Notes for Wednesday September 25, 2002

Outline
• Synapses
• Integration
• Spinal cord:
  • General functions
  • Anatomy - external & internal
  • Meninges

Chemical synapses Fig. 12.14
• AP arrives at synaptic end bulb (presynaptic membrane)
• Depolarization causes Ca+ channels to open
• Exocytosis of synaptic vesicles
• Neurotransmitter released into synaptic cleft

• Diffusion across cleft
• Binds to receptors on ligand ion specific channels => channels open
• Postsynaptic membrane potential altered: closer to threshold (excitatory) or away from threshold (inhibitory)

Postsynaptic potentials
• Excitatory postsynaptic potential = EPSP: membrane potential moves towards threshold => graded potential
• Inhibitory postsynaptic potential = IPSP: membrane potential moves away from threshold

Things to remember
• Chemical synapse:
  — is in ONE direction
  — is slower
  — neurotransmitter is only in the presynaptic neuron

Removal of neurotransmitter
- Diffusion
- Enzymatic breakdown e.g. acetycholinesterase (AChE)
- Reuptake

**Problems with synapses**
- What happens if neurotransmitter isn’t removed?

**Neurotransmitters**
- Acetylcholine (ACh):
  - Cholinergic synapses
- Norepinephrine (NE) = noradrenaline:
  - Adrenergic synapses
- Dopamine
- Serotonin

**Neural Integration Fig. 12.15**
- Summation = mechanism responsible for integration of EPSP’s & IPSP’s
- Spatial summation = multiple synapses that act simultaneously
- Temporal summation = single synapse that acts repeatedly

**Spinal Cord**
- Conveys sensory information from PNS to brain
- Conveys motor information from brain to PNS
- Processes sensory information in a limited manner: reflexes

**Structure**
- Located in vertebral canal of vertebral column
- Extends from inferior part of the brain stem to vertebra L2 Conus medullaris
- Filum terminale
- Cauda equina
• 4 main regions
• Cervical & lumbar enlargements
• 31 pairs of nerves extend out/in

• Dorsal roots & ganglia => sensory
• Ventral roots => motor
• Spinal nerves are mixed

Protection of S.C.
• Vertebral column (bone)
• Epidural space (adipose)
• Meninges (connective):
  Dura mater (dense irregular)
  Subdural space ? (interstitial fluid)

• Arachnoid (web of collagen & elastic fibers)
• Subarachnoid space (cerebrospinal fluid = CSF)
• Pia mater (connective tissue w/blood vessels) binds to underlying nervous tissue
• Denticulate ligaments

Cerebrospinal Fluid (CSF)
• Provides cushioning & protection of CNS
• Delivers nutrients & removes wastes
• Used for diagnostic purposes

Meningitis
• Inflammation of the meninges
• Viral or bacterial
• Pressure on spinal cord

Spinal tap = Lumbar puncture
• Removal of CSF at 3-5 lumbar vertebra
— Diagnostic
— Administer medication
— Contrast medium
— Measure pressure

**Internal Anatomy**

- White matter: myelinated axons
- Gray matter: un-myelinated fibers & nuclei (cell bodies)
- Central canal - CSF

**Gray Matter**

- Four regions:
  - Anterior horns: nuclei of MOTOR neurons
  - Posterior horns: interneurons and SENSORY axons

**White Matter**

- Anterior; posterior & lateral white columns:
  Ascending TRACTS
  Descending TRACTS

**Roots**

- Dorsal/posterior roots x 2 contain the SENSORY GANGLIA (cluster of sensory cell bodies)
- Ventral/anterior roots x 2 contain MOTOR axons
- Meet up laterally to form nerve Nerves x 31 pairs
- Bundles of neurons
- Typically mixed (sensory & motor)

**Protective connective tissue coverings:**

- Endoneurium wraps each axon
- Fascicles = bundles of axons
• Perineurium wraps each fascicle
• Epineurium wraps all the fascicles to form the nerve; continuous with Dura Mater