Chapter 13
Spinal Cord, Spinal Nerves and Somatic Reflexes

- Spinal cord
- Spinal nerves
- Somatic reflexes

Gross Anatomy of Lower Spinal Cord

Meninges of Vertebra & Spinal Cord

Spina Bifida

- Congenital defect in 1 baby out of 1000
- Failure of vertebral arch to close covering spinal cord
- Mothers can reduce risk by taking folic acid supplement during pregnancy
Cross-Sectional Anatomy of the Spinal Cord

- Central area of gray matter shaped like a butterfly and surrounded by white matter in 3 columns

Gray Matter in the Spinal Cord

- Pair of dorsal or posterior horns
- Pair of ventral or anterior horns
- Connected by gray commissure punctured by a central canal continuous above with 4th ventricle

White Matter in the Spinal Cord

- White column = bundles of myelinated axons that carry signals up & down

Spinal Tracts

- Ascending & descending tract head up or down while decussation means that the fibers cross sides
- Contralateral means origin and destination are on opposite sides while ipsilateral means on same side

Dorsal Column Ascending Pathway

Spinothalamic Pathway
Spinocerebellar Pathway

• Proprioceptive signals in limbs and trunk travel up to the cerebellum
• Second order nerves ascend in lateral column

Corticospinal Tract

Descending Motor Tracts

• Tectospinal tract
  – reflex movements of head
• Reticulospinal tract
  – controls limb movements important to maintain posture
• Vestibulospinal tract
  – postural muscle activity in response to inner ear signals

Anatomy of a Nerve

• A nerve is a bundle of nerve fibers (axons)
• Epineurium covers nerves, perineurium surrounds a fascicle & endoneurium separates individual nerve fibers
• Blood vessels penetrate only to the perineurium

Anatomy of Ganglia in the PNS

• Cluster of neuron cell bodies in nerve in PNS
• Dorsal root ganglion is sensory cell bodies
  – fibers pass through without synapsing
Branches of a Spinal Nerve

Spinal nerves: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral and 1 coccygeal.
Each has dorsal and ventral ramus.

Shingles

- Skin eruptions along path of nerve
- Varicella-zoster virus (chicken pox) remains for life in dorsal root ganglia
- Occurs after age 50 if immune system is compromised
- No special treatment

Nerve Plexuses

- Ventral rami branch & anastomose repeatedly to form 5 nerve plexuses
  - cervical in the neck, C1 to C5
    - supplies neck and phrenic nerve to the diaphragm
  - brachial in the armpit, C5 to T1
    - supplies upper limb and some of shoulder & neck
  - lumbar in the low back, L1 to L4
    - supplies abdominal wall, anterior thigh & genitalia
  - sacral in the pelvis, L4, L5 & S1 to S4
    - supplies remainder of butt & lower limb
  - coccygeal, S4, S5 and C0

Structure of a Nerve Plexus

- Notice the branching and merging of nerves in this example of a plexus

The Cervical Plexus

The Brachial Plexus
Dissection of the Brachial Plexus

The Lumbar Plexus

The Sacral and Coccygeal Plexuses

Cutaneous Innervation & Dermatomes

Nature of Somatic Reflexes

The Muscle Spindle
The Stretch (Myotatic) Reflex

• When a muscle is stretched, it contracts & maintains increased tonus (stretch reflex)
  – helps maintain equilibrium & posture
  – head starts to tip forward as you fall asleep
  – muscles contract to raise the head
  – stabilize joints by balancing tension in extensors & flexors

• Very sudden muscle stretch causes tendon reflex
  – knee-jerk (patellar) reflex is monosynaptic reflex
  – testing somatic reflexes helps diagnose many diseases

• Reciprocal inhibition prevents muscles from working against each other

The Patellar Tendon Reflex Arc

Flexor Withdrawal Reflexes

• Flexor(withdrawal) reflex occurs during withdrawal of foot from pain
  – polysynaptic reflex arc
  – neural circuitry in spinal cord controls sequence and duration of muscle contractions

Crossed Extensor Reflexes

• Crossed extensor reflex maintains balance by extending other leg
  – intersegmental reflex extends up and down the spinal cord
  – contralateral reflex arcs explained by pain at one foot causes muscle contraction in other leg

Golgi Tendon Reflex

• Proprioceptors in a tendon near its junction with a muscle -- 1mm long, encapsulated nerve bundle
• Excessive tension on tendon inhibits motor neuron
  – muscle contraction decreased
• Also functions when muscle contracts unevenly

Spinal Cord Trauma

• 10-12,000 people/ year are paralyzed
• 55% occur in traffic accidents
• This damage poses risk of respiratory failure
• Early symptoms are called spinal shock
• Tissue damage at time of injury is followed by post-traumatic infarction