Conduction of Nerve Impulses

Synaptic Transmission
- Similar sequence of events occurs at
  - Synapse (neuron-neuron)
  - Neuromuscular junction (neuron-muscle fiber)
  - Neuroglandular junction (neuron-gland)
- Triggered by action potential (nerve impulse)
- Components of synapse:
  - Sending neuron: presynaptic neuron (releases neurotransmitter)
  - Space between neurons: synaptic cleft
  - Receiving neuron: postsynaptic neuron

Synaptic Transmission
- Action potential arrives at presynaptic neuron's end bulb
- Opens voltage gated Ca\(^{2+}\) channels \(\rightarrow\) Ca\(^{2+}\) flows into presynaptic cytosol
- Increased Ca\(^{2+}\) concentration \(\rightarrow\) exocytosis of synaptic vesicles
- Neurotransmitter (NT) released into cleft
- NT diffuses across cleft and binds to receptors in postsynaptic cell membrane

Synaptic Transmission
- NT serves as chemical trigger (stimulus) of ion channels
- Postsynaptic cell membrane may be depolarized or hyperpolarized
  - Depends on type of NT and type of postsynaptic cell
  - 1000+ neurons converge on synapse; the sum of all of their NTs determines effect
- If threshold reached, then postsynaptic cell action potential results
Aging

- Rapid brain growth during first few years of life
  - Due to increase in size of neurons and proliferation of neuroglia
  - Increase in development of dendritic branches and synaptic contacts
- From early adulthood through old age:
  - Decline in brain mass
  - Fewer synaptic contacts: brain function
  - Some decreased in brain function

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Somatic Senses and Special Senses

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Special Senses

- Smell (olfaction)
- Taste (gustation)
- Vision
- Balance
- Hearing

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General Senses: Somatic and Visceral

- Somatic
  - Tactile: touch, pressure, vibration
  - Thermal (warm, cold)
  - Pain
  - Proprioception (joint, muscle position sense; movements of limbs, head)
- Visceral: internal organ conditions
Pain Sensations

- Nociceptors
  - Free nerve endings in every tissue except brain
  - Can respond to any excessive stimulus
  - Minimal adaptation

- Types of pain
  - Fast pain: acute, sharp pain
    - Well localized
  - Slow pain: chronic, dull, aching, throbbing
    - More diffuse (not localized)

- Referred pain is visceral pain displaced to the surface

Distribution of Referred Pain

Proprioception (Kinesthesia)

- Awareness of
  - Body position, movements, weight of objects

- Sites of receptors
  - Muscles (muscle spindles)
  - Tendons (tendon organs)
  - Joint kinesthetic receptors (synovial joints)
  - Inner ear (hair cells): head position

- Tracts to
  - Somatosensory area of cerebral cortex and Cerebellum

- Slight adaptation

Functional Areas of the Cerebrum