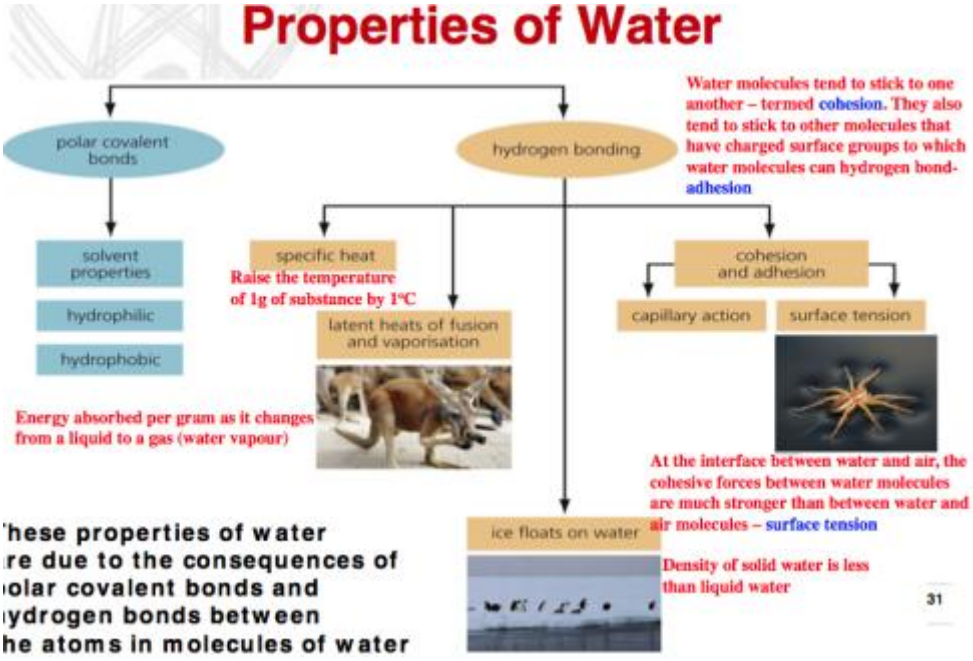
BIOL103 Notes

Lecture 1 – Chemistry of Life

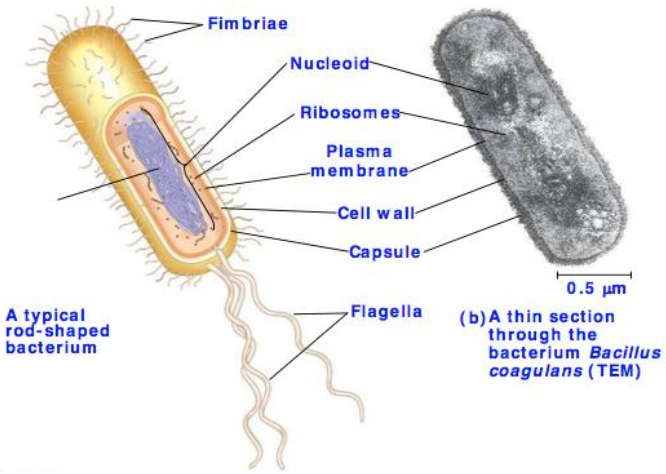
- Matter is made of elements; elements cannot be broken down
- 20-25% of the 92 natural elements are essential for life
- 4 elements make 96% of living parts of organisms: O, N, C, H
- An atom is the smallest part of a particle; atoms consist of protons neutrons and electrons
- Atomic number: all atoms of same element have same number of protons; this is written subscript to the left of the element name
- Atomic mass: sum of protons and neutrons; written superscript to the left of the element symbol
- Isotopes: more neutrons than other atoms of same element; greater mass; behaviour identical to the original element in reactions
- Covalent bonds: sharing of electrons; creates a molecule
- Non-polar covalent bond has equal sharing of e-; polar covalent bonds have unequal sharing of e-
- Ionic bonds: when atoms gain or lose e- from outer shell they become charged ions; atoms lose electrons = +ve charge = cation; atoms gain e- = -ve = anion
- Ionic compounds: composed by cation and anions bonded together
- Hydrogen bonds: in a H2O molecule electrons re shred unequally (H slightly more +ve); the molecule is polar; these bonds are weak



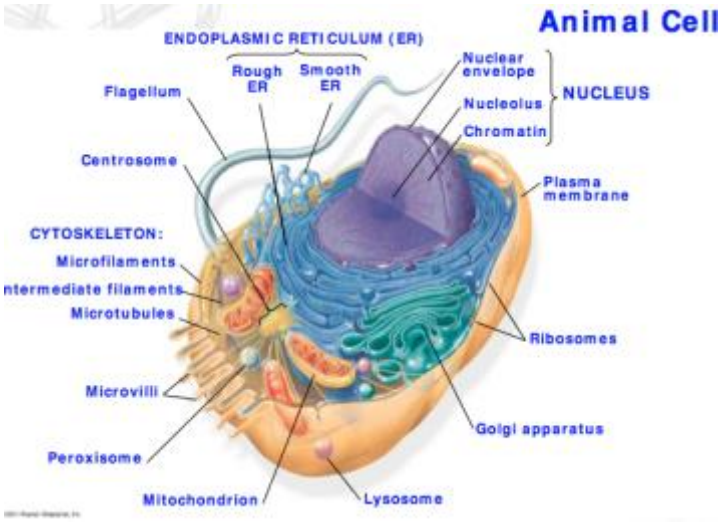
Lecture 2 – Cell Structure Part 1

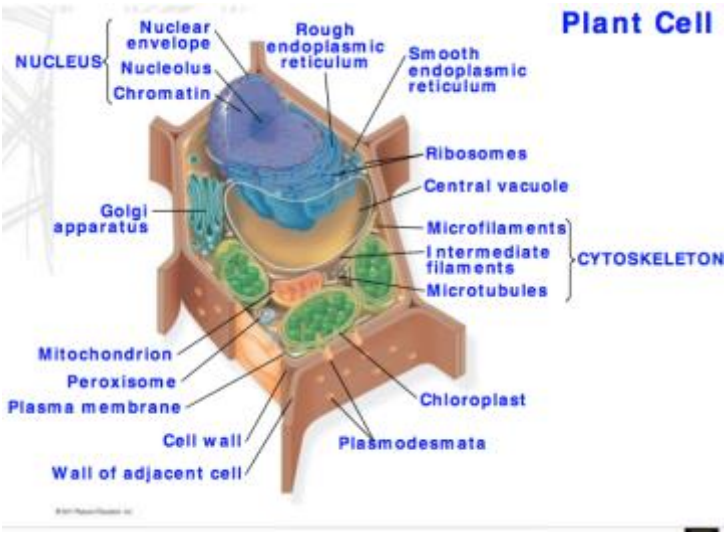
- Microscopy: human eye limits of resolution approx. 200um; most cells between 1-100um and thus only visible under a microscope
- Bacteria and Archaea are only domains with prokaryotic cells

- Basic features of all cells: plasma membrane; cytosol (semi-fluid substance); chromosomes; ribosomes (make proteins)
- Prokaryotic cells: 1um diameter; lack nucleus; DNA unbound in region called nucleoid; cytoplasm bound by plasma membrane; no membrane bound organelles;



- Eukaryotes: DNA in nuclear bounds envelope in nucleus; larger than prokaryotes; organelles and other subcellular components lie in the cytosol; cytoplasm consists of cytosol and subcellular components ecl. nucleus
- Protoplasm = cytoplasm + nucleus





- Nucleus: surrounded by double membrane (nuclear envelope); contains several nucleoli – high concentrations of RNA DNA and protein; nuclear pores (channels allowing movement of certain molecules)
- Ribosomes: complexes made of rRNA and protein – carries out protein synthesis; cytoplasm of eukaryotes contain several million ribosomes; 25-30nm in diamteter; free and bound ribosomes; composed of 2 subunits assembled in the nucleolus from RNA and protein molecules… subunits pass through the nuclear pore into the cytosol – associated with a mRNA molecule – form a functional ribosome – facilitates protein synthesis
- Endomembrane System: regulates protein traffic and performs metabolic function in the cell. Components of the endomembrane system: Nuclear envelope； Endoplasmic reticulum； Golgi apparatus; Lysosomes; Vacuoles； Plasma membrane
- These components are either continuous or connected via transfer by vesicles
- Endoplasmic Reticulum (ER) aka Biosynthetic factory: network of membranous sacs (cisternae); accounts for more than half the membrane in most eukaryotes;

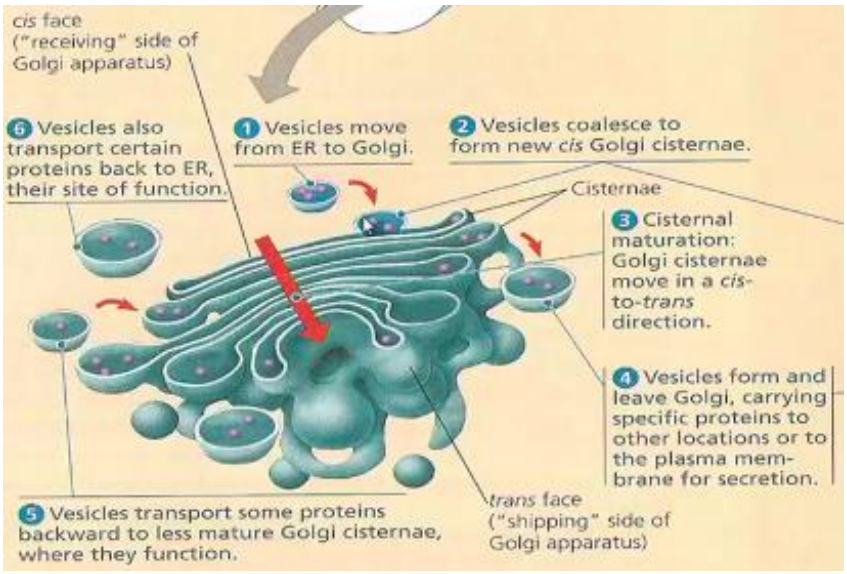
continuous with the outer-membrane of nuclear envelope; smooth ER lacks ribosomes; rough ER has ribosomes studding the surface

- Smooth ER functions: 1. Synthesizes Lipids 2. metabolizes carbohydrates 3. detoxifies drugs and poisons 4. stores calcium ions
- Rough ER: has bound ribosomes; proteins are glycosylated (covalently bonded to carbohydrates) in ER lumen; is a membrane factory for the cell

Lecture 3 – Cell Structure Part 2

ENDOMEMBRANE SYSTEM: golgi apparatus, lysosomes, vacuoles

- Golgi apparatus – consists of flattened membranous stacks called cisternae; golgi stacks usually surrounded by a cloud of small vesicles; each stack has distinct polarity: cis face – faces the cisterna of ER "receiving side", trans face – opposite side of golgi stack "shipping side"; receives proteins and glycoproteins – each enter at the cis face via the transport vesicles which bud off the ER membrane; transport vesicles fuse with the cis cisterna; makes macromolecules e.g. pectin; sorts and packages material into transport materials



- Lysosomes – digestive compartments; membrane bound organelles; in animal cells involved in the degradation of many types of macro molecules; membranous sacs of hydrolytic enzymes that can digest macromolecules; lysosomal enzymes can hydrolyse proteins, fats, polysaccharides and nucleic acids – important way of recycling things within the cell
- Vacuoles – membrane bound vesicles; varying functions; contain hydrolytic enzymes; store nutrients and waste; maintain turgid pressure in plant cells; in many types of cells
- Mitochondria – have a double membrane; contain free ribosomes and circular DNA; grow and reproduce somewhat independently in cell; evolved by endosymbiosis; site of cellular respiration: where sugars and fats are converted into ATP aka oxidative phosphorylation; spherical or elongated; outer membrane is smooth, inner membrane has cristae foldings, increase SA and allows more respiration to occur, inner membrane responsible for ATP synthesis; the core = matrix = mitochondrial ribosomes, mitochondrial DNA and structural proteins
- Chloroplast – capture light energy and convert this to sugar to be used in respiration; member of family of organelles called plastids; highly developed internal membranes;