

NOTE Format

Titles and Units

Subheadings

Important Concepts

SS content (Triple)

Anything highlighted

Twice is in

2 sections @

once

if ydk what
a word means,

search it up.



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BIOLOGY (SS + Combined)

B1 - Cell Structure

There are 2 types of cells.

eukaryotic - these cells have organelles, and their genetic material is stored in a NUCLEUS. They're also usually larger.

prokaryotic - these cells don't have organelles and are usually smaller. Their genetic material is stored in the cytoplasm.

There are two types of eukaryotic cells:

ANIMAL



PLANT



they have
different
organelles

diagram of a eukaryotic cell (w)

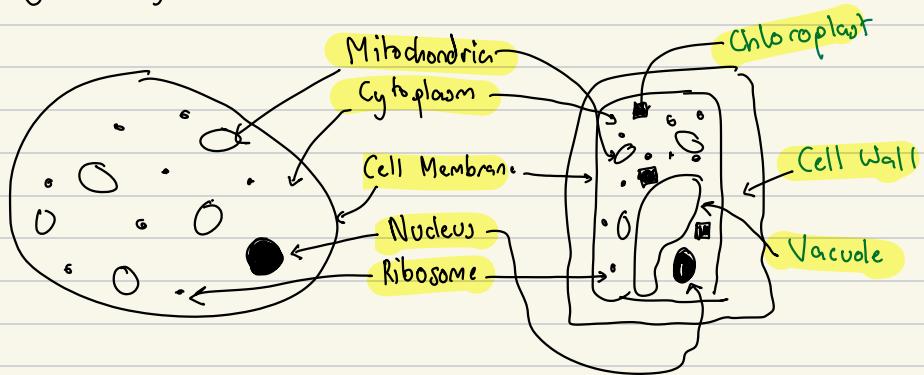
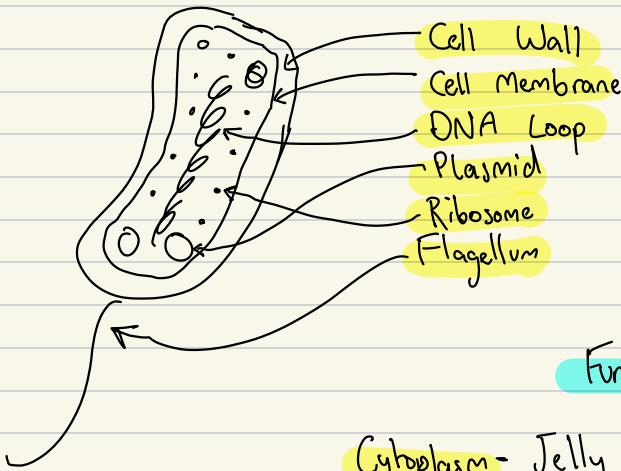


diagram of prokaryotic cell



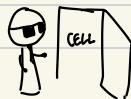
Functions of Organelles

Cytoplasm - Jelly like material that supports organelles and is the site of many chemical reactions.

Nucleus - Contains DNA; controls the cell

you do that ~ you do this
!!

Cell Membrane - A partially permeable membrane that controls what goes in and comes out



Mitochondria - Site of respiration in the cell (produces energy)



Ribosome - Site of protein synthesis (where proteins are made)

Chloroplast - Site of Photosynthesis, contains chlorophyll.

Cell Wall - Made out of cellulose and strengthens the cell.

Permanent Vacuole - Filled with cell sap to keep the cell turgid

B2 - Organization

Multicellular organisms are made of:

Organelles

Many organelles make a CELL

Many Cells make a TISSUE

Many Tissues make an ORGAN

Many Organs make an ORGAN SYSTEM

Many Organ Systems make an ORGANISM

Functions of the above structures:

Organelle - A specialized unit in a cell that carries out a function

Cell - Basic building block of all organisms

Tissue - a group of cells that work together to do a function

Organ - a group of tissues that carry out a function

Organ System - a group of organs that work together to perform functions

To not die, organisms need essential substances from the environment and dispose of waste.

Small organisms use diffusion on the surface of their bodies

Diffusion would be sufficient for them, as they would have a higher surface area: volume ratio

If the organism's bigger, they'll have a smaller Surface Area: Volume Ratio

This is problematic as you can't just rely on diffusion anymore.

Thus organisms have developed other means of intake and disposal of substances and ways to transport them more efficiently too.

A good exchange surface would ideally have

- Large Surface Area
- Short distance required for diffusion.

Animals would also greatly increase blood flow to an exchange surface

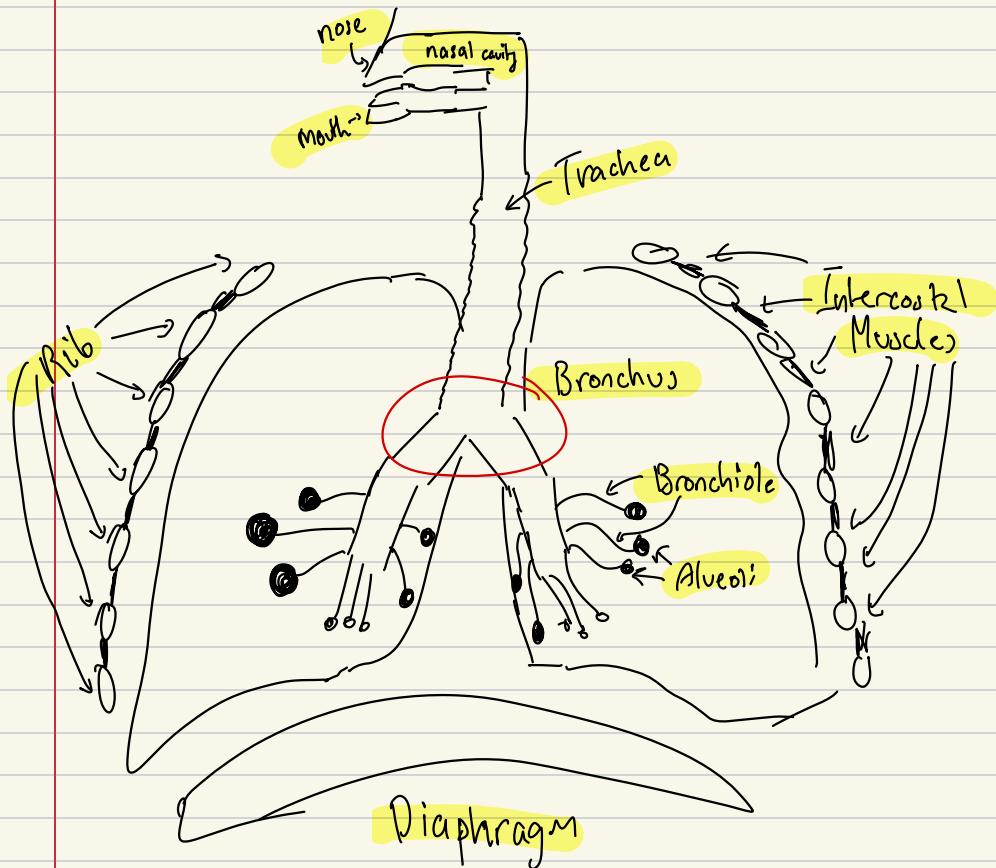
Example of an Exchange Surface - Lungs

They have adaptations to:

- Absorb Oxygen

- Transfer CO_2 from the blood \rightarrow lungs \rightarrow air

Diagram of the Respiratory System



B3 (SS and Comb.)

Infection and Response

Pathogens are microorganisms or substances that cause disease.

There are 6 main types of pathogens
(but we only care about 4)

VIRUS

BACTERIA

FUNGI

PROTISTS (also known as PROTOZOA)

HELMINTHS (types of worms)

PRIONS (misfolded proteins)

IMPORTANT !!

All pathogens cause disease but not all disease is caused by pathogens. These are called non-communicable diseases.

Examples of Diseases

any boxed text is needed
for ss students

COMMUNICABLE

- Salmonella
- Covid-19
- HIV/AIDS

spread from one person to another

NON COMMUNICABLE

- Cancer
- Deficiency Diseases
- Inherited disorders (e.g. diabetes)

doesn't spread from one person to another

A disease is something that causes ill health.

Characteristics of Pathogens

Viruses

- acellular (non-living)
- they basically hijack a cell and forces it to make copies of itself
- made up of a protein coat and a small amount of DNA
- cannot be treated with antibiotics

Examples of Viruses

TMV (Tobacco Mosaic Virus)

- causes leaf discolouration (chloroplasts infected)
- this leads to stunted growth as the plant's ability to photosynthesize is hindered
- No cure, so control is the best thing to do.
- Spread by **fomites**

• HIV/Aids

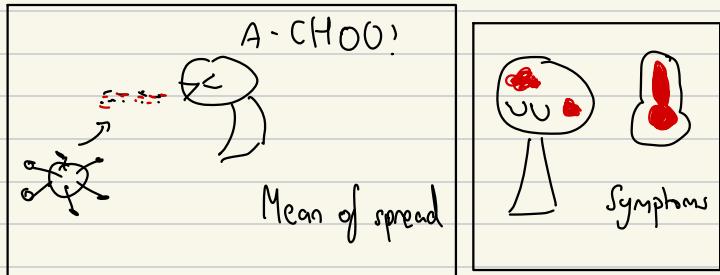
- STD, but also spreads from shared needles
- Stands for Human immunodeficiency virus (HIV)
- Symptoms are mild and flu-like

- After many months, HIV becomes active and it attacks the immune system. It becomes AIDS

- AIDS - Acquired Immunodeficiency Syndrome
- No known cure, infected people are given protection and avoiding sharing needles are preventive measures

MEASLES

- Highly contagious, often caught by young children
- Spreads on infected droplets after an infected person sneezes
- Causes a fever and skin rash
- In adults, it can lead to infertility.
- The MMR vaccine is a preventive measure.
- Face masks block infected droplets from being inhaled.



Bacterial Diseases

- Not all bacteria are pathogen. • prokaryotes
- cellular (living)
- can self-replicate

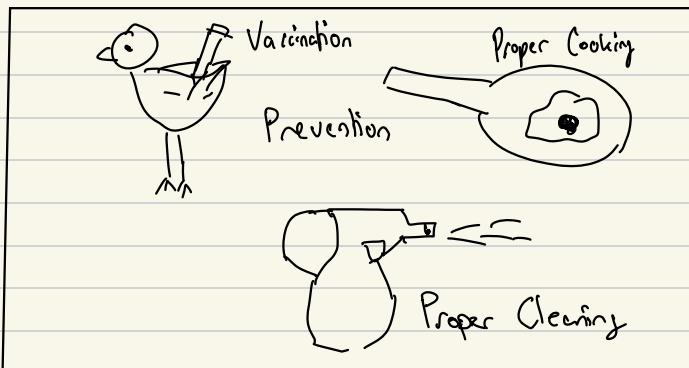
EXAMPLES

Gonorrhoea

- STD, common in ages 15-24
- Causes a yellow or green discharge from reproductive organs
- Leads to infertility if untreated
- Using protection or abstaining from sex (PREVENTION)
- Antibiotics (Treatment)

Salmonella

- Causes food poisoning (abdominal cramps, vomiting, diarrhoea)
- Found in unsanitary kitchens or undercooked meat and eggs
- Vaccinating chickens, proper and thorough cleaning of kitchens and properly cooking meat are ways of prevention.



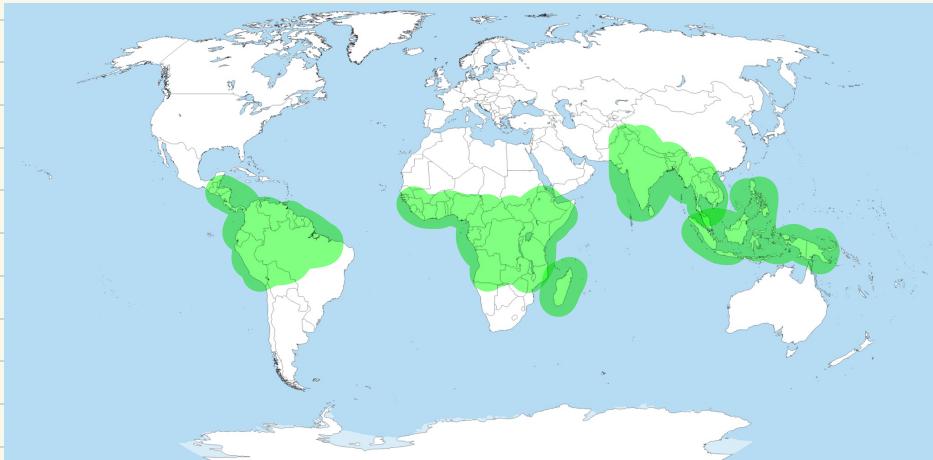
Protoist Disease)

- cellular
- eukaryotic
- have features of animals, plants and fungi.

EXAMPLE

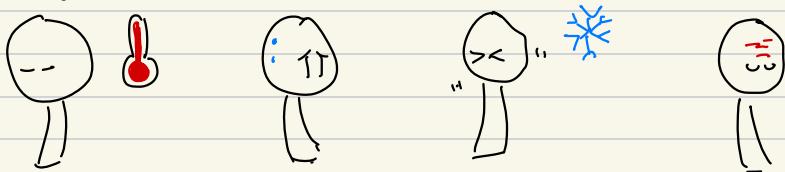
Malaria

- Spread by mosquitoes which are VECTORS of the plasmodium protoist.
- Found in warmer climates like India, Central Africa & America and S.E. Asia



- Mosquitoes facilitate the spread of Malaria by sucking the blood of infected people then sucking a healthy person's blood.

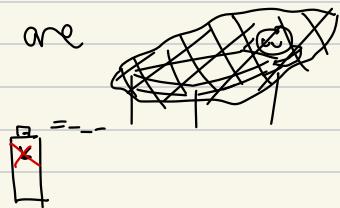
- Malaria causes fever, sweat, chills and headaches
- It also causes vomiting and diarrhoea
- Damage is also caused to the blood and liver



The Malaria vaccine helps in prevention, ever since its release in 2021

Other means of prevention are

- Using mosquito net
- Insect Repellent



Antimalarial drugs can also treat symptoms and even prevent infection

Fungus

- Like **Bacteria**, not all **fungi** cause disease
e.g. yeast
- **Eukaryotic**
- **Multicellular**

Examples

Athlete's foot

- causes a **rash** in between toes
- makes skin dry, flaky, red or wet, white, cracked.
- Often found in communal areas like changing rooms or gyms.
- **Transmitted** via **mites** (infected skin or surface)
- **Treated** with **antifungal** medication

Rose Black Spot

- Causes leaf **discoloration** (black spot)
- The rest of the leaves turn yellow
- This reduces **photosynthesis**, stunting growth
- Transmitted via air, water (spores) as well as **mites** (gardeners)
- Treatable with **Fungicides** and the removal and destruction of affected leaves

Human Defense against Disease

There are two types of Defence used by Humans

Non Specific - Doesn't Target any pathogen
Specific - Targets a specific pathogen

Non-Specific Defenses

Skin

- Acts as a giant wall (physical barrier)
- Antimicrobial peptides are secreted also, creating a CHEMICAL BARRIER
- Microbiome of Bacteria that aid in the secretion of AMPs

Nose

- Nasal hairs trap bacteria (Physical Barrier)
- Mucus is secreted, and when the nose is blown, it removes any pathogens trapped in it. (PHYSICAL BARRIER)

Trachea

- Mucus is also secreted here.
- Any trapped pathogen gets caught by the Mucus and that mucus gets transported to the throat then stomach by the cilia.

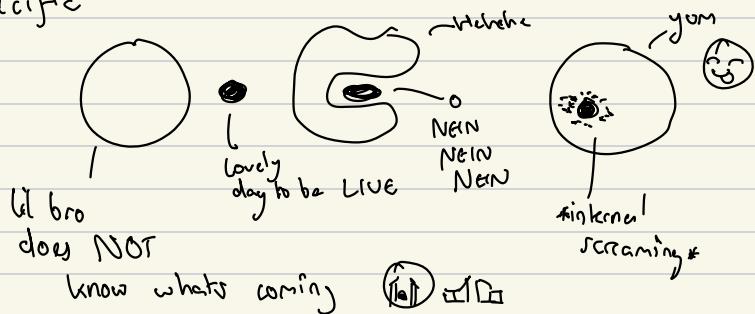
Stomach

- The acid annihilates the bacteria (Chemical Barrier)
- This is the simplest one of them all
- Why are you still reading this line



Phagocytes

- They surround and consume pathogens in the blood
- It goes after EVERY Pathogen, hence it's 'non-specific'



Specific Defenses

Lymphocytes

They produce **antibodies** which correspond to the **antigen** of a pathogen

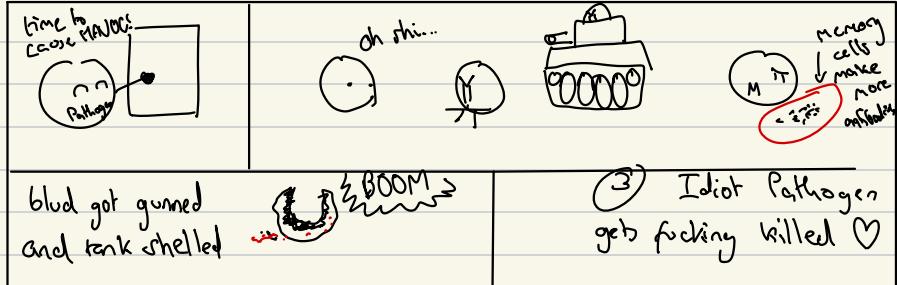
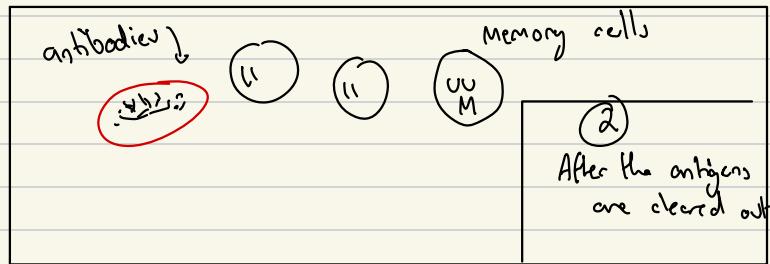
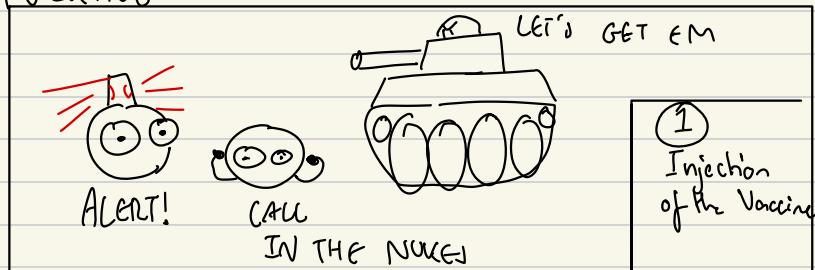
They also produce **antitoxins** to neutralize **toxins** released by pathogens (that's why they're specific defenses)

ANTIBODIES are specific to their **ANTIGEN**
ANTI TOXIN are specific to their **TOXIN**

Ways to treat / control disease

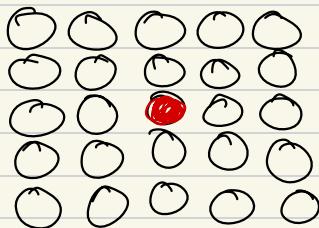
Vaccination

- lessens the severity or makes a person immune to disease
- altered form (dead, inactive or weakened) of a pathogen is injected
- the body goes: 'OH SHIT OH FUCK SOUND THE ALARM' and makes a shit ton of antibodies, and lymphocytes become memory cells
- when the actual disease arrives, it gets FUCKING GANKED

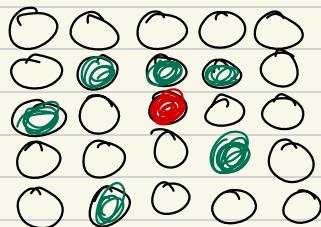
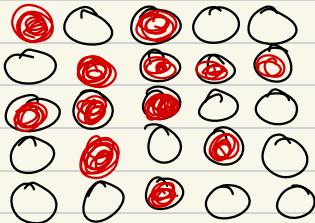


Herd Immunity

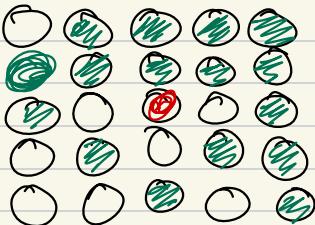
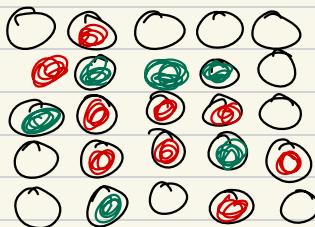
Vaccines are only effective if the majority of the populous takes it.
(That just skips the majority of you)



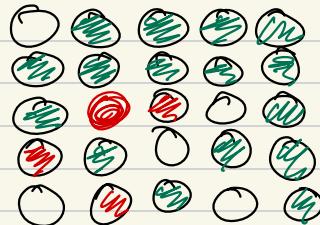
no one
gets vaxxed
(massive
outbreak)



some get
vaxxed
(large outbreak)



most get
vaxxed
(small,
controlled
outbreak)



Antiseptics

- Kill bacteria outside the body
- Used for cleaning open wounds or surfaces

Antibiotics

- Kill bacteria inside the body
- Interfere with the growth of bacterial cells, leading to them dying off as they can't reproduce
- Only kill bacterial cells

HOW ANTIBIOTICS WORK

Penicillin - Breaks down cell walls

Erythromycin, Neomycin, Vancomycin - Stops protein synthesis

Ciprofloxacin - Stops DNA replication

Placebos

A fake or inactive drug that somehow makes us feel better. Talk how.

Painkillers

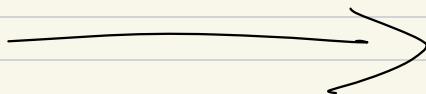
Relieve / Treat the symptoms of a disease but don't kill pathogens

Why not many antivirals?

Viruses are just harder to destroy, Antivirals often destroy viruses and the cell they hijacked or stops the virus from replicating

COMBINED
SCIENCE STOP
HERE

TRIPLE SCIENCE
CONTINUE



I think this is B9??

Bacterial Growth in cultures (SS)

Bacteria replicate @ a rate of once every 20 mins

Formula to calculate # of bacteria at any time

t - time elapsed (s)

r - rate of replications (replications per second)

n - number of starting bacteria

$$\frac{t}{r}$$

$$n \times 2^{\frac{t}{r}}$$

There are many ways to culture bacteria

- nutrient broth solution
- agar plate colonies

e.g. a bacteria replicates once every minute. There is 3 bacteria now. How many bacteria in 4 mins?

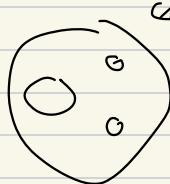
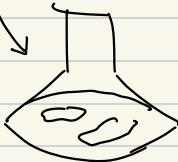
$$3 \cdot 2^{\frac{4}{1}}$$

$$3 \cdot 16$$

48 bacteria

NUTRIENT BROTH

- a liquid or gel with
 - carbohydrates for energy
 - nitrogen for protein synthesis
 - other minerals for growth + survival



AGAR GEL

- agar gel mixed with nutrients are added to sterile petri dishes
- bacteria spread and form "colonies"

Aseptic Techniques + Practical

- a set of strict procedures to prevent the spread of micro-organisms & reduce risk of contamination

- below is an example (w)

STEP ONE

- clear workspace of non-essential items
- spray desk with disinfectant

STEP TWO

- put the inoculating loop over a bunsen to kill bacteria
- quickly dip it in your bacteria and strike on agar petri dish
- quickly close your petri dish and seal it with tape

STEP THREE

- put it into a incubator and wait for bacteria to grow

Plant Deficiencies

Nitrate Deficiency

Plants need nitrates to make proteins for healthy growth. Not enough leads to less chlorophyll and consequently yellow leaves, stunted growth and reduced photosynthesis.

Fertilizers can help increase nitrate levels.

Magnesium Ion Deficiency

Plants also need magnesium ions to make chlorophyll, so a lack of magnesium ions leads to similar symptoms above.

Plant Defences

There are 3 types of plant defense:

Physical defenses

- Physically block the entry of pathogens
- e.g. bark (a layer of dead cells) forms a barrier
- e.g. cellulose cell wall forms a secondary barrier
- e.g. leaves' waxy cuticle

Chemical Defenses

- Some plants produce antibacterial chemicals
- Some plants developed poisons to stop herbivores from eating them (doesn't defend against pathogens)

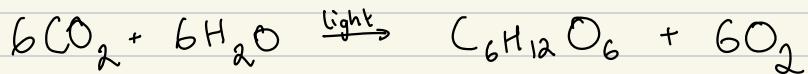
Mechanical Defenses

- make it more difficult to get eaten
- e.g. thorns/hair making eating painful
- e.g. drooping leaves making it harder for insects to eat them
- e.g. Mimicry - mimics surroundings and manipulates nature to its advantage

B4 Bioenergetics

Photosynthesis

A process where light energy, carbon dioxide and water becomes glucose:



carbon dioxide + water $\xrightarrow{\text{light}}$ Glucose + Oxygen

The carbon dioxide required enters the leaf through the stomata

Water is absorbed from the roots

Light is absorbed by Chlorophyll in the chloroplasts



but
why
do we need
Glucose?

Glucose has many uses:

- | | |
|-----------|--------------------------|
| energy | (respiration) |
| cellulose | (cell walls) |
| proteins | (when added w/ nitrates) |
| lipids | (fats/oils) |

Factor affecting the rate of photosynthesis

The rate of photosynthesis can be measured by

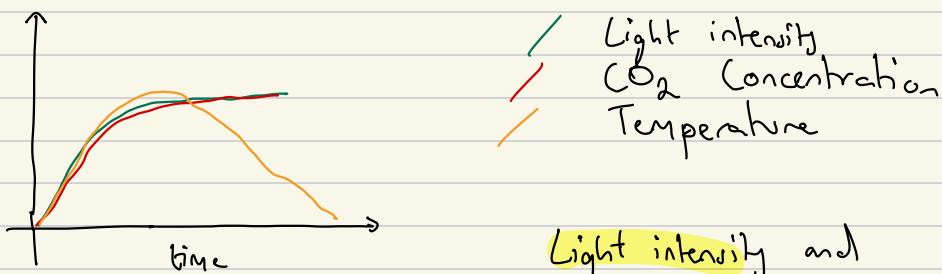
- oxygen output rate
- CO_2 uptake rate
- rate of carbohydrate production

The amount of chlorophyll also affect the rate of photosynthesis

There are 3 main limiting factors:

Light Intensity (Lux)
 CO_2 Concentration (g/cm^3 or ppm)
Temperature (K)

SI
Units



Light intensity and CO_2 level off, simply because either there's not enough light or not enough CO_2 to keep reacting more

As the plant approaches the optimum temperature, the rate of photosynthesis increases. Enzymes denature at high temperatures, and molecular collisions are limited at cooler temperatures, so the rate of photosynthesis is lower.

Respiration

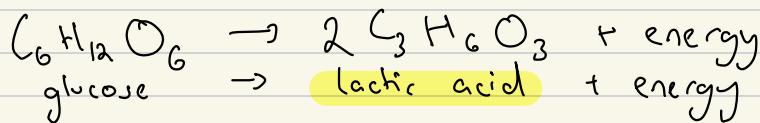
There are 2 types of respiration:

Aerobic:

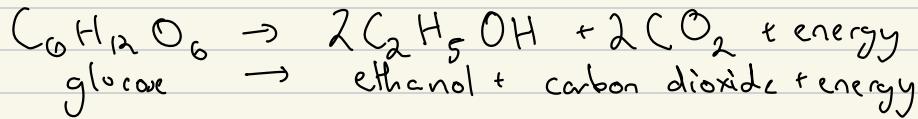


If there's not enough oxygen, the body uses anaerobic respiration, which is far less efficient but does yield extra energy

IN ANIMALS



IN PLANTS



However, Lactic acid causes muscle fatigue and needs to be broken down with oxygen, so it's not sustainable.

Anaerobic Respiration creates this "oxygen debt"

That's why it takes time for breathing to slow down after strenuous tasks,

This can last a few hours to days.

we're
fucking
chat
done!!

only took me 10 hours



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