CHAPTER 11  NERVOUS TISSUE

Control Systems

- nervous system
  - sensation info in
  - motor info out
  - integration processing, memory

- endocrine system

Structural divisions of Nervous System

- Central nervous system (CNS)
  - brain
  - spinal cord

- Peripheral nervous system (PNS)
  - spinal nerves
  - cranial nerves

Functional division of nervous system

- direction:
  - sensory = afferent info toward CNS gets stimulated
  - motor = efferent info from CNS responds

- connection:
  - somatic skin, muscles
  - visceral organs

Functional division of nervous system

- somatic sensory

- visceral sensory

- somatic motor

- visceral motor to cardiac and smooth muscle, glands
  = Autonomic nervous system

Division of Nervous System

- Central nervous system (CNS)
  - brain
  - spinal cord

- Peripheral nervous system (PNS)
  - spinal nerves sensory somatic visceral motor somatic visceral = ANS
  - cranial nerves sensory somatic visceral motor somatic visceral
• stimulus change in conditions excites a neuron
• impulse wave of excitation along the neuron

Cells of the nervous system
• neurons conduct impulse
• neuroglia supportive cells don’t conduct impulse

Neuron anatomy
• cell body = soma
  – nucleus + organelles
• dendrite impulse starts
  – receptors specialized for different sensations
• axon transmits impulse
  – axon hillock “threshold” for action potential
  – axon terminal release neurotransmitter

• impulse – one direction
  • dendrite → axon → axon terminal
• amitotic

cell bodies
• cell body = soma
• ganglion cluster of cell bodies in PNS
• nucleus cluster of cell bodies in CNS

need for speed!
• myelin covers most of axon
• increases speed of impulse
• insulates neurons
  • Node of Ranvier – gap between myelin bundles

  • PNS – Schwann cells produce myelin
    – Schwann cells + myelin = neurilemma
  • CNS – myelin made by oligodendrocytes

CNS tissue
• gray matter
  – neuron cell bodies
  – unmyelinated interneurons
  – synapses
• white matter
  – myelinated axons
  – brain and spinal cord

synapse
• synapse = space between neurons
  space between neuron and effector cells
• pre-synaptic neuron
  — axon terminal end of axon
  — releases neurotransmitter
• post-synaptic neuron
  — dendrite, cell body, or axon
• neurotransmitter
  — chemical released by pre-synaptic axon terminal
  — stimulates post-synaptic neuron (or muscle)

structural classes of neurons
• based on number of processes from the cell body
  • multipolar multiple dendrites + 1 axon
    all motor neurons; interneurons
  • bipolar 1 dendrite + 1 axon
    sensory - eye, smell
  • unipolar 1 process - short dendrite; long axon
    most sensory neurons
      • peripheral process
      • central process
      • = pseudounipolar

supporting cells
• CNS neuroglia cells
  — astrocytes blood-brain barrier
  — microglia phagocytes (defense)
  — ependymal cells produce cerebrospinal fluid
  — oligodendrocytes produce myelin sheaths
• PNS
  — satellite cells support cell bodies
  — Schwann cells surround axons; produce myelin

nerve terms
• neuron 1 cell
• nerve fiber 1 axon
• nerve fascicles groups of like axons
• nerve many axons + connective tissue
  mixed = sensory + motor PNS
  • endoneurium areolar ct around each axon
  • perineurium ct around each fascicle
  • epineurium fibrous ct around entire nerve
• tract axon bundles in CNS

Connections
• integration sensory neuron meets motor neuron
• connection usually in CNS
• 2 neurons
  — sensory + synapse + motor
• 3 neurons
  — sensory + interneuron + motor
• networks
  — sensory + many interneurons + motor

reflex

• automatic response to a stimulus
• involuntary w/o conscious control
• unlearned
• somatic reflexes skeletal muscle response
  hot stove
  tendon reflexes
  scared
• visceral reflexes organ response, glands
  cardiac or smooth muscles
  heart rate
  blood pressure
  pupil constriction

reflex arc

• receptor receives stimulus
  skin, muscle, organ
• sensory neuron afferent to CNS
• integration center synapse, interneurons in CNS
  spinal cord or brain
• motor neuron efferent to effector
• effector muscle or gland

reflex examples

• stretch reflex DTR
  • stimulus stretch muscle (spindles)
  • motor muscle contraction
  • monosynaptic
• withdrawal reflex
  • stimulus pain, temperature, light, sound
  • motor muscle (flexors) contraction
  • polysynaptic
• visceral reflex motor to organs

CNS = integration centers

CNS is connection between sensory and motor
  synapse
  1 interneuron
  many interneurons

appropriate response to stimulus