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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

they have different organelles

PLANT

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diagram of a eukaryotic cell(s)

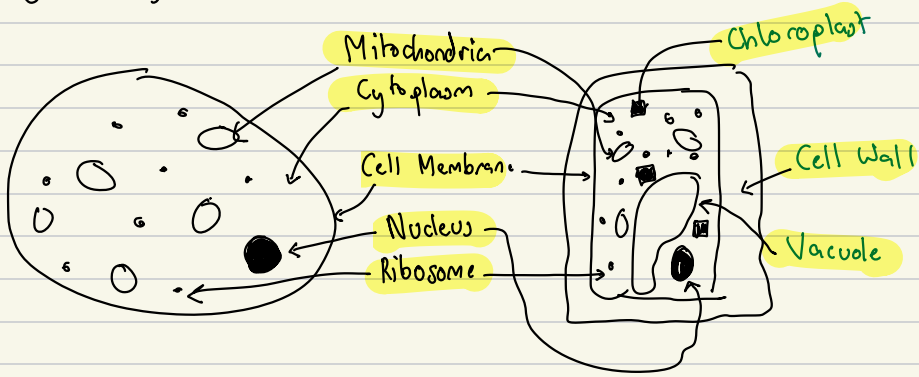
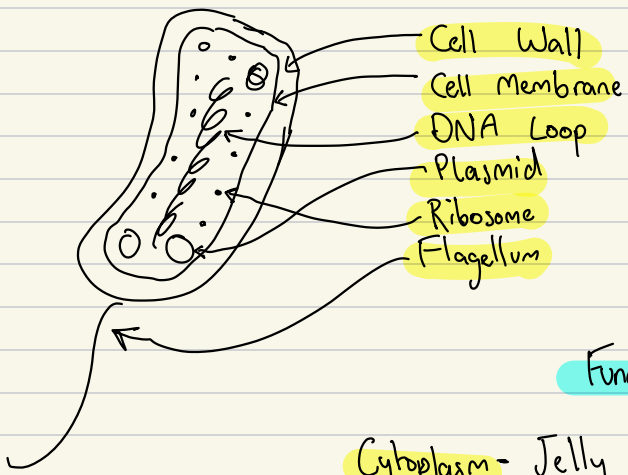


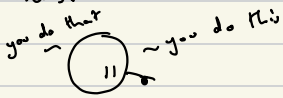
diagram of prokaryotic cell



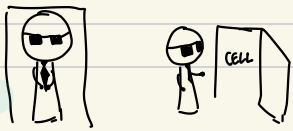
Functions of Organelles

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

Nucleus - Contains DNA, controls the cell



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



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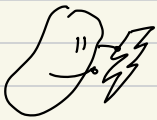
Mitochondria – Site of respiration in the cell (produces energy)



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

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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

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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

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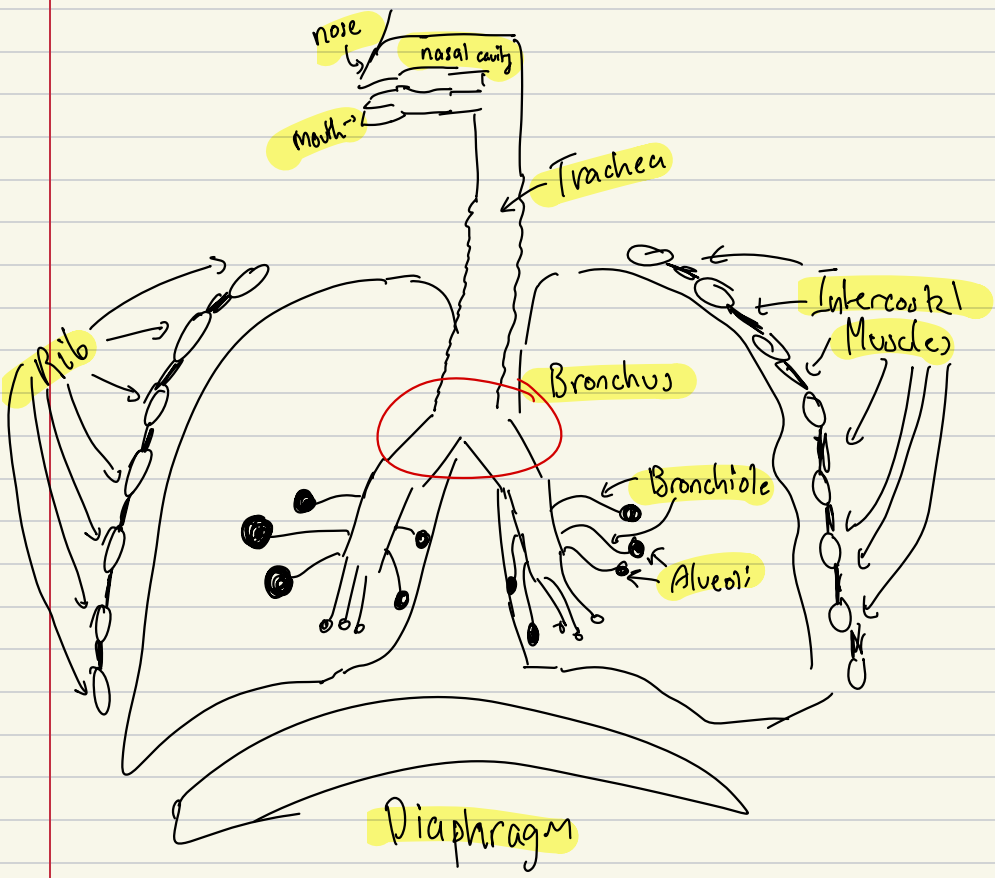
Example of an Exchange Surface - Lungs

They have adaptations to:
- Absorb Oxygen
- Transfer CO_2 from the blood → lungs → air

Diagram of the Respiratory System



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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.

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Examples of Diseases

any boxed text is needed for SS students

COMMUNICABLE

spread from one person to another

- Salmonella
- Covid-19
- HIV/AIDS

NON COMMUNICABLE

doesn't spread from one person to another

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

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

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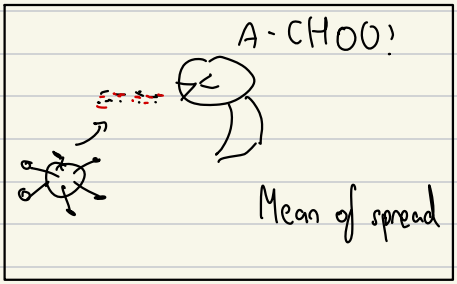
- HIV/Aids
  - STD, but also spreads from shared needles
  - Stands for Human immunodeficiency virus (HIV)
  - Symptoms are mild and flu-like

- 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
- Using protection and avoiding sharing needles are preventative 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 preventative measure.
- Face masks block infected droplets from being inhaled.



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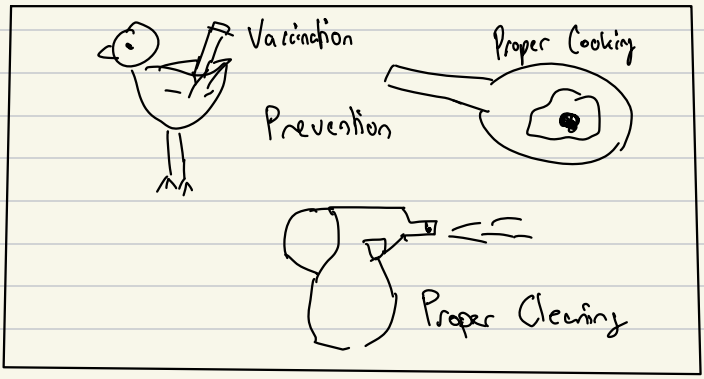
Bacterial Diseases

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

EXAMPLES

- Gonorrhea
  - 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 thourough cleaning of kitchens and properly cooking meat are ways of prevention.



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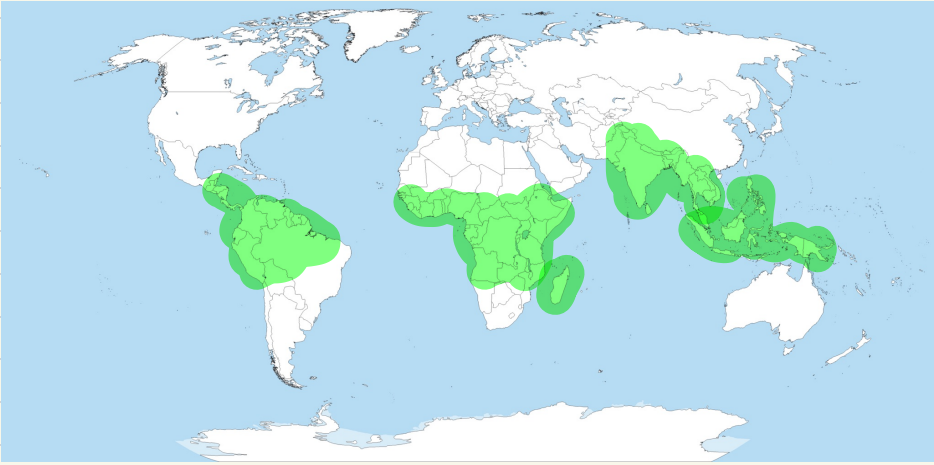
Protist Diseases

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

EXAMPLE

Malaria

- Spread by mosquitoes which are VECTORS of the plasmodium protist.
- 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.

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- Malaria causes fever, sweats, 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 nets
- Insect Repellent

Antimalarial drugs can also treat symptoms and even prevent infection

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Fungus

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

Examples

Athlete's foot

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

Rose Black Spot

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

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Human Defense against Disease

There are two types of Defence used by Human

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

Non-Specific Defense

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.

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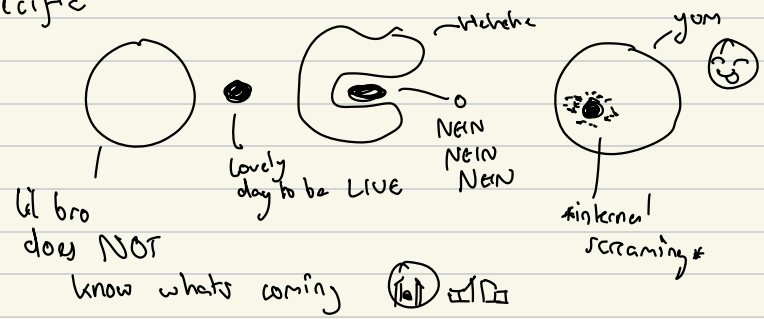
Stomach

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

Phagocytes

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



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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 defense)

ANTIBODIES are specific to their ANTIGEN
ANTITOXINS are specific to their TOXIN

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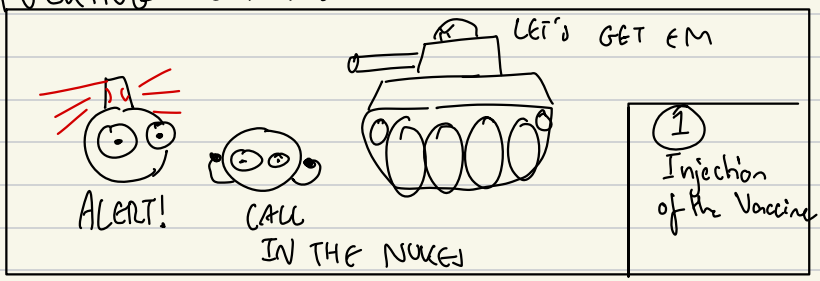
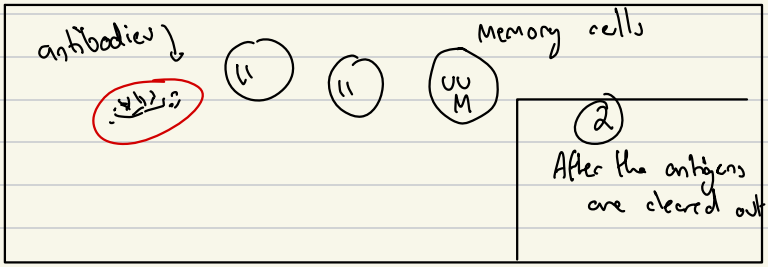
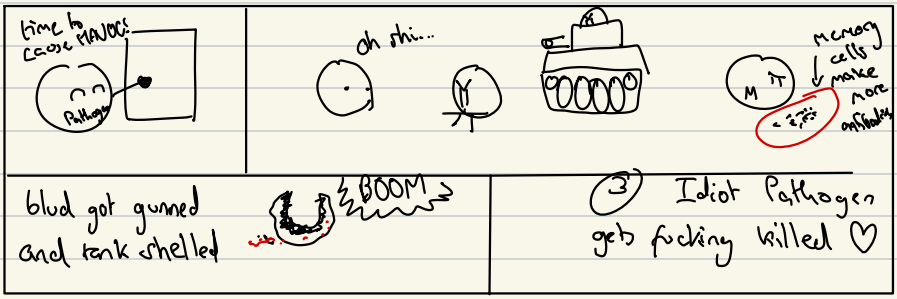
Ways to treat/control disease

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







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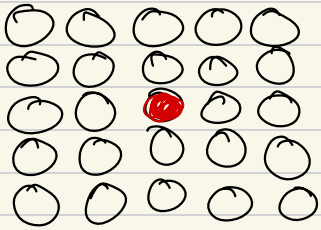
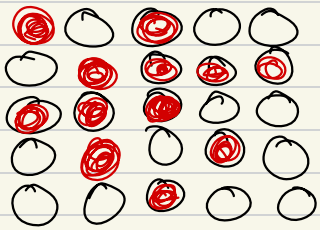
Herd Immunity

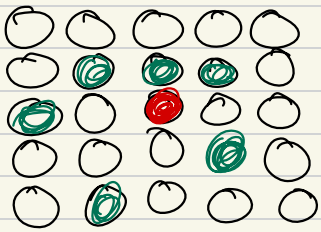
Vaccines are only effective if the majority of the populous takes it.

(that just skips the majority of yap)

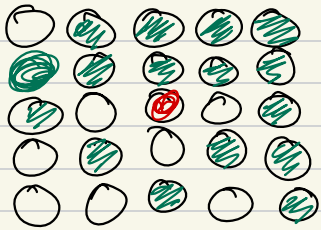


no one gets vaxxed (massive outbreak)

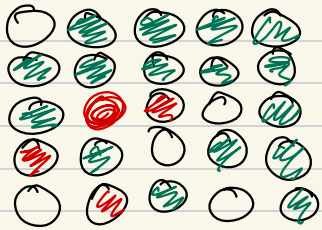




some get vaxxed (large outbreak)



most get vaxxed (small, controlled outbreak)



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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

Penecillin - 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. Idk how.

Painkillers

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

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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

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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

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

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

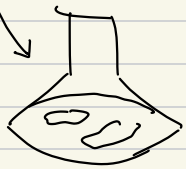
$3 \cdot 2^{\frac{4}{1}}$
$3 \cdot 16$
48 bacteria

There are many ways to culture bacteria

- nutrient broth solution
- agar plate colonies

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"

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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 innoculating 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

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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.

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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+hairs 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

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we're fucking done chat

only took me 10 hours

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