Scientific Method

Steps of the Scientific Method

1) Observation
2) Question
3) Hypothesis
4) Prediction
5) Experiment
6) Record and Analyze data

Types of Variables

Controlled Variable

> The variable that stays constant throughout the experiment

Independent Variable

> The variable that you are changing (I-vary)

Dependent Variable

> The variable that responds to the changes from the independent variable

Negative Control Variable

> A control variable that does not result in any changes

Positive Control Variable

> A control variable that results in a change

Single Blind v.s Double Blind Experiment

Single-Blind

> When the participants of the experiment do not know which group they are in

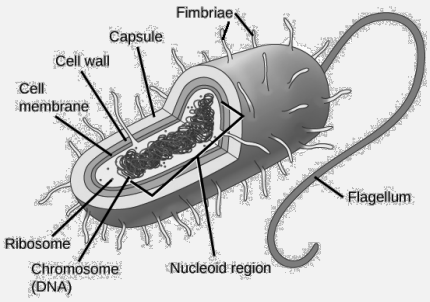
Double-Blind

> When both the researcher and the participants do not know which group they are in

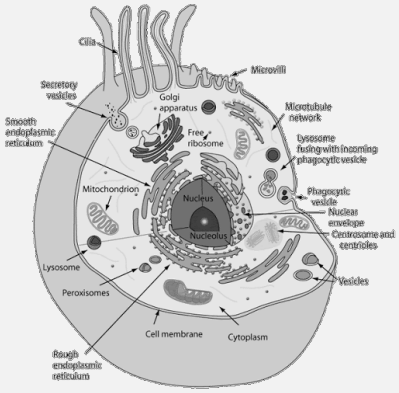
Why is this important?

> It helps eliminate bias in an experiment and help obtain honest results

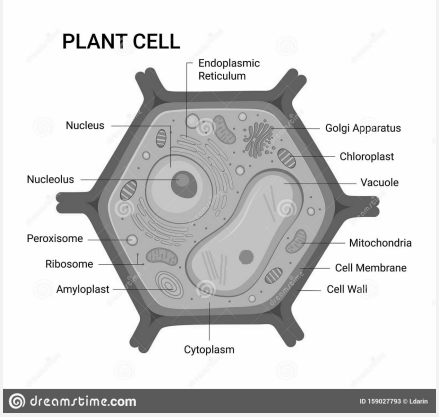
Prokaryotic Cell Structure



Eukaryotic Cell Structure



Plant Cell Structure



Phospholipids

A phospholipid has 2 parts:
1) **Polar region** *(hydrophilic)*
2) **Non-polar** *(hydrophobic)*

Phospholipids form a bilayer in the membrane *(phospholipid bilayer)*

Passive transport

-> requires no energy
-> Spontaneous movement of a substance across a membrane from an area **high concentration** to an area of **low concentration** *(spreading out)*
ex: a ball rolls down a hill

-> **Non-polar substances** can dissolve through the non-polar lipid bilayer.
-> *(sex hormones, pesticides)*
-> **Small, unchanged molecules**: *O2 & the CO2*

Active transport

-> **REQUIRES AN INPUT OF ENERGY**
-> The movement of a substance across a membrane from an area of **low** concentration to an area of **high** concentration
-> **LOWER CONCENTRATION TO HIGHER CONCENTRATION**
-> *ex: we must work to roll the ball back uphill*

Active transport v.s Passive transport

Active	Passive
Molecules **need energy** to move across the membrane *ex: requires transport proteins*	Molecules move spontaneously **(no imput of energy)** *ex: Diffusion & Osmoisis*

What is excluded from passing the membrane?

Ions *(Ca2+, H+, Na+, Cl-)*

> -> even though they are small, their charges cause them to be repelled by the hydrophobic tails of te membrane

Large polar molecules

> ***(gluclose & amino acids)*** cannot pass the hydrophilic tails of the membrane

Transport membranes

> help these molecules pass through the lipid bilayer
> -> **Facilitated Diffusion**: is when the passive movement of a substance *with* the help of membrane transport proteins: *channels carriers*

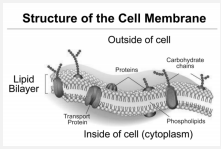
Hydrophilic v.s Hydrophobic

Hydrophilic	Hydrophobic
Attracts Water Molecules	**Repels Water Molecules**

What is the monomer unit of a protein?

Answer: **Amino Acids**

What is the main component of the plasma membrane?



Membrane

What charateristic makes a membrane semi-permeable

> Substances move in & out of the cell through proteins or btwn phospholipids

Characteristics of All Living things

1) Are made up of 1 or more cells

2) Can reproduce using DNA

3) Obtain energy from the environment around them

4) Able to grow & develop

5) able to evolve as a group

Prokaryotic v.s Eukaryotic

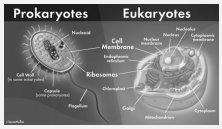
Prokaryotic(Unicellular)

> The entire organism is made up of one cell
> This cell carries out all the functions for survival
> *ex: Bacteria & Archea*

Eukaryotic(Multicellualr)

> Are composed of many specialized cells working together
> *ex: small plants and animals*

Prokaryotic v.s Eukaryotic



DNA v.s RNA

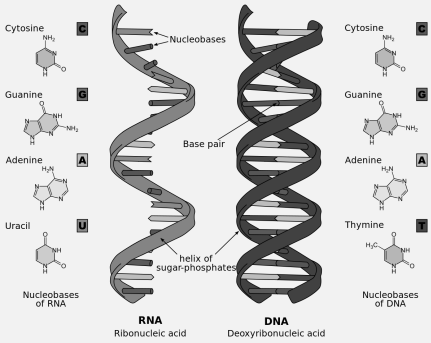
DNA

-> deoxyribosose nucleic acid
-> gene carry an ATCG code
-> are the blueprint for protein molecules

RNA

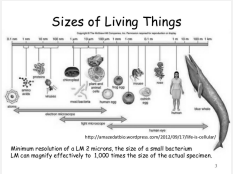
-> ribonucleic acid
-> acts as a messenger carrying out orders from the DNA
-> controls synthesis of protein
-> The genetic code is AGCT

DNA v.s RNA



Macromolecules comparison

Size Ranges of Biological Structure



Cell Structures; to real life ex

Nucleus = Town Hall (controls the cell)
Golgi = USPS/ UPS (packages and delivers
ER= Factories (make lipids/ Proteins
Ribosomes = Factory workers (makes lipids proteins)
Chloroplast= Solar Panel (Captures light)
Mitochondria = Power House (Convert Energy)
Lysosomes = break down bacteria and worn out (sanitation)
Vacuoles = Break down bacteria etc.and store energy (sanitation)
Cell membrane = to regulate what gets in and out of the cell (Bouncer)
Cytoskeleton = structures and movement of chromosomes (infrastructure of town/ highway)
Cytoplasm = holds all the organelles together & cellular respiration (air)
Vesicles = storage and move things around move proteins out of the cell (mailman/ mail truck)

Diffusion

-> **Diffusion**= substances moving spontaneously
-> Diffusion stops when the substance is equally distributed -**Equilibrium**
-> There is no net movement of molecules, even though the molecules are still moving
-> They are moving in a space at the same rate as they are leaving the space

What factors can affect the rate of diffusion?

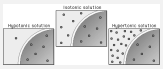
-> **Temperature**(*heat/cold*): Heat causes particles to move faster
Cold slows down the movement of particles
-> **Size of particles**: Small molecules will move faster than the large ones

Osmosis

-> is the movement of water across a selectively permeable membrane
-> Through polar, water molecules are small enough to weave through the lipid bilayer
-> If a large amount of water is needed, the movement is done through a protein channel ***-Aquaporin***

-> The diffusion of water across the membrane is **PASSIVE**
-> **NO INPUT OF ENERGY IS REQUIRED**
-> Water moves from an area of **high** concentration to an area of **low** concentreation
-> Water moves from areas of **low solute** *(salt,sugar)* to **high solute**

Solution types



Isotonic = having the same/equal
Hypotonic = having a lower concentration of solute than the other solution{
Hypertonic = having higher osmotic pressure than the comparison solution

Cheatography

BIO 130T Cheat Sheet

by msingh25 via cheatography.com/126395/cs/24442/

Solution differences

Intracellular v.s Extracellular

Intracellular: located **Inside** of the cell

Extracellular: located **outside** of the cell

Producers v.s Consumers

Producer

-> Plants obtain energy from the non-living part of the environment

-> Autotrophs = Producers

Consumer

-> Animals obtain energy from the living part of the environment

Hetrotrophs =Consumers

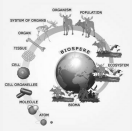
Linnean Hierarchy of Classification

8 category system

Top to bottom = Least specific to most

Bottom to the top = Most specific to least

Biological Organization



4 Biological Molecules

1) **Proteins**

2) **Lipids**

3) **Carbohydrates**

4) **Nucleic Acids**

Monomer v.s Polymer

Monomer

-> is any molecule that contains atleast 1 **C-H** bond

->*Small Building Blocks*

Polymer

-> are small organic molecules that are used as repeating links together via covalent bonds to form a macromolecule (polymers)

Dehydration Reaction v.s Hydrolysis Reaction

Dehydration Reaction

-> connects a monomer to another monomer or a polymer
-> In a dehydration reaction the 2 reactants(monomer/polymer) contributes a part of the water molecule released in the reaction
-> *one contributes the* ***-OH****(hydroxyl group)* & the other **H** *(Hydrogen)*
-> Continuous reaction

Hydrolysis

-> breaks down polymers into monomers
The bond btwn the monomers attaching to one monomer and the hydroxyl attaching to the other monomer

The Order of Making Protein

DNA -> RNA -> Protein

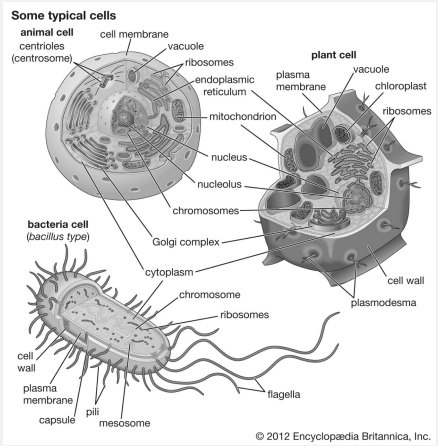
The Plasma Membrane

-> Forms the external boundary of all types of cells
-> Seperates the inside contents of the cell from the outside
-> Controls communication and exchange of some materials

-> Is **Selectively Permeable**
the membrane regulates the passage of materials
-> Membrane allows some substances to pass through, more easily than others.
-> Some molecules can enter and exit the cell freely
Some molecules can pass under some circumstances
-> Others have some trouble

Functions of a Plasma Membrane:
-> They keep toxic substances out of the cell
-> They contain receptors and channels that allow molecules*such as ions, nutrients, waste, and metabolic product*
-> Regulates the **transport** of substances in and out of the cell
-> Protects the cell by acting as a barrier

Cells



4 Macromolecules Functions & Examples

Macromolecules	Building Blocks	Functions	E
Lipids	Fatty acids & glycerol	to provide cells with long-term energy & make-up biological membranes	*F*
Nucleic acids	Nucleotides	to store and pass on genetic info	*D*
Carbohydrates	Monosaccharides *(simple sugars)*	to provide cells with short term energy & source of fiber	*G*
Proteins	Amino Acids	to provide cell structure, send chemical signals, speed up chemical reactions, & more	*K*

key role in cell communication

Answer: The plasma membrane plays a key role in communication btwn cells & their environment

Active Transport & Channels

Ion Channels	Intergral pores that allow specific ions to get in/out of the cell
Transporters	Integral proteins that selectively move a polar substance/ion to one side of the membrane
Receptors	Integral proteins that serve as recognition sites. Each binds to a specific type of molecule
Ligand	A specific molecule that binds to a receptor
Enzymes	Intergral proteins that catalyze specific chemical reactions at the cell surface
Linkers	Intergral proteins that hold down proteins in the plasma membrane. Helps form structure of cells and link cells together

Signal Transduction Pathway

A series of steps linking a mechanical/chemical stimulus to a specific cellular response

Local v.s Long Distance(animal cells)

Local	Both	Long
	target only specific target cells recognize & respond to a given signal molecule	
Panacrine Signaling	A secreting cell acts on nearby target cells by discharging molecules of a local regulator into extracellular fluid	
Synaptic Signaling	A nerve cell releases nuerotransmitter molecules into a synapse stimulating the target cell	
	Hormonal Signaling	Specialized endocrine cells secrete hormones into body fluids, *often blood* Hormones may

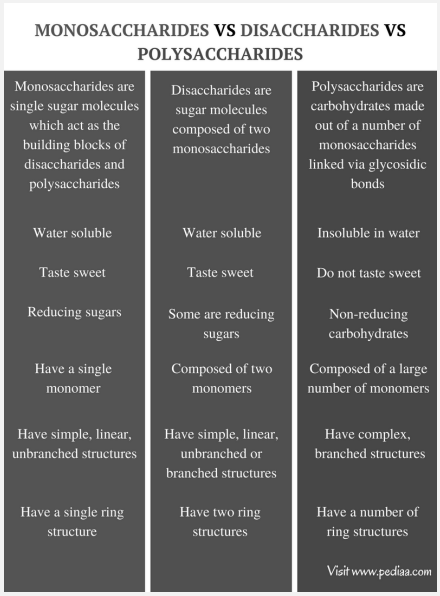
Regulators

Local Regulators: a secreted molecule that influences cells near where it was secreted

G-protein-coupled receptors: a signal receptor protein that responds to the binding of a signal molecule by activating a G-protein

Ion Channel receptors: a ligand-gated ion channel is a type of membrane receptor containing a region that can act as a "gate" when the receptor

mono v.s di v.s poly (saccharides)



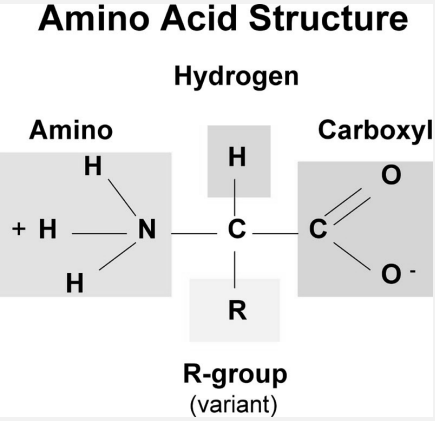
Amino Acid Monomers

-> are organic molecules with carboxyl and an amino acid group

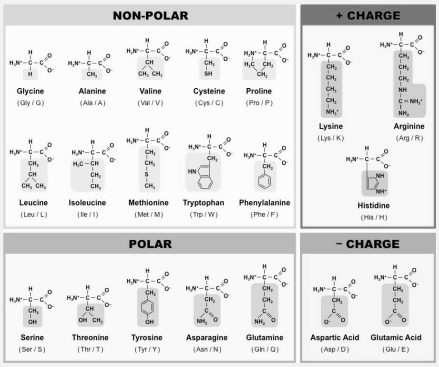
-> at the center of the small molecules is the carbon atom called " **Alpha Carbon**"

-> surrounded by amino group, carboxyl group, a hydrogen group with a "**-R**" group

Amino Acid Structure



20 amino acids



Protein Structure & Function

-> A functional protein consists of 1 or more polypeptides

3 Levels of Structure:

1) Primary Structure
2) Secondary Structure
3) Teritary Structure
4) Quaternary Structure

Protein Structure & Function (cont)

Primary Structure: is the proteins linear sequence
Secondary Structure: is when polypeptide chains coil or fold to the backbone of the polypeptide interact and form bonds
Teritiary Structure: happens through the interactions of the amino acids. Determines the overall shape of the polypeptide
Quaternary Structure: is when 2 or more polypeptides combine (aggregate)

Endomembrane System

-> Nuclear Envelope
-> Endoplasmic Reticulum
-> Golgi Body
-> Lysosomes
-> Plasma Membranes
-> Vacuoles

Plasma membrane

What macromolecule makes up the majority of the plasma membrane of cells?

A) Proteins
B) Carbohydrates
C) Lipids -->> **Phospholipids**
D) Nucleic Acids

Proteins and carbohydrates also compose the membrane

Amphipathic

having both hydrophillic & hydrophobic parts

Concentration Gradient

oocurs when the concentration of particle in one area than another.s is higher

Permeable

allowing cells/ions to pass through

Turgid

Swollen or congested

Solution vocab

Solvent: able to dissolve other solutions

Solution: a homogenous *(balanced)* mixture of solvent or solute molecules

Solute: is a substance that can be dissolved by a solvent to create a solution

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