

Human Biology Week 1-12 Notes

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Lecture 1

The Human Body

- Vocab
 - Human anatomy: study of structure
 - Systemic anatomy: study of the structure of a system
 - Human physiology: study of function
 - Systemic physiology: study of the function of a system
 - Cytology: study of cells
 - Can visualise using light microscopes, staining (e.g. fluorescence), scanning electron micrograph
 - Histology: study of tissues
- Homeostasis
 - Described by Claude Bernard, state of balance, must be maintained as disruption causes
 - Different to haemostasis (stopping blood loss)
 - Separation of fluid into compartments to prevent fluid loss
 - ICF = intracellular fluid (fluid within cells)
 - ECF = extracellular fluid (fluid outside cells)
 - Intercellular fluid (tissue/interstitial fluid)
 - Plasma = clear fluid portion of blood
 - Composition of fluids change as substances move between compartments
 - Feedback mechanisms maintain homeostasis
 - Negative: results in reduction of intensity of original stimulus
 - Thermoregulation: body temperature rises → temperature receptors → thermoregulatory centre in brain → blood vessels + sweat glands in skin → increased blood flow to skin, increased sweating → stimulus removed and homeostasis restored
 - Negative as stimulus must decrease as high temperature puts body at risk
 - Positive: results in increase in intensity of stimulus
 - Childbirth: stretch receptors (in wall of cervix + uterus) → pituitary gland releases oxytocin (messenger system) into blood stream) → uterine smooth muscle contracts more forceful → more stretching etc. Cycle ends after baby is born/stimulus is removed
 - Positive as stimulus must increase so baby can be born
- Cellular Structure
 - A cell is the smallest living component of the human body, and is a single living unit with a command centre called a nucleus

Lecture 2

Cells

- Plasma membrane is a flexible phospholipid bilayer which gives the cell shape and separates the intercellular and extracellular fluid
 - Membrane is amphipathic as phosphate group is hydrophilic and lipid group is hydrophobic
 - Hydrophobic lipids prevent aqueous or charged particles passing through
 - Lipids move freely but orient inwards to avoid water, allowing membranes to self-assemble/reseal; unsaturated nature of lipids increases space and thus fluidity
 - Lipid layer also includes cholesterol and glycolipids

- Cholesterol: 20% of membrane lipid; has polar hydroxyl group and non-polar hydrocarbon rings; hydroxyl wedges between phospholipid tails to stabilise membrane and decrease fluidity. It also is used in steroid formation
- Glycolipids: make up 5% of membrane lipid; found on outer plasma membrane surface; polar sugar groups
 - Proteins embed (integral) or float (peripheral) in membrane, with 50 lipids/protein
- Layer is selectively permeable
 - Water's low charge lets it flow slowly through gaps in hydrophobic core as lipids move
 - Simple diffusion: molecules move along concentration gradient
 - Speed of diffusion increases for small particles and high temperatures; in closed system dispersion continues until uniform composition and equilibrium is reached
 - Molecules can go straight though if they are nonpolar (lipid soluble) and small
 - Passive facilitated diffusion: proteins transport molecules along concentration gradient
 - Carrier mediated facilitated diffusion: polar + large molecules bind to proteins and change the binding site from one side of the membrane to the other, thus changing the shape of protein to allow it to envelop then release the molecule
 - Allows movement based on diffusion
 - Rate limited by proteins available; all carriers are engaged they are saturated
 - Channel-mediated facilitated diffusion: ions/water flows through aqueous channel transmembrane protein channel; selects on pore size/amino acids lining channels
 - Leakage channels are always open and allow movement based on diffusion
 - Gated channels are controlled by chemical/electrical signal
 - Active facilitated diffusion: molecules bind to proteins, changing shape and hydrolysing ATP to ADP (producing kinetic energy) to transport against concentration gradient
 - Vesicular transport: endocytosis or exocytosis of macromolecules in fluid packets
 - In phagocytosis membrane comes out around the molecule and 'eats it'
 - In pinocytosis opens to lets some molecules in and 'drinks it'
- Receptor protein: sends signals from outside to inside cell cellular recognition site, molecule binds to send a signal to the nucleus, relay messages from outside to inside the cell, receptor alters activity + function of cell (can go wrong: growth hormone receptor defect = growth abnormalities)
- Identity mark: allows cell to recognise other similar cells (e.g. blood type – MHC need to match for transplants so immune system accepts)
- Linker protein: anchors to other cells, allows cell movement, holds cell shape and structure, anchors filament inside + outside membrane providing structural stability
- Enzyme: catalyse chemical reactions but don't change; ends in ase
- Cytoplasm: full of cytosol (fluid) containing organelles; has a cytoskeleton to maintain structure
- Nucleus: the organelle in the centre which contains most of the genetic material

Lecture 3

Cytoskeleton + Organelles

- Cytoskeleton: network of constantly reorganising protein filaments throughout cytoplasm which aids movement, provides shape, supports structure, assists division + organises chemical reactions
 - Microfilaments: double strands made of spherical F-actin protein subunits 7nm thick
 - Dense cross-linked terminal web on inner plasma membrane, for strength + movement