Structural Organization of Body

Organization of the Body

- Atoms, molecules, organelle, cell, tissue, organs, organ system, organisms

Structure of Cell

- Nucleus- genetic info (DNA/ chromosomes/chromatin)
    - Histones to make chromosomes and chromatin
    - Nucleolus- no membrane (rRNA and ribosomal subunits)
    - DNA- mRNA-
    - Transcription- make mRNA
    - Nuclear proteins
- Cytoplasm
    - Other organelles
- Cytoskeleton
    - Microfilament
        - Actin
        - Stretch and change shape
        - Roadway for protein transport
    - Intermediate filaments
        - Anchor
        - Cell to cell junction
    - Microtubules
        - tubules
        - Hollow
        - Form centrioles for cell division
        - Form flagella and cilia

Tissues

- Epithelial
    - General
        - Polarity - apical and basement have different polarity
        - Specialized cell to cell junction
        - Anchored to CT basement membrane
        - Avascular- use diffusion
        - Regenerative
    - Classification
        - Cells
            - Squamous
            - Cuboidal
            - Columnar
        - Layers

                - Simple (absorption, filtration)
                - Stratified (more protection)
            - Other
                - Pseudo stratisfied - appear to have more layers due to abundance of nucleus
                - Transitional- urinary
    - Glandular
        - Endocrine
            - Ductless and produce hormones
            - Hormones diffuse into adjacent blood vessels
        - Exocrine
            - Unicellular or multicellular
            - Multicellular form ducts
            - Secrete products from ducts
            - Secretion
                - Merocrine- exocytosis
                    - sweat
                - Holocrine- cell rupture
                    - sebaceous
                - Apocrine- apex pinching off
                    - Mammary gland
- Connective
    - Features
        - Ground substance
        - Fibers
        - Proteins
            - Collagen- strength
            - Elastic- ability to recoil
            - Reticular- wrapped around soft tissue and vessels
        - Loose
            - Areola (loose fibers, fluid and salt reservoir) , adipose (adipocytes/ areolar that can hold nutrients- fuel reservoirs, grows bigger), reticular (only reticular; ex. Lympathic)
        - Dense
            - Regular- collagen run parallel to stretch
                - Ex. tendons and ligaments
            - Irregular- collagen arranged irregularly
                - Fibrous capsules of joints
            - Elastic- elastic fibers

        - Ex. arteries
- Muscle
- Nervous

Cell Physiology

Cell Junctions

- Tight
    - Transmembrane proteins studded along membrane that attach to proteins of adjacent cells
    - Strength and polarity
- Desmosomes
    - Anchors joining cells thru protein plaques and transmembrane hooks/adapters
    - Strength and resist stress
- Gap
    - Proteins (connexins) creates pores btwn adjacent cells, cytoplasmically connecting cell

Membrane Transport Systems

- Ways to enter cell
    - Diffusion
        - Only non polar or small polar
        - Ions down gradient
        - Influenced by conc gradient, temp, molecule size
    - Simple diffusion
    - Facilitated diffusion
        - Channels
        - Transport large molecules down conc gradient
        - Carriers and channels passively
        - Leaky channels
        - Gated channels uder certain
        - Bidirectional
    - Active Transport
        - Primary
            - Use ATP thru carrier protein
            - Against conc gradient
            - Coupled
                - Symport- same direction
                - Antiport- one in one out
            - Ex. Na/K ATPase
                - antiport : Na out and K in
                - Membrane potential maintenance

        - Secondary
            - Indirectly using ATP
    - Filtration
    - Vesicle mediated

Neuron Potential

- Structure
    - Dendrite- reception
    - Axon hillock
    - Axon
        - Anterograde- towards terminal
        - Retrograde- towards cell body
    - Axon terminals
        - Release NT
- Electrophysiology
    - RMP
        - -70mV with high Na outside and low K in
        - Cell is more permeable to K than Na therefore more K is released
        - Maintained by Na/K ATPase
    - Initiated by chemically gated channels
    - Voltage gated propagate signals
    - Graded potentials
        - Short lived, local changed to voltage (depolarization or hyperpolarization)
        - Or else
    - AP- self sustained
        - Graded travels to region with V gates (axon hillock)
        - If threshold is reached -55mV, Na channels open for more depolarization
        - Depolarization is large enough to trigger adjacent V gates (propagating signal)
        - Na gates close, K channel opens- repolarizes
        - Na/K channels move ion back to appropriate locations
    - AP prop
        - Myelin (formed by schwann in PNS and oligodendrocytes in CNS)
    - From cell to cell
        - Occurs in synapse - release NT which stimulates next cell
        - Causes graded potential to next cell
        - Electrical
            - rare
        - Chemical
            - Common

        - EPSP excitatory post synaptic potential
        - IPSP inhibitory post synaptic potential
            - Cause hyperpolarization

Muscle Physiology

- NT that activates AP in muscle - ACh
    - Antagonist in this case
    - Opens chemically gated channels on muscle until
    - Cause depol-
    - Synptic cleft with most chemically gated
- T tubules
    - AP propagates in T and release Ca
    - Once you hit SR, calcium influx which affects actin ship and exposing myosin binding site
    - Myosin protein binds to sites which is bind to ADP, ADP release, ATP in, removes P
    - LABEL T TUBULES AND TERMINAL CISTERNAE
- SARCOMERE
    - I BAND
    - A BAND
    - IMPORTANCE OF FIBERS AND FILAMENTS