Lecture 3

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Page 60 and 62-67 not anymore required, just 61 (blood flow)
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Subcortical systems (Telencephelon)

Basal Ganglia (motor control)

- Caudate nucleus
- Substantia nigra
- Amygdala

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Limbic System (emotion, memory)

- Cingulate cortex
    - Part of limbic system
- Hippocampus
    - Memory and navigation
- Mammilary bodies
    - Part of limbic system & involved in circadian
    - rhythms
- Olfactory bulb
    - Smell
- Thalamus
    - Major way station for processing motor and sensory information

        - Medial geniculate nucleus
            - Major way station for audition information going into the brain
        - Lateral geniculate nucleus
            - Major way station for visual information going into the brain
- Hypothalamus
    - Endocrine system
- Brain stem
    - Pineal body
    - Superior colliculus
    - Inferior colliculus
- Cerebellum
    - Reflexive activity, posture control, timing

Central and peripheral nervous system

- Central nervous system
- Peripheral nervous system
    - Parasympathetic branch (Norepinephrine)
    - Sympathetic branch (Acetylcholine)
- The cranial nerves
    - Terminal
    - Olfactory
    - Optic
    - Oculomotor

    - Trochlear
    - Trigeminal
    - Adbucens
    - Facial
    - Vestibulocochlear
    - Glossopharyngeal
    - Vagus
    - Accessory
    - Hypoglossal
- Blood supply (page 61)

The neuron doctrine

- The gross anatomy of the brain was well understood by 1850. However, it was not known whether this anatomy reflected a complex tangle of continuous wires, or some unknown scheme
- Camilo Golgi (1873) developed a revolutionary staining method that revealed individual neurons. He believed that neurons were coupled directly
- Ramon y Cajal (1888) carried out extensive microanatomical analysis and formulated the cell doctrine for neurons
- Charles Sherrington (1897) developed the idea of specialized synapses that transmit signals from one neuron to another

Neurons come in many shapes and sizes

- Purkinjie
- Granule
- Motor
- Pyramidal
- Chandelier
- Spindle
- Stellate
- Tripolar

Cell body & dendrites of a vertebrate neuron

- Dendrites have spines (little bumps)

The resting pontential

- An electrochemical equilibrium
- The resting potential is about –60–70 mv

-	**Sodium (Na^+)**	**Potassium (K^+)**	**Chloride (Cl^-)**
Inside	Low	High	Low
Outside	High	Low	High

1. Open K^+ channels create the resting potential
    - Open K^+ channel
    - Closed Na^+ channel
2. Some Na^+ channels open, depolarizing the cell to threshold

    - Open Na^+ channel
    - Closed K^+ channel

3. At threshold, additional voltage-gated Na^+ channels open, causing a rapid change of polarity - the action potential

4. Na^+ channels are inactivated; gated K^+ channels open, re-polarizing and even hyper-polarizing the cell (undershoot phase)
    - Inactivated Na6+ channels
    - Open K^+ channel

5. All gated channels close. The cell returns to its resting potential

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Neuronal Circuits

- Mammalian neocortex has ~6 layers of neurons (between 1–4mm)
    - Superficial
    - Upper
    - Middle
    - Deep
- Cortex is also organized in columns
- White mater makes connections between areas
    - Several long tracts
    - Short tracts
    - Long projection fibers
- Brain connections influence brain folding

    - Wires act as springs pulling areas together to reduce length of wires
    - During development they pull together
        - Cortex at the two sides of a gyrus have similar tasks
        - Cortex at opposite sides of sulcus probably don't have related tasks
- Cortical input and output is systematic
    - Layer for is the recipient layer (receives input from the thalamus)
- The brain is hierarchical, parallel network