Spinal Cord and Spinal Nerves

Explain spinal cord anatomy, including gray and white matter and meninges (give the general functions of this organ).

Discuss the structure and functions of the spinal nerves and plexuses.

Describe the structural components of reflexes.
Adult spinal cord:

- Resides inside vertebral canal
- Extends to L1/ L2
- 31 segments, each associated with a pair of dorsal root ganglia
- Two enlargements
1. Cervical Enlargement

Gray matter expanded to incorporate more sensory input from limbs and more cell bodies for motor control of limbs
Spinal Meninges

Three membranes surround all of CNS

1) **Dura mater** - "tough mother", strong
2) **Arachnoid** - spidery looking, carries blood vessels, etc.
3) **Pia mater** - "delicate mother", adheres tightly to surface of spinal cord
- **Conus medullaris** - inferior end of spinal cord proper
- **Cauda equina** - individual spinal nerves within spinal canal
- **Filum terminale** - filamentous end of meninges, "tie-down"
For clinical examination of CSF or administration of radiopaque dyes, drugs and sometimes anesthetics

However: mostly "epidurals" for anesthetics
Organization of Cord Cross Section

Gray matter - interior horns
- posterior - somatic and visceral sensory nuclei
- anterior (and lateral) gray horns – somatic and visceral motor control
- gray commissures - axons carrying information from side to side

White matter - tracts or columns
- posterior white column
- anterior white column
- lateral white column
- anterior white commissure

functions
- ascending tracts - sensory toward brain
- descending tracts - motor from brain

Fig 14-5
Peripheral Nerves

Definition: bundles of axons. AKA tracts in CNS

Organization – coverings:

Epineurium
  wraps entire nerve

Perineurium
  wraps fascicles of tracts

Endoneurium
  wraps individual axons
Anatomy of a Peripheral nerve

*Function:*
sensory - afferent
motor - efferent
mixed - contains axons of both

- Blood vessels
- Perineurium (around one fasciculus)
- Endoneurium
- Myelinated axon
Organization of Spinal Nerves:

1. **Root** – inside vertebral canal
   a. dorsal sensory root with a ganglion
   b. ventral motor

2. **Mixed spinal nerve**

3. **Rami**
   a. dorsal - mixed to skin and muscles of back
   b. ventral - mixed “spinal nerve” to ventrolateral body surfaces and limbs
   c. *white ramus communicans* motor ANS
   d. *gray ramus communicans* motor ANS
Dermatomes

- Sensory innervations by specific spinal nerves ⇒ Each pair of spinal nerves monitors specific region of body surface.

- Clinical significance?
4 Principal Plexuses

Braids of ventral rami of **cervical, thoracic, lumbar** or **sacral** spinal nerves

**Cervical Plexus**

- Phrenic nerve
- Innervates diaphragm
Musculocutaneous nerve - innervates biceps and brachialis muscles

Median nerve - innervates lateral flexors

Ulnar nerve - innervates medial flexors

Radial nerve - innervates forearm extensors

study in lab!!
Reflexes

Fast, stereotypical, inborn, protective actions

Occur at spinal cord or brainstem levels

May be either monosynaptic or polysynaptic

All require
a. stimulus at receptor
b. sensory information relay
c. processing at CNS level
d. activation of motor response
e. response of peripheral effector

Examples?
Shingles

- **Varicella-zoster virus** (of the herpes family)
- In dorsal root ganglia and cranial nerves
- Initial infection: chicken pox

[Image of dermatological condition]

[Website link: www.fisiokinesiterapia.biz]