____

D. Cooperative Effects

1. Explain "cooperative effects" when one division of the ANS is involved?

_____

2. Explain "cooperative effects" when two divisions of the ANS are involved?

_____

E. General Versus Localized Effects

1. Which division of the ANS has a more general effect on the entire body?

_____

a. What role does the adrenal medulla play in this? _____

_____

b. What role does neuron divergence play in this? _____

_____

c. Sympathetic stimulation often activates _____ at the same time

F. Functions at Rest Versus Activity

1. Which ANS division has a greater influence during physical activity?

_____

2. Which ANS division has a greater influence during resting conditions?

_____

3. What does "fight-or-flight response" refer to? _____

_____

4. What does "SLUDD" stand for? _____

_____