A. PNS = cranial and spinal nerves

PNS provides connections between body and CNS
- sensory vs motor
- visceral vs somatic

PNS components:

1. sensory receptors -
   - monitor changes in environment (stimuli)
   - convert stimuli into signals sent viA sensory neurons to CNS

2. motor endings - control effectors

   a. somatic
      - axon terminal of somatic motor neuron contains neurotransmitter (ACh) stored in vesicles
      - motor end plate of skeletal muscle cell folded for large surface area; contains ACh receptors

   b. visceral
      - visceral motor axon has varicosities containing vesicles of neurotransmitter
      - membrane of effector cell contains receptors for the neurotransmitters

3. nerves and ganglia - connect CNS to receptors and motor endings

B. classification of receptors

1. by structure

a. specialized dendritic endings of sensory neurons used for general senses

free / unencapsulated
example: root hair plexus (also called hair follicle receptor)

encapsulated - dendrites enclosed in c.t. capsule that amplifies or filters stimuli
example: Pacinian corpuscle

b. receptor cells (specialized epithelial cells or neurons) that synapse with dendrites of afferent neurons \

used for special senses

2. by location of stimulus

a. exteroceptor
b. interoceptor
c. proprioceptors are located in skeletal muscles, tendons, joints and ligaments
they monitor the position and movement of the body
muscle spindles
Golgi tendon organs
joint kinesthetic receptors

3. by type of stimulus detected

a. mechanoreceptor - stretch, pressure, bending

b. thermoreceptor - heat

c. chemoreceptor - oxygen, pH

d. photoreceptor - light

e. nocireceptor - tissue damage

d. osmoreceptor - osmotic pressure

C. muscle spindles - monitor muscle length via stretch
embedded in perimysium
used for maintaining normal muscle tone, posture and balance

- contain modified muscle cells (intrafusal fibers) that have smaller diameters than regular skeletal muscle cells (extrafusal fibers)

- intrafusal fibers are inside the capsule and extrafusal fibers are outside the capsule
- primary and secondary sensory endings innervate intrafusal fibers and monitor the amount of stretch
- gamma efferent (motor) endings innervate the intrafusal fibers and preset their sensitivity to stretch
- alpha efferent (motor) endings innervate the extrafusal fibers and make them contract when the muscle spindle is stretched

D. cranial nerves

most cranial nerves contain the axons of both sensory and motor neurons
the cell bodies of the sensory neurons are located
in sensory organs
in cranial sensory ganglia near the brain (comparable to dorsal root ganglia of spinal nerves)
the cell bodies of motor neurons are located in gray matter (nuclei) in the brain stem

use diagram provided to draw cranial nerve roots

1. primarily sensory: I, II, VIII
no motor nucleus in brain stem
location of sensory cell bodies:
I - olfactory - olfactory epithelium
II - optic - retina
VIII - vestibular - vestibular ganglion near inner ear
VIII - cochlear - spiral ganglion in cochlea of inner ear

2. primarily motor: III, IV, VI, XI, XII

3. mixed (both sensory and motor): V, VII, IX, X

E. spinal nerves

1. general structure
   - nerve connected to spinal cord by dorsal and ventral roots
   - one pair per spinal segment
   - dorsal root carries sensory signals into the spinal cord
   - dorsal root ganglion = swelling in dorsal root where cell bodies of sensory neurons are located
   - ventral root carries motor signals away from the spinal cord
   - cell bodies of axons in ventral root are in lateral and ventral gray matter of spinal cord
   - each spinal nerve leaves the vertebral canal via an intervertebral foramen

2. classification by region

cervical – C1 – C8

thoracic – T1 – T12

lumbar – L1 – L5

sacral – S1 – S5

coccygeal – Co1

3. rami

after leaving the spinal column each spinal nerve branches into rami (sing. = ramus)
dorsal rami supply dorsum of trunk
ventral rami supply anterolateral trunk and limbs and form plexuses
rami communicantes (autonomic rami) connect spinal nerves to autonomic ganglia

4. spinal nerve plexuses

ventral rami form spinal nerve plexuses (networks)

fibers from several spinal nerves intermingle in the plexus, and recombine to form different nerves that innervate (primarily) the limbs

cervical - C1-C5

phrenic (C3-5) controls the diaphragm

brachial - C5-T1

musculotaneous (C5-7) controls the biceps brachii m.

lumbar - L1-L4

femoral (L2-4) controls the quadriceps femoris m.

sacral - L4 - S4

sciatic (L4-S3) controls muscles on posterior thigh and leg