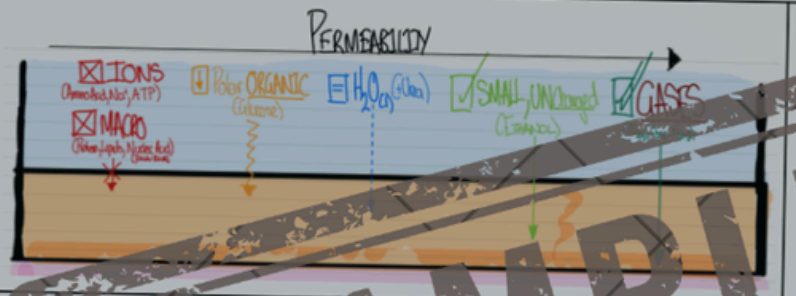
UNSW Molecules, Cells and Genes

BABS 1201

ENTIRE Course Covered (Weeks 1-10)

2026 HD Student

LO2: Describe the different components of the cell *membrane* that are important in → maintaining cell integrity



Phospholipid Bilayer

- Cell integrity: Ability of a cell to maintain its structure/environment despite external changes
- The phospholipid bilayer is a ***permeability barrier*** to most molecules = Important for cell integrity

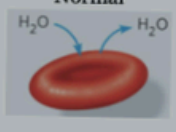
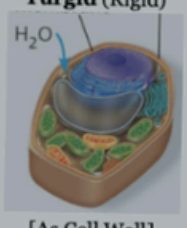
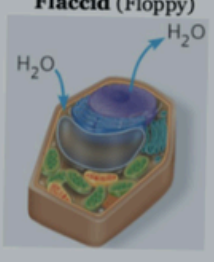
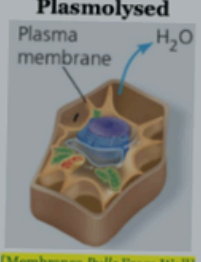
Membrane Proteins

Also important for cell integrity: Play a role in flexibility + durability of cells (ANT transport - next lecture)
Red blood cells squeezing through capillaries — need membrane proteins for flexibility

Transport

LO3: Explain the non-selective diffusion of some small molecules across cell membranes

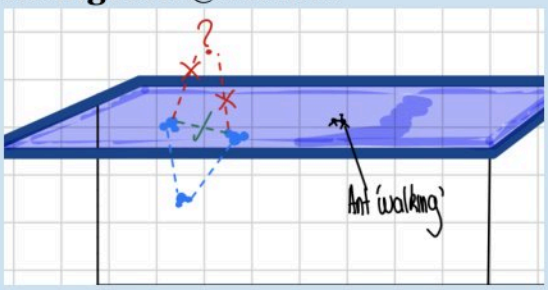
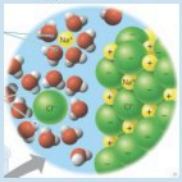
PASSIVE Transport (NO Energy)

OSMOSIS (Low → HIGH)	**DIFFUSION** (HIGH → Low)		
*"Water chases **salt**"* *(Always goes → Hyper to dilute)*	• Perfume spreading across a room		
Always refers to the solution substance is INSIDE • Hypo (Blood + H20) • Hyper (Salt + H20)		*Hypo Sol.*	*Isotonic Sol.*	*Hyper Sol.*
	Animal	**Lysed/ Plasmolysis** 	Normal 	**Shrivelled** 
Tonicity: Measure of how a solution changes the volume of a cell (via water) *"Osmotic Pressure"*: Force exerted BY SOLUTE molecules to ***move* water** across semi-permeable membrane	*Plant*	**Turgid** (Rigid)  [As Cell Wall]	**Flaccid** (Floppy) 	**Plasmolysed**  [Membrance *Pulls* From Wall]

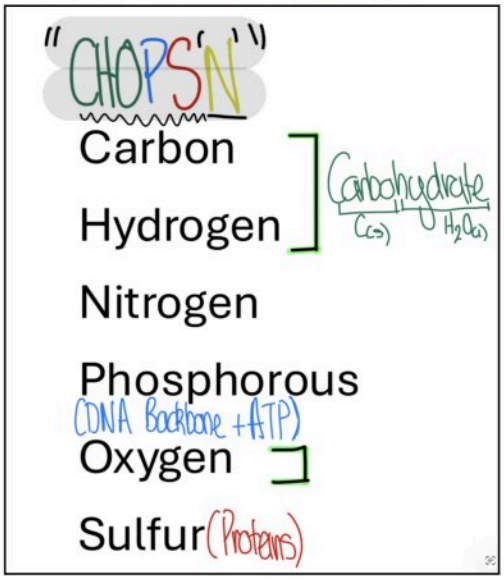
LIFE (#1)

- List the major **elements** of life
- Describe some **properties of water** that make it essential for life as we know it
- Explain how **changes in pH** affect living organisms

H-Bonds give water many ***unique properties***

Cohesion	Attraction of water molecules to *each other* Column of water in a tree (from transpiration) via cohesion can oppose gravity
Adhesion	Attraction of water molecules to ***polar surfaces*** (such as glass)
(Surface) Tension	Above the surface = nothing = nothing to bond to = will just interact *more* w below/adjacent molecules = **strengthen** @ surface! 
Universal Solvent	Dissolves more substances than ANY other liquid as can interact w polar + charged substances "***Hydrated***" 

Major Elements Of Life



Density	
WARM (Dense) 💧	**FREEZE (NOT Dense) 🧊**
↑KE → ↑molecule movement → **H-Bonds break + re-form** → Molecules *closer* together (when moving) → ↑molecules/volume → ↑density	Freezing → Forms **lattice structure** (*tetrahedral* w neighboring) → Hence, molecules further apart → ↓molecules/volume → ↓density
*(THIS property supports life! The less dense ice covers the entire ocean in freezing temperatures to maintain warm ocean temperatures). This is **unlike most liquids**, where its solid state is typically more dense,*	

NOTES: i. You cannot "kill" viruses/prions ii. prokaryotes do NOThave a 'cyto**plasm**' (they DO all have a cytosol)'

Cell: Smallest unit of organisation that CAN perform ALL the activities essential for life

② MEMBRANE (The Plasma...)

- Seperates inside vs outside
- "Selective Barrier": Controls traffic of materials in/out of cell
- Controls SIZE of cell

③ CYTOPLASM

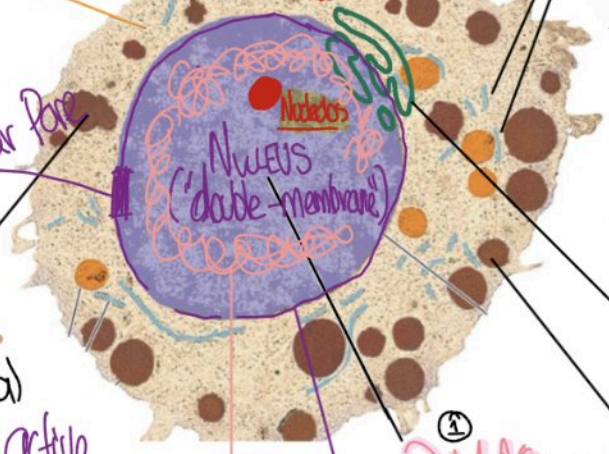
- CYTOSOL: Jelly-like substance (no organelles)
- Does NOT include nucleus (but ALL other organelles)

⑥ ER (Endoplasmic Reticulum)

i) Rough ii) Smooth
(w/ ribosomes) (x ribosomes)

ANIMAL CELL

(x cell-wall) (x chloroplast)
(x large central vacuole)



Nuclear Pore

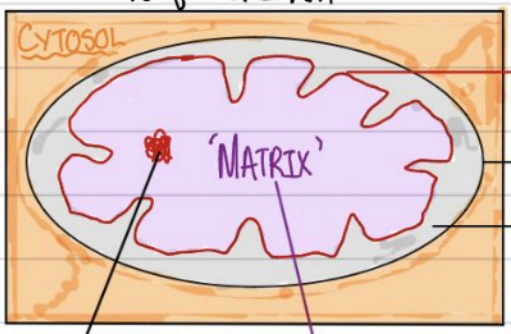
Chromatin

④ RIBOSOMES

- NOT membrane-bound organelles (much smaller)
- Exist either:
  - i) FREE (in cytosol)
  - ii) BOUND (to rough ER) (in eukaryotes)
- "Protein 'factories' of cells"

⑤ MITOCHONDRIA

- # of 'brown spots' (mitochondria) based on how metabolically active cell is - 'how much they rely on taking O_2(g) to generate ATP'



- Inner-Membrane
  - Folds = Cristea
  - To MAX SA of mitochondria
- Outer-membrane
- Inter-membrane ("Selectively Permeable")

"Double-membrane"

Mitochondrial DNA

Fluid inside mitochondria (includes DNA + Ribosomes)

① DNA (throughout nucleus)

- Carry chromosomes
- (Unlike prokaryotes, contained in a membrane)
- "Chromatin": DNA + protein
- 'Nuclear envelope': x2 membrane enclosing nucleus
- rRNA: Synthesis for formation of Ribosomes

⑦ GOLGI APPARATUS

- "Cells 'post office'"

⑧ PEROXISOMES

- Specialised metabolic compartments
- Contains ENZYMES that neutralise reactive O_2(g) (H_2O_2) [Removes toxicity]

Smooth ER: 'Smooth' like FATS = Lipids **Rough ER:** 'Rough' like Ribosomes = Proteins

LO1: Explain the mechanisms by which small molecules may be selectively *transported* in/out of cells

Natural Direction is HIGH → LOW concentration… THIS is the **gradient** (concentration difference) *(i.e if High Glucose inside, will move outside)*

Molecular Transport (Through Lipid Bilayer OR Embedded Proteins)

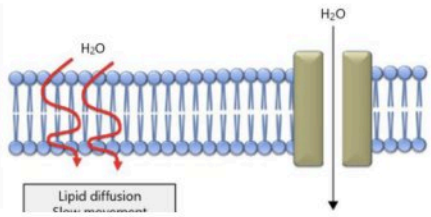
	SIMPLE	FACILITATED	ACTIVE
Energy	**NO** (Passive)		**YES** (Active) Primary: Uses ATP (Direct) Secondary: Uses gradient
Direction	HIGH → LOW		LOW → HIGH (AGAINST Gradient)
Goal	Equalise		Just Maintain A Gradient (Even if unequal)
Protein	**NO** (Non-Specific)	**YES** (Specific) *(Channel + Carrier Proteins)*	**YES** (Specific) *(Proton Pumps + Cotransport)*
Moving:	Small, Non-Polar	Ions + Polar	

Facilitated

CHANNEL

Provide a *corridor* for specific molecules to cross membrane

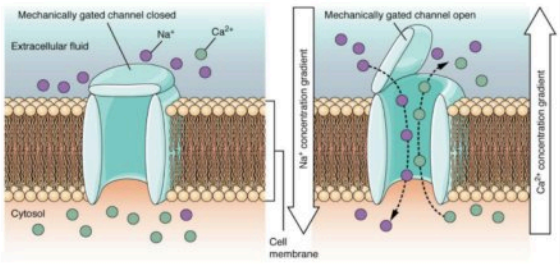
(Aquaporins Specific To H2O in Plants)



Gated Channels: May be opened/closed in response to a stimulus

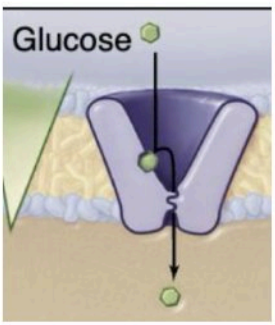
Stimulus: Binding A Specific Molecule. It's ALL in the name.. So if you get a MCQ on it, just match the keyword!!!

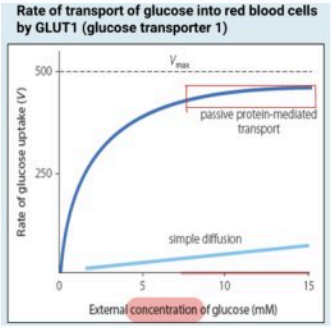
- *'Voltage-Gated **Na+** Channel'*: Current applied allows **Na+** through
- *'Na+ Gated K+ Channel'*: Na+ binded allows **K+** through



CARRIER

1. Binding on one side of membrane to the target molecule
2. This **changes shape** to transport + release solutes on other side





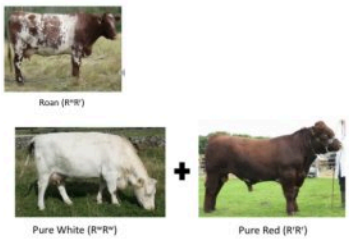
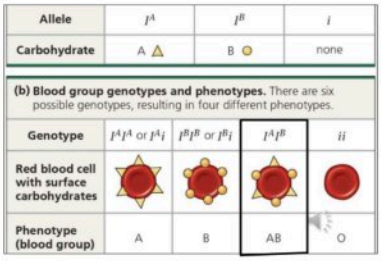
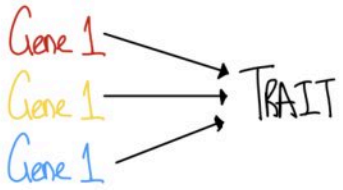
- Highly specific (Glucose)
- **SLOWER** (Than Channels) as must bind + release solutes

HENCE, can become saturated (as [ ]↑) if too much substrate binded (= v. slow)

	GENERATION	BIAS	AFFECTED PARENT	Example
Dominant (A)	**YES**	**NO**	At least ONE Affected	Huntington's
Recessive (A) (Inbreeding ↑ Likelihood)	**NO**	**NO**	BOTH Parents can be Unaffected	Cystic Fibrosis
Dominant (X) (Dominant = **GOOD** for Men)	**YES**	No SONS (from father)	Affected mum: 50% S + 50% D affected Affected dad: 100% D + **0% S affected**	Haemophilia (Colour Blindness)
Recessive (X) (Recessive = Bad For Men)	**NO**	**M>F**	Unaffected (carrier) mother → passes to sons	Hypertrichosis
Y-Linked	**YES**	*Only* **M**	Every male has an affected father	Hairy Earlobes

- **Hemizygous:** ONE copy Of allele (Like how males have ONE copy of X and ONE copy of Y = no dominant X if the current X is recessive = X-Recessive)
  - Homo: TWO copies of same allelle
  - Hetero: TWO copies of different allelle
- **Dominant (A) vs X-Linked Dominant:** Key distinction that affected fathers pass to ALL daughters (rather than some random chance...)

EXTENDING MENDELIAN PRINCIPLES

INCOMPLETE	CODOMINANCE	MULTIPLE ALLELLES	POLYGENETIC
			
NEITHER Allelle is ***fully*** dominant. Instead, blended/ intermediate phenotype	BOTH alleles are fully expressed simultaneously in heterozygotes. (No blending, both traits visible)	>**2** Alleles exist (for ONE gene) (Blood Types)	Multiple genes influence ONE trait *Continuous* (rather than traits being binary that Mendelian thought) (Height, Skin, Colour)

(Incomplete + Codominance = TWO alleles = Monohybrid = 1:2:1 Ratio)