Dehydration Synthesis(monomer → polymer)

- Monomers form polymers by covalently linking with each other, removing water for each covalent bond
- **All the linkages are the RESULT of the reaction**

Ether linkage [R-O-R']

- R-OH + HO-R → R-O-R' + H2O
- Alcohol + alcohol → ether + water

Ester linkage

- R-COOH + HO-R → R-COO-R' + H2O
- carboxylic acid + an alcohol → ester + water
- Carboxyl + acid → ester + water
    - The OH and H will form a water molecule and the rest of the two molecules should join - check whether its legit before moving on (nitrogen can make 3 bonds, carbon can make 4 bonds)
- R-COOH + HO-R' → R-COOR'
- Just testing on drawing molecules, the reactions between the molecule

Peptide linkage [R-CONH-R'] (Amide)

- Carboxylic acid + amine → amide
- Carboxyl + amino → amide + water
- R-COOH + H_2N → R-CONH-R' + H_2O

Hydrolysis (polymer → monomer)

- Breaking covalent bonds between monomers by the addition of a water molecule
    - Effectively reverse dehydration synthesis, work backwards from a molecule to its monomer groups
- Molecules of Life (CHO|N|P|S)
    - H,C,O (these guys hang out everywhere)
    - N (amino acids)
    - P (DNA backbones)
    - Carbohydrates, fats, proteins, DNA are made of the ^above^

Carbohydrates (sugars) (-ose)

- Contains C, H, O
- Refers to the “sugar” family
    - Glucose, fructose, starch, cellulose (fruits like broccoli have tons of cellulose)
- **Body’s most important source of energy and are building material and cell communication**
- Come from plants, made with carbon dioxide and energy from the sun
- Named with -OSE

3 groups

(⅓) Monosaccharides(simple sugars)

- Examples:
    - Glucose
    - Fructose (you’ll see more of these in your food)
    - Galactose
    - LACTOSE
- Simple sugars → monomers = 1
- One building block of a larger molecule
- Contains Cn, H2n, On
- Glucose is most likely monosaccharide
- **Sweetness is proportional to the number of saccharides (more monosaccharides reduces the sweetness)**
- **Occur in linear form OR as a ring**
- Or as a ring when 5 carbons bend back to make a ring
    - The ring is more of a lie - it’s still really the single linear molecule but an oxygen atom connects the ends (we **START numbering monosaccharides with the carbon that HAS the carboxyl group, typically rightmost**)
- 2 arrangements of the -OH ring → isomers
- 2 types of glucose:
    - a glucose (alpha) → OH is on bottom
    - b glucose (beta) → OH is on top
- Galactose is up up down down
- Glucose and galactose are optical isomers
- Both have aldehyde group → aldose
- Fructose has a ketone group, is numbered differently than other sugars smh
- Typically have many polar functional group → hydrophilic
- **Small sugars are highly soluble in water**
- **Sweetest of the three sugar groups**

Disaccharides(double sugars)

- 2 monosaccharides linked together through dehydration synthesis
- How to make sugars:
    - a-Glucose + a-Glucose = Maltose
    - Glucose + Fructose = Sucrose → table sugar
    - Glucose + Galactose = Lactose → milk
- Dehydration synthesis
    - One monosaccharide loses an -OH and one loses a hydrogen -H
    - Monosacc + monosacc → disacc + water
    - Bonds between monosaccharides are called glycosidic bonds
- Hydrolysis
    - Opposite of dehydration synthesis
    - Disacc + water → monosacc + monosacc
- Beta-linkage **(ALWAYS FLIPPED)**
    - B-glucose + b-glucose → Cellulose + water
    - Dehydration synthesis
        - A b-glucose is flipped so that one -OH can give its hydrogen to make water with the other -OH and let the oxygen form the glycosidic bond
    - b-1,4-glycosidic linkage

Polysaccharides(complex sugars)

- Polymer of a few hundred or thousand molecules
- Polymerization - process in which small sub units are linked to form a large molecule
- Complex carbs, not sweet, very polar = hydrophilic
- Don't dissolve in water because they are so big, intermolecular forces say NO
- Examples:
    - For Storage: Starch, glycogen
    - Structure: cellulose and chitin
- Starch
    - Polymer of alpha glucose
    - Plant storage
    - Simplest form of starch = amylose (unbranched)
    - Amylopectin → branched and more complex
    - Our saliva is amylase to break down amylose
- Amylose vs. Amylopection:
    - Amylose is a single spiral chain of a-glucoses connected by a-1,4-glycosidic bonds
    - Amylopectin is branching spiral chains of a-glucoses connected by a-1,4-glycosidic bonds and a-1,6-glycosidic bonds
- Glycogen

        - Energy storage for animals
        - Stored in muscles + liver
        - More extensively bonded than amylose and amylopectin (more branching)
    - Cellulose
        - Structural component of cell wall in plants
        - Polymer of b-glucose joined together by b 1,4-glycosidic linkage
        - **Enzymes that digest starch can't digest b-linkage cellulose because the active site of the enzyme cannot break beta 1,4-glycosidic linkage** (why we can't digest cellulose, why can't humans digest cellulose)

Summary of sugars:

Name		Structural Unit	Linkages	Occurrence
storage	Amylose	α glucose	α 1,4	Plant starch
	Amylopectin	α glucose	α 1,4 & α 1,6	Plant starch
	Glycogen	α glucose	α 1,4 & α 1,6	Muscles, liver
structural	cellulose	β glucose	β 1,4	Plant cell wall
	chitin	Glucosamine (β glucose + N)	β 1,4	Arthropod cuticle (shell)

Steric Repulsion in polysaccharides (Why the spiral shape)

- More compact, store more in same space → like the concept of DNA
- Amylose, amylopectin and glycogen
    - Composed of a-glucose units linked together by a-1,4,glycosidic linkage
        - These linkages are polar covalent bonds that leave the hydrogens slightly electro-positive
        - The hydrogens repel one another, forcing the linkage to bend, forming spirals
- Cellulose
    - Composed of beta-glucose units linked together by beta-1,4-glycosidic linkage
        - These linkages are polar covalent bonds that leave the hydrogens slightly electro-positive

        - Steric repulsion between electro-positive hydrogens makes the structure bend in alternating directions to form the zigzag shape
    - Cellulose can then interlock with other celluloses, creating a strong inflexible cell wall.
    - Successive monosaccharides are inverted relative to one another (zig zag shape)
    - Zigzag is very strong and inflexible → used in cell wall

- https://www.youtube.com/watch?v=jQi84TnstI4

Lipids

- Insoluble in water = Hydrophobic, nonpolar
- Have a hydrophilic head
- Composed of c, h, o (no specific ratio)
- Used by organisms to
    - Store energy long term
    - Build membranes and other cell parts
    - Hormones that regulate cell activities
    - Vitamins
- Four groups of lipids
    - Fats
    - Phospholipids
    - Steroids
    - waxes

1 / 4 Groups of Lipids: Fats

- Most common energy storing molecule in living organism
- 20-35% of daily intake
- Excess carbohydrates are converted to fat
- Store droplets in cells of adipose (fat) tissue
- Other uses of fats:
    - Warmth / insulation
    - Cushioning for organs

Functions

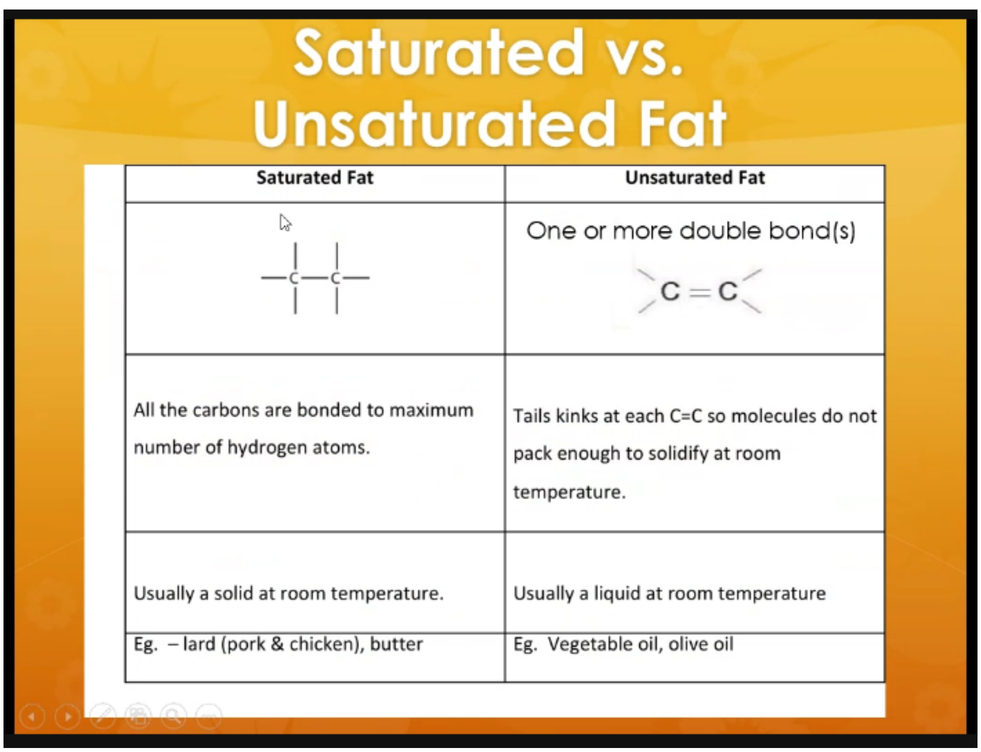
    - 1 gram of fat stores 9 calories while 1g of carbohydrate stores 4 calories
    - Also weighs less than carbs (more energy-dense)
    - Cushioning effect for internal organs
    - Insulation for cold temperatures

Makeup

- Made from 2 types of molecules: fatty acids and a glycerol
    - **Fatty acid (carboxylic acid) + glycerol (alcohol) → Fats(esters) + water**
        - **ESTER LINKAGE**
    - Glycerol makes the backbone of most lipids
    - Fatty acids are carboxylic acids
        - consist of a COOH (carboxyl group) and a hydrocarbon chain
    - **Most common fats in plants n animals are triglycerides (1 glycerol molecule + 3 fatty acid chains)**
    - Hydrophilic head, Hydrophobic tail
        - Glycerol slurp water, fatty acids nono water
    - **Triglycerides form through dehydration synthesis and form an ester linkage**
    - **Sometimes triglycerides will have a double bond on their tail resulting in a 120 degree "kink"**
    - Most common forms have even-numbered fatty acids chains of 14-22
    - As chain length increases, fatty acids become less soluble (**fatty acid = carboxylic acid)**

Saturated vs Unsaturated fats:

- Saturated = **Ester with alkane**(Each carbon has at least 2 hydrogens except for ester)
- Unsaturated = **Ester with an ALKENE** (There's a double bond somewhere)→ better for you



Saturated Fat	Unsaturated Fat
	One or more double bond(s) C = C
All the carbons are bonded to maximum number of hydrogen atoms.	Tails kinks at each C=C so molecules do not pack enough to solidify at room temperature.
Usually a solid at room temperature.	Usually a liquid at room temperature
Eg. – lard (pork & chicken), butter	Eg. Vegetable oil, olive oil

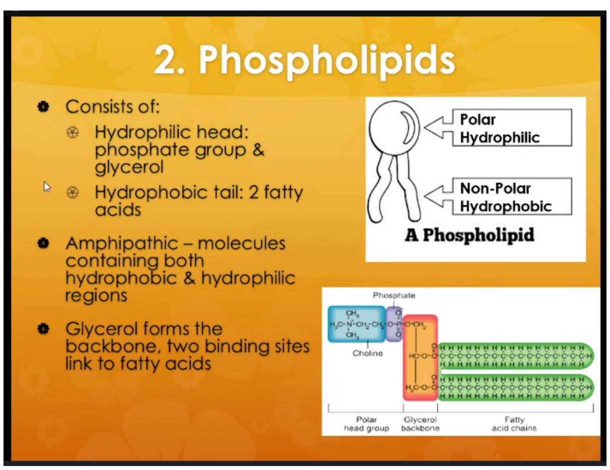
- Saturated fats are solid due to long straight chains allowing to be packed close together
- Fatty acid chains with kinks can’t be packed as tightly as saturated fats
- Diets rich in saturated fats can lead to heart disease
- Inuits have high fat and protein diet beneficial for cold climates
- Diets rich in fat can result in blocked arteries as atherolsclerotic plaque builds up from → atherosclerotic plaque is called that when the fat builds up in the artery
- Polyunsaturated fatty acids (PUFAs) many C double bonds
    - Industrial process called hydrogenation adds hydrogen atoms to the double bond making it → semisolid
- What is fat? - George Zaidan
    - https://www.youtube.com/watch?v=QhUrc4BnPgg
    - “Partially hydrogenated” → trans fat = bad

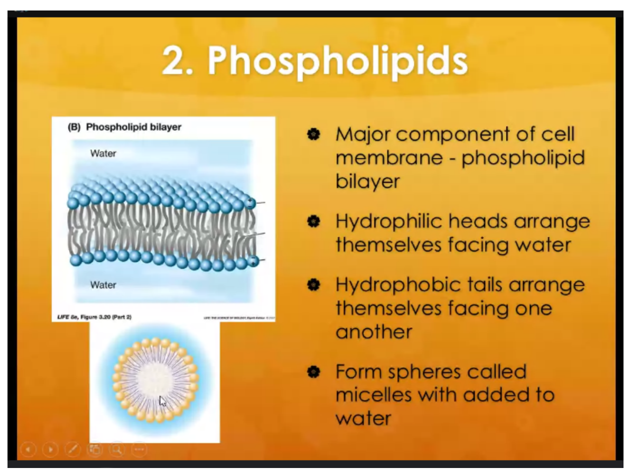
Medical Procedures

- Balloon angioplasty
    - Clearing out plaque from arteries
    - Put balloon in artery and expand it so that plaque is pushed to the walls
- Bypass surgery
    - Severe surgery when other surgeries have failed
    - Take another artery from the body and replace the coronary arteries near the aorta to divert blood flow around aorta

2 / 4 Groups of Lipids: Phospholipids

- Hydrophilic head: phosphate group + glycerol
- Hydrophobic tail: 2 fatty acids





- Amphipiatic - molecules containing both hydrophobic AND hydrophilic regions
- Glycerol, once again, forms the backbone, has two binding sites to link fatty acids and phosphate groups
- Major component of cell membrane - phospholipid bilayer
- Hydrophilic heads face the water with hydrophobic tails inside

- Micelles: Spheres of the phospholipid bilayer with water
- Application of phospholipids: detergents and soaps
- Detergents and soaps are amphiatic (have both hydrophillic and hydrophobic parts)
- Dirt and grime tend to be nonpolar or oily
    - bind to non polar tails of detergents
    - Detergent grabs dirt and pulls it away

Essential fatty acids

- essential fatty acids are essential
    - Some lipids are essential
    - This means the body can't make the molecule and must eat it
    - Eg. linoleic or linolenic fatty acids

3 / 4 Groups of Lipids: Steroids

- Also found in membranes!
- Compact hydrophobic molecules with:
    - 4 fused hydrocarbon rings
    - Several functional groups
    - They do have an OH at the end of a ring, making it slightly polar/hydrophillic
- Steroids are secreted into the blood stream for distribution
    - Chloesterol (buildup of this can be dangerous)
    - Sex horomones
        - Testosterones
        - Estrogens
        - progesterone

Cholesterol

- Essential for animal cell membranes and converts into compounds like vitamin D
- Atherosclerosis has been linked to high cholesterol concentrations and diets rich in saturated fats
- HDL is good, when checked you want your HDL to be H (high)
- LDL is bad, when checked you want your LDL to be L (low)

Sex Hormones

- Ex: Testosterones, Estrogens, progesterone
- Control development of sexual traits and sex cells
- Anabolic steroids:
    - Can have harmful effects:
        - High blood pressure, depression, suicidal tendencies, changes in level of sex hormones, reduced growth in young people

4 / 4 Groups of Lipids: Waxes

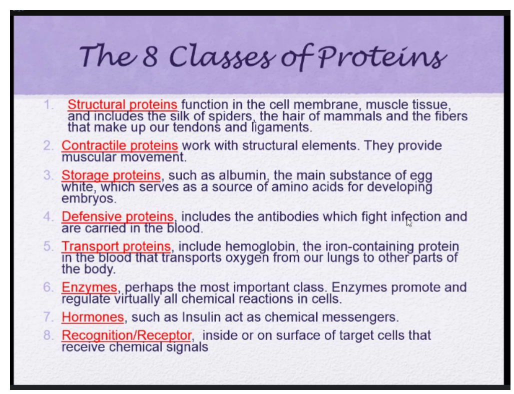
- Large lipid molecules that are made of LONG fatty acid chains linked to alcohols(glycerol) or carbon rings
- Hydrophobic (extremely non-polar)
- Soft solids over a wide range of temperatures
- Ideal for flexible waterproof coating over various plants and animal parts
- Cutin part of the cuticle meant to prevent water loss

Proteins

- Proteins account for more than 50% of the dry weight of most cells and involved in almost everything the cell does
- Recommened daily intake is 20%, but we eat closer to 40%

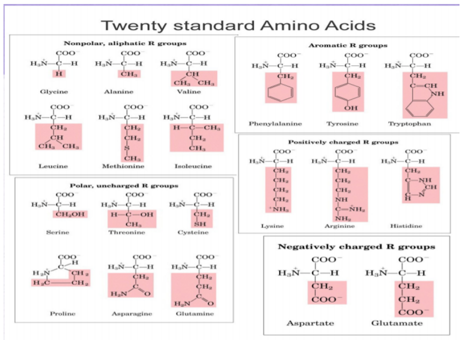
8 Classes of proteins

  - Structural proteins
  - Contractile proteins
  - Storage proteins
  - Defensive proteins
  - Transport proteins
  - Enzymes → most important class of proteins
  - Hormones
  - Recognition/ receptor



Amino acids

- Amino acids are building blocks of proteins
  - Amino groups(NH2) + carboxyl group + side chain which is different in each amino acid
  - 9 essential amino acids (body can't produce, must get
  - 20 standard amino acids



Building Proteins

- Proteins are built from the same 20 amino acids (A.A.s)
- DNA codes for the order of amino acids → changing the order of amino acids = new protein
- Amino acid monomers form polypeptide chains held together by peptide bonds (amides) through dehydration synthesis reactions

Protein structure

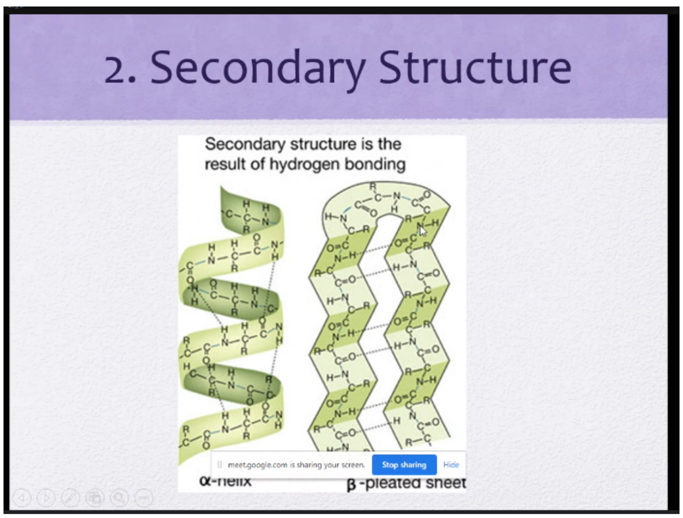
- Proteins can be made up of anywhere from 8 amino acids to 4000!
- 1 amino acid = 1 amino acid monomer (no preotein with just 1 amino acid)
- 2 amino acid = dipeptide molecule
- Many amino acids = polypeptide chain
- 1 or more polypeptide chains = a protein molecule that

Primary structure

- Amino acids are held together by covalent bonds
- Unique sequence of amino acid in a protein molecule - the sequence is determined by your DNA
    - Changes to the DNA can make the protein's structure and function very different
- Ex: Sickle-Cell Anemia is the result of slight changes in DNA that make misshapen red blood cells
    - Block blood flow due to curved "sickle" shaped cells
    - Cant transport oxygen as easily
    - Genetic mutation, helps prevent contraction of malaria
- Primary bonds are stronger than secondary and tertiary

Secondary structure

- Alpha-helix structure

    - The structure is maintained by hydrogen bonds between every N-H group and the oxygen of a C=O group in the next turn of the helix (4 amino acids down the chain)
    - Typical alpha-helix is 11 amino acids long
- Secondary bonds not as strong as primary covalent bonds
- All function proteins demonstrate a certain amount of alpha-helix bonding(~70%)
- Beta-pleated sheet
    - Adjacent polypeptides are organized in anti-parallel fashion
    - Polypeptides organize themselves into two different planes (sort of like the zig-zag but now in three dimensions like lasagna
    - Ex: silk which is very elastic
    - 

    - This is what a beta pleated sheet looks like in comparison to a-helix
    - In a big protein molecule, it can have both a-helix and b-pleated

Tertiary structure

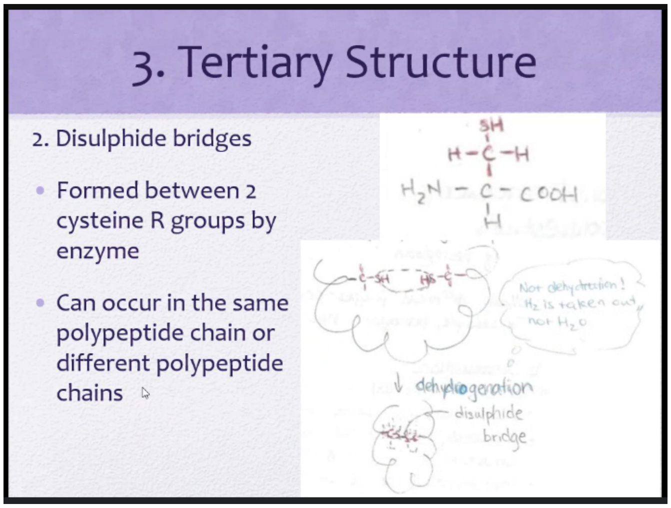
- When the alpha-helix and beta-plated shapes fold on each other, the protein has a new shape
- The protein has van der Waals forces between hydrocarbons
- Hydrogen bonds from ether-looking fellas
- Electrostatic attraction between NH3 and OOC

Hydrophobic & hydrophilic R-groups

- **Odd number R groups are hydroPHILIC** and **fold OUTWARD**
- **Even number R groups are hydroPHOBIC** and **fold INWARD AWAY FROM WATER**
- Changes in folding causes weird shapes of tertiary structure

Disulphide bridges

- Formed between 2 cysteine R groups by an enzyme

- Can occur in the same polypeptide chain or different polypeptide chains
- 

- Dehydrogenation to take out the hydrogen resulting in a sulfur-sulfur bond known as a disulphide bridge **(NOT DEHYDRATION SYNTHESIS** - we don't lose any waters**)**
- Hair grows really fast
  - Hair salon uses reducing agent to break down sulfide bridges and then a oxidizing agent to reform them in the way you want → usually to get a perm

Prosthetic group (heme group)

- Hemoglobin contains 4 heme groups carrying 4 O2, so that's 32 oxygens per hemoglobin
- Prosthetic group is anything with an iron in it

Hydrogen bonds between distant amino acids

- Not a real bond, just an attractive force

Quaternary structure

  - 2 or more polypeptide chains linked together (Ex: Hemoglobin has 4 polypeptides)

Denaturing Proteins

- Processes in which the secondary, tertiary, and quaternary structure of a protein is disturbed or disrupted
- Causes:
  - Temperature change
  - pH change
  - Chemicals
  - Solvents

- Chemicals and/or heat disrupt the H bond, ionic bonds, disulfide bridges, and hydrophobic interactions
- Proteins can’t carry out their functions after the bonds that make up its shape have been disrupted
- Mild cases may be reversible, but are often not.

Protein supplements

- If you want more protein, eat supplements

Nucleic acids

- Contain instructions to make proteins
    - DNA: Stores hereditary info responsible for inherited traits
    - RNA: Converts information stored in DNA into proteins

Nucleotides: the building blocks of nucleic acids

- Contain: Nitrogenous base, 5-carbon sugar, phosphate group
- Nitrogenous bases are divided into two groups:
    - Purines (Two rings)
        - Uracil, Thymine, Cytosine
    - Pyrimidines (Single ring)
        - Adenine, guanine

Polynucleotide Chain

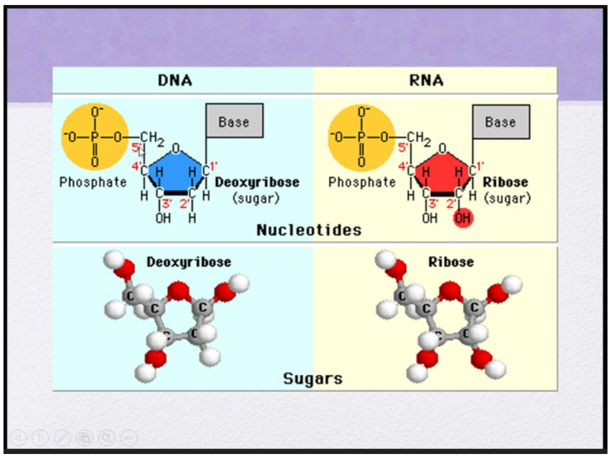
- Nucleotides link by phosphate groups forming single bonds between 5’-carbon of one sugar and 3’-carbon of the next sugar
- Done through dehydration synthesis
- Phosphate groups and sugar molecules form the backbone of the chain, and the baes stick out like the teeth on a zipper
- This chain forms the backbone of DNA

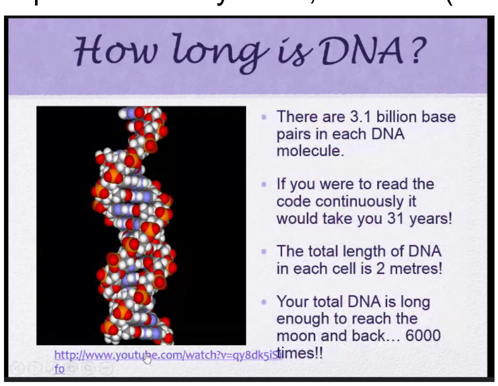
2 Types of Nucleic Acids(DNA and RNA)

DNA

- DNA=genetic code for all proteins and life functions
- 2 nucleotide strands linked by hydrogen bonds between nitrogenous bases (A&t, C&G)
- Is shaped like a double helix
- The genetic information is encoded by teh sequence of nucleotides

RNA

- Carries the protein blueprint from the nuclus to the ribosome during protein synthesis
- Usually 1 nucleotide strand containing A, U, C, H
- mRNA=messengerRNA - leaves nucleus to deliver messages (m) to ribosomes
- rRNA - ribosomal rna to link amino acids together to form a coated protein
- tRNA=transferRNA- match AAs together
- Double bond between A&T and triple bond between C&G
- 

- Dont need to memorize these, just know big structure
- DNA structure - deoxyribonucleic acid, D for the name of the sugar
    - Two strand chains are oriented in oppsoite directions - Antiparallel
    - The end with the phosphate group is the 5’ end
    - THe end with the deoxyribose sugar is 3’ end
    - Pyrimidines: Cytosine, Thymine
    - Purines: Adenosine, Guanine
        - Double bonded: Adenosine, Thymine (AT)
        - Triple bonded: Cytosine, Guanine (CG)
        - 

ATP

- A monomer

- A nucleotide
- ENERGY PROVIDING MOLECULE OF THE CELL
- ATP → ADP + P + ENERGY

Levels of Biological Organization

1. Atoms: CHONPS, etc.
2. Chemical building blocks (amino acids, nucleotides, monosaccharides, fatty acids, ATP)
3. Macromolecules: Dna,RNA, proteins
4. Organelles: Mitochondria, etc. (1 x 10^-7 m)
5. Cells: Heart muscle cells
6. Tissue: Cardiac tissue
7. Organs: Heart
8. Organ Systems: Circulatory system
9. Individual / Person
10. Population

Cells

- 10 x more cells in body than stars in the milky way

Cell theory

- All living things are made up of cells
- Basic unit of living organisms
- All cells come from preexisting cells
- ~100 trillion cells, specialized to perform various tasks
- BUT ALL CELLS MUST:
    - Digest nutrients
    - Excrete wastes
    - Snythesize needed chemicals
    - Reproduce

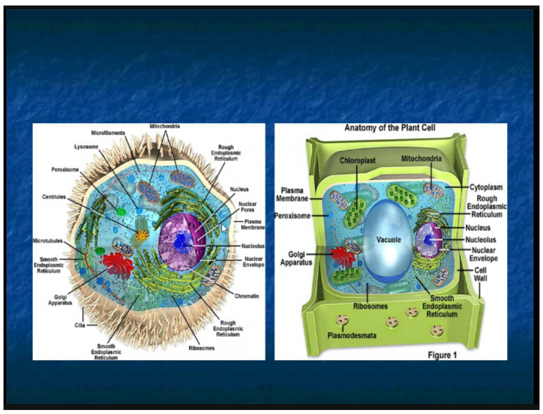
PROKARYOTIC Cells

- No true nucleus
- No internal compartments
- No organelles
- All prokaryotes are unicellular organisms
- Quite small
- DNA is located in nucleoid region
- May not need O2

Eukaryotic Cells

- Nucleus, internal compartments, organelles
- Can be unicellular or multicellular
- Larger cells
- DNA in nucleus
- Typically need O2

Cell anatomy



Nucleus

Structure

- Contains DNA
- Envelope is a double membrane with pores

Function

- Regulates cell functions like protein synthesis
- Pores allow mRNA and ribosomes to pass in and out

Nucleolus

Structure

- Made of DNA, granules, and fibers

Function

- Ribosomes are made here

Endoplasmic Reticulum

Structure

- Series of interconnected tubules made of a single membrane
- Can run from the nuclear envelope to the cell mebrane

Function

- Transport cell products through the cytoplasm.
- Provide surface area for chemical reactions.
- Can produce lysosomes and vesicles.

SMOOTH ER

- Is not studded with ribosomes
- Makes lipids like phospholipids and steroids

ROUGH ER

- Studded with ribosomes
- Makes proteins for expert
- Typically connected to the Golgo body for packaging proteins into vesicles

Mitochondria

Structure

- 2 membranes: smooth outer, inner folded into “cristae”
- Filled with a liquid called “matrix”

Function

- Site of cellular respiration
- Converts glucose into ATP
- Folded cristae provide maximum surface area for these chemical reactions

Chloroplasts

Structure

- Green from chlorophyll
- Found only in plant cells and a few protists

- Double membrane on outside and a series of stacked internal membranes calle d”Grana”
- Filled with a fluid called “Stroma”

Function

- Site of photosynthesis (converts sunlight to glucose)
- Chlorophyll traps the sunlight
- Membranes provide a large surface area for the reactions

Golgi Body

Structure

- Flattened stacks of membrane
- Small vesicles form and a repinched off at the end of the folds

Function

- Recieve, modify and transport proteins of polypeptides made by the Rough ER and smooth ER respectively
- Membranes provide surface area for chemical reactions
- Various polypeptides are combined here to make 1 large protein molecule
- These are stored in vesicles and release when needed

Ribosomes

Structure

- Dense looking granules
- 2 sphere
- Made of rRNA and protein
- Found on ER floating free in cytosol

Function

- Site of Protein Synthesis
- mRNA is helf b/w 2 spheres. Proteins are coded for and built using amino acids
- Proteins are then either used by or exported from the cell.

Vacuoles

Structure

- Single membrane bags, filled with water and dissolved molecules
- Mainly in plant cells

Function

- Storage
- Starch molecules hold water to create TURGOR pressue to support the plant

Vesicles

Structure

- In plant and animal cells
- Round, temporary sac made by the Golgi

Function

- Store hormones and transport materials through cell messengers
- Bring in food (endocytosis) and digest it. Then excrete waste (exocytosis)

Lysosomes

Structure

- Single membrane sac full of hydraulic enzyme

Function

- Only in animal cells:
    - 1-cell organism: joins w/food vacuole and qnzymes digest the food
    - In white blood cells: destory bacterai
    - In most cells: break down old organelles or destroy dead cells

Cytoskeleton

Structure

- Support network of protein fibres
- Made of microfilaments, intermediate filaments, and microtubules
- Outside membrane=cilia and flagella

Function

- Gives animal cells their shape
- Anchor organells
- Might relay messages b/w inside and outside of cell

Cilia + Falgella

Structure

- Cila=short + numerous
- Flagella=long but few

Function

- Move.

Cytoplasm

Structure

- Everything b/w nuclear envelope and cell membrane
- Made of organelles and a liquid called Cytosol

Function

- Allows movement within the cell
- Cytosol holds all the ions and moeclules made by or needed by the organelles
- Enzymes, amino acids, atp, glucose

Cell wall

Structure

- Polysaccharide called cellulose
- Tough fibrous box
- On plant + prokaryoic cells only

Function

- Gives plant cells support and shape
- Permits turger pressure to be created

Cell membrane (Fluid mosaic model)

Fluid mosaic

- Molecules can move about allowing membrane to adjust
    - Phospholipids can vibrate, flex, spin, move sideways and exchange places within half othe bilayer

- Proteins = big and move slowly
- Proteins attached to cytoskeleton don't move far
- Membrane solidifies when it cools, its permeability will change and enzymatic proteins becom inactive

Cell membrane

- Separates cell from external environment
- Selectively permeable membrane

Phospholipid bi-layer

Structure

- 2 layers of phsopholipid molecules held by hydrophibic attraction

Function

- Kepps cell intact
- Hydrophillic heads+ hydrophbic tails regular what enters and leaves the cells
- Membrane asymeetry = internal and external bilayers differ
- Extenral:
    - Consist of glycolipids and carboyhydrate groups attached to proteins
    - Contains recepto protein that can bind to hromones and growth factors and sell signals with in thecell
    - Example of external layer: serotonin binds to end of cell to send a signal to it
- Internal
- Cytoskeleton components bind to proteins

Proteins

- Protein activities can be grouped into:
- 1. Transport: hydrophilic channels that change shape to allow some molecules across
- 2. Enzymatic: involved in respiration & photosynthesis.
- 3. Triggering signals: bind with chemicals (ie.hormones) to trigger a cascade of events within cell.
- 4. Attachment and recognition: exposed to both external & internal membrane. Attachment point for cytoskeleton or used for cell-cell recognition.

Integral Proteins

Structure:

- Embedded randomly b/w the phospholipids

Function:

- Transport larger items through the membrane
- Allow hydrophilic particles through

Glycoprotein

Structure:

- Protein with attached sugar moleculues

Function:

- Attachment sites for molecules needing to enter, or for messenger molecules such as hormones.
- These are very specific to each person and play a role in recognizing our own cells (organ transplants).

Other Peripheral protein

- not embedded in the lipid bilayer, found on surface. Interacts with integral proteins
- do not interact with the hydrophobic part of the membrane
- Held by non-covalent bonds
- Most are on the cytosol (external) side, some are part of the cytoskeleton (ex. microtubules, microfilament)

Cholesterol

- Essentail structural componnet ofcell membranes, helps to establish proper membrane permeability and fluidity

Carbohydrates

- Found on the surface of thecell
- Important for cell-cell recognition and immunological reaction

Membrane fluidity

- dynamic of the bilayer depends on how densely the individual lipid molecules can pack together
- Major factors:
    - Composition of the lipid molecules in the membrane (saturated vs. unsaturated lipid)
    - Temperature (forms highly viscous semisolid gel when extremely cold)

        - Sterols (help restrain movement at high temperature and ensure fluidity at low temperature)

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Experimental Quiz over the weekend → not for marks, just to practice

Test → Tuesday

Time → Will give us more time?

- Will take ~1 hour, shes gonna reduce uploaded questions
- Mostly typing answers
- 1 hour lesson + 1 hour test
- Starting at latest 10:30

On → everything after nomenclature, starting from carbohydrates

- Includes dehydration synthesis
- Everything up to tomorrow
- Diagrams will be optional if they help you explain

Homework

- 81-85 in textbook
- Cell membrane questions

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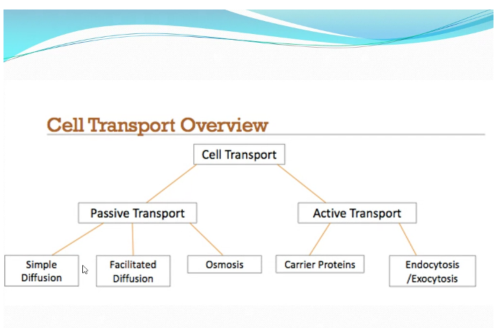
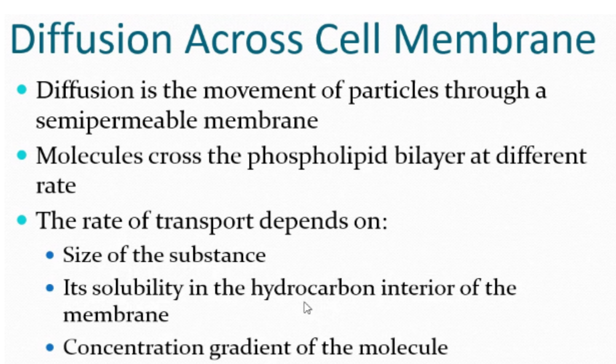
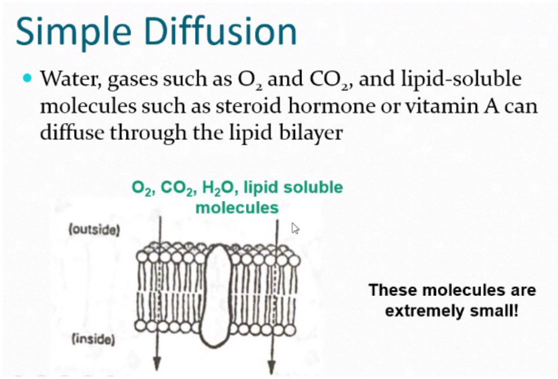
Cell Transport



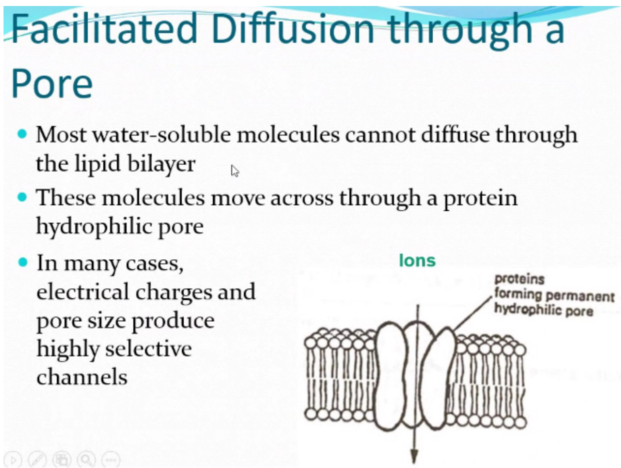
Diffusion

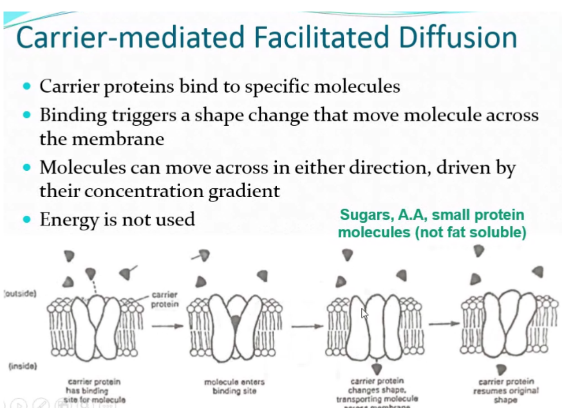
- 

- Simple Diffusion

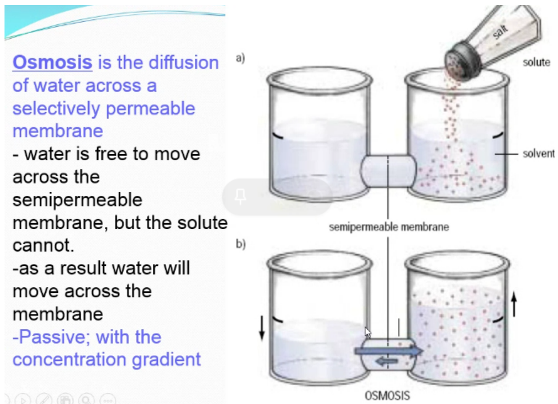


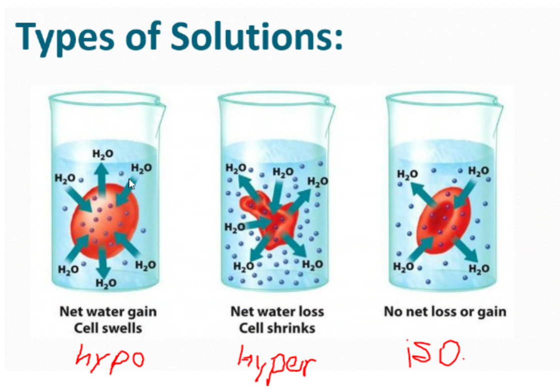
- Facilitated diffusion





Osmosis

- 

    - Water moves to the salt side to maintain the concentration gradient
- 

    - Good way to remember → hypertonic is like a cucumber going into a salt water pool and becoming a pickle

Active Transport

- Moving stuff agains a concentration gradient
- Low → high
- Required by the cell to keep internal env. Dif. from extern. Env.
- Reuiqmrents:
    - Pumps molcoosl again concentration gradient
    - ATP
    - Carrier protein

ATP (adenosine triphosphate)

- Atp energy is used to change the shape of the transpoprt protein which moves the glucose across the cell membrane
- Hydrolysis of atp releases energy that is used by the cell

- Adp and inorganic phosphate are produced

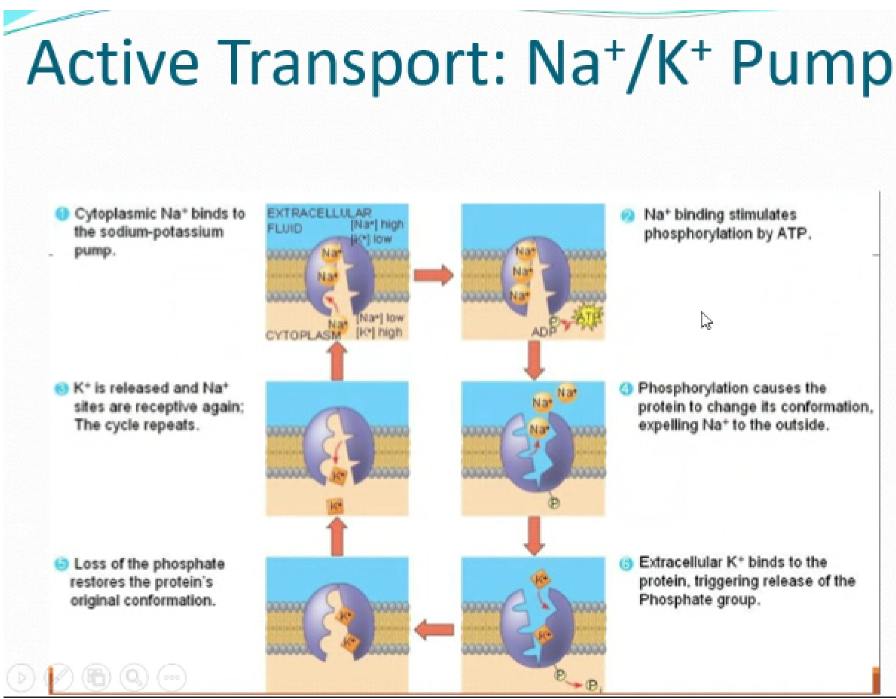
Carrier protiens

- Help pump the nutrients into the cell against its concentration gradient
- Use the energy from ATP breakdown to move the nutrients across the bilayer
- has recognition/binding sites

Steps of active transport

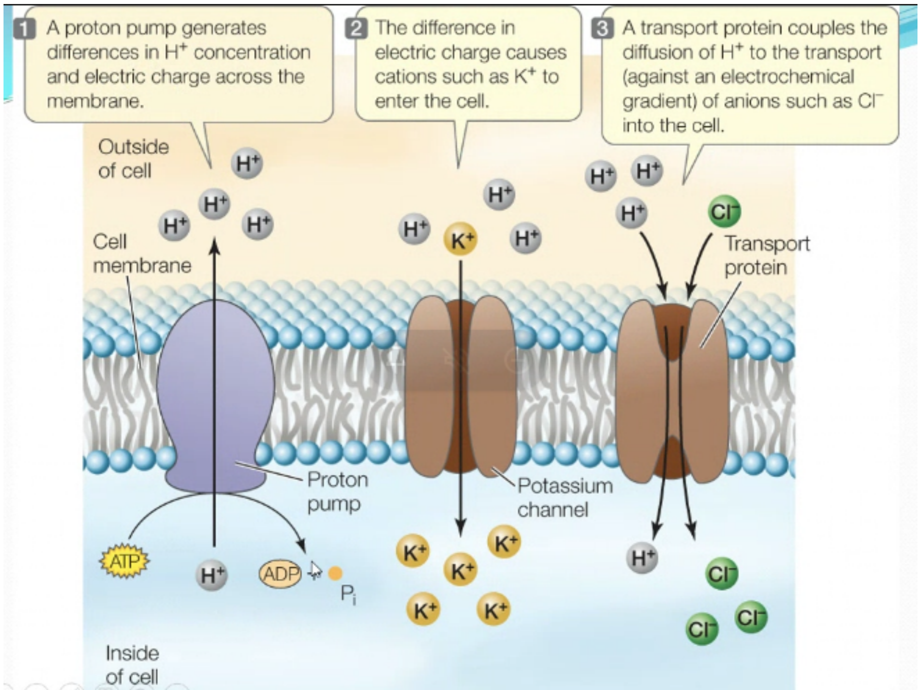
1. Solute binds to protein
2. Protein is phosphorylated by ATP to change protein conformation
3. Other solute binds and the phosphate is removed to change protein conformation
4. Solute is released into the cell

Active Transport - Sodium Potassium channels

- 

- Basically just amoeba sisters everything for this unit

Active transport - Co transporter / proton pumps



Active transport - Membrane Assisted

- Membrane-assisted transport is how we move materials that are too big to move through channels or carrier proteins
- Endo=coming in, exo=going out

Endocytosis

- Exterior medium brought into the cell by folding the cell membrane and pinching off to form a vesicle
- Used to INCORPORATE EXTRACELLULAR SUBSTANCES
- Types of endocytosis:
    - Phagocytosis (CELL EATING):
        - Large particle is enclosed by membrane-enclosed vacuole. Particles are digestd when the vacuole binds to a lysosome
    - Pinoyctosis (CELL DRINKING)
        - Cell drinks extracellular fluid into vesicles
    - Receptor-mediated
        - Membrane has receptors that bind to specific molecules
        - Receptors are clustered in caotaed pits which are coated protein thhat line the interior part of the cell

    - Ligand (sepcific molecule) binds to the receptor on the cell surface which causes the coated pits to form a vescile
    - Once ingested, the receptor molecules are recycled back onto the surface of the cell
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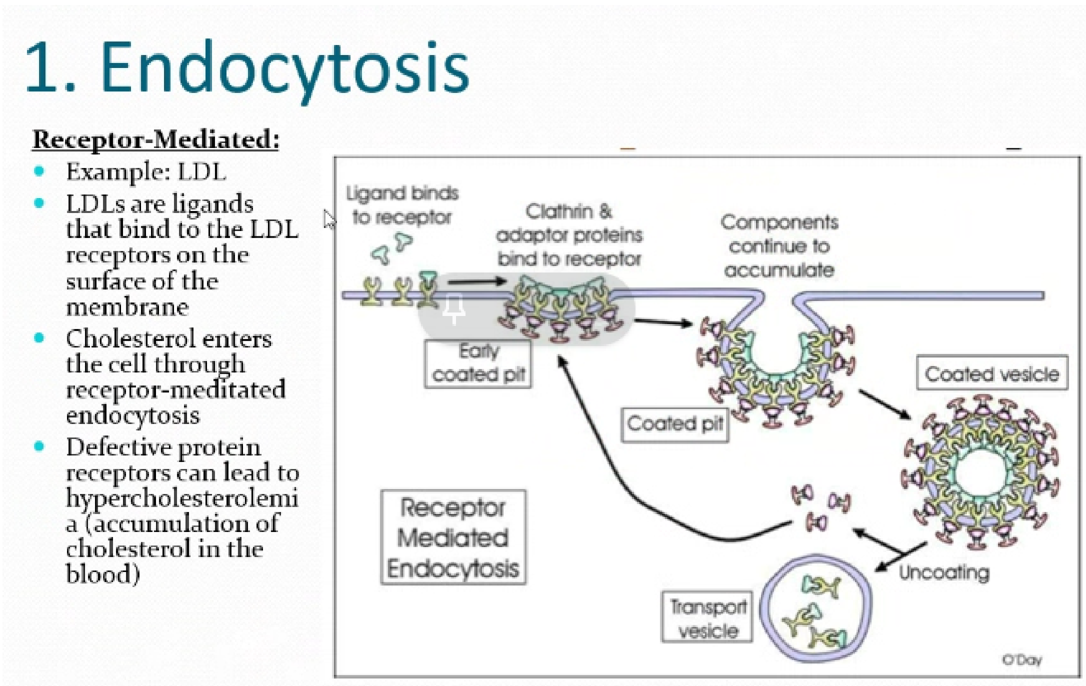

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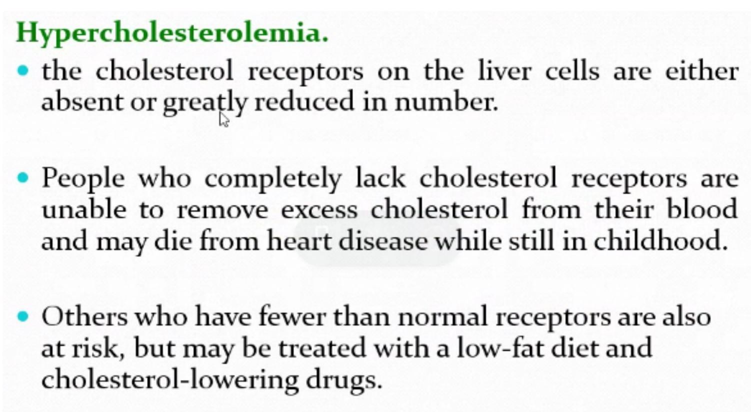

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Exocytosis

- Cell secretes macromolecules by fusing a vescile with the cell membrane
- Vescile usually budded from ER or Golgi and migrates to plasma membrane to incresae surface area