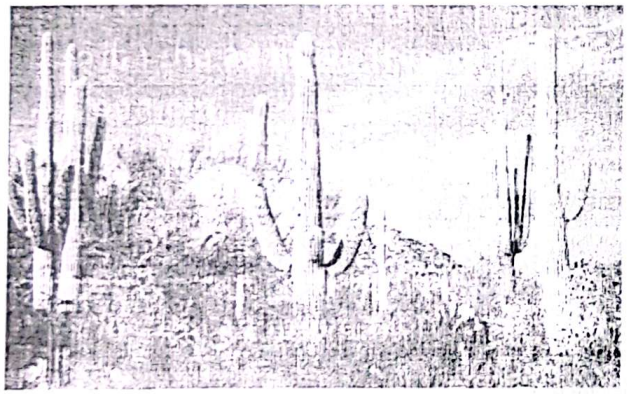
Adaptive Features

Adaptive features: It is the inherited feature of an organism to survive and reproduce in its environment.

Fitness: The probability of an organism to survive in the environment in which it is found.

Describe the adaptive feature of xerophytes and hydrophytes to their environment.

Xerophytes: Plants that are adapted to live in places where water is short in supply like dessert are called xerophytes.



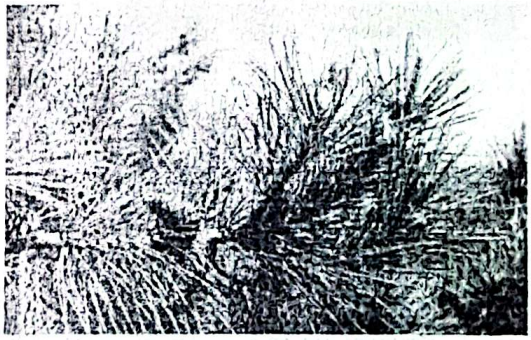
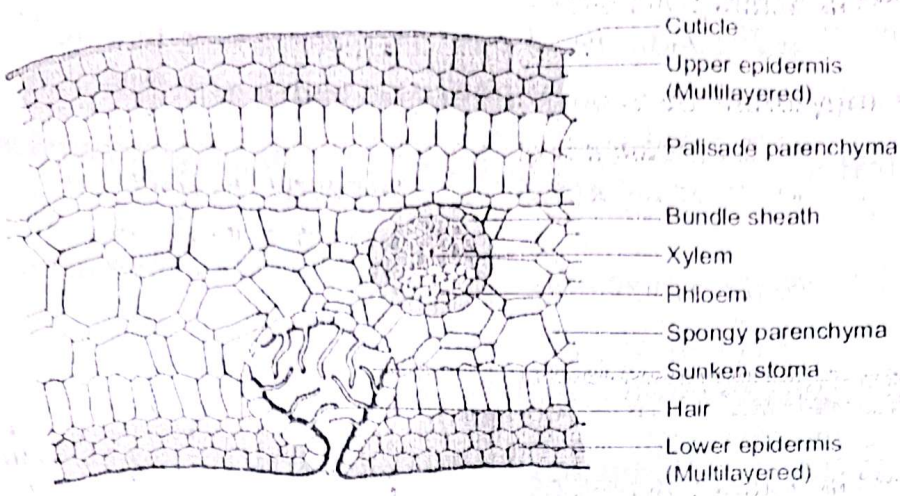


Figure 18.16 Pine leaves, reduced to needles to lower the rate of

Adaptive features of xerophyte:

I. Some plants have hair on their leaves. These hair traps a layer of moist air next to the leaf, reduce air movements. So, humidity builds up and transpiration is reduced.
II. Thick waxy cuticle which reduces evaporation from the surface area of the plants.
III. Small leaves and in some plants, leaves are modified into spines and thorns. This reduces the surface area, hence, less transpiration rate.
IV. Sunken stomata, so it is less exposed to the environmental factors and to create high humidity.
V. It has fleshy green stem to store water and to do photosynthesis.
VI. It has thick water storing trunk to help the plant to store water for survival.



VII. Some grass plants have their leaves rolled up to increase humidity, reducing transpiration rate.

VIII. The plants which live in dry conditions have both shallow and deep root. Long roots to search for water deep in the soil. Shallow roots to absorb water vapour from air and to take water immediately after rain.

Hydrophytes: Plant that lives in very wet places including plants which live in water are called hydrophytes.

Adaptive features of hydrophytes

I. They have large air spaces which increase their buoyancy. So, they float on or near the surface. This helps them to get light for photosynthesis.

fig: Water Lily

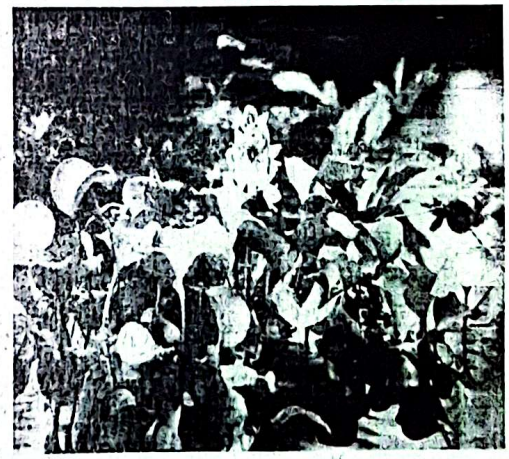


fig: Water hyacinth

II. The lower epidermis lacks stomata to prevent water entering the air spaces, while the stomata are present in upper epidermis for gas exchange.

III. The roots of hydrophytes, which can be poorly developed also has air spaces. This is because the mud they grow in is poorly oxygenated and root cells need oxygen for respiration.

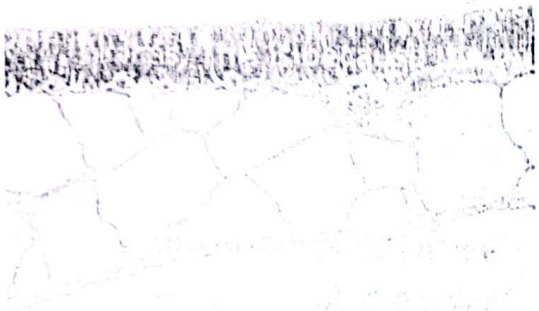
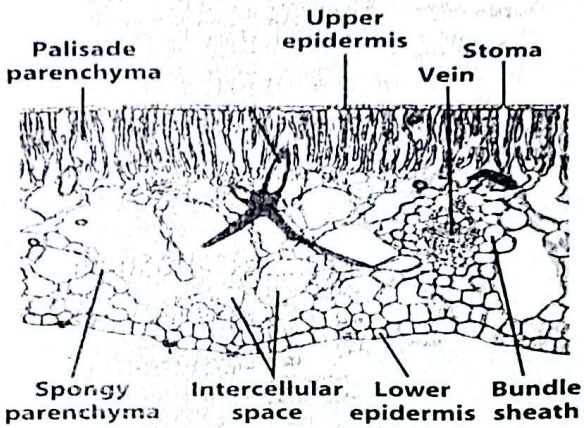


Figure 18.21



IV. The stems lack much support as the water they are surrounded by provides buoyancy for the plant.

V. They have thin cuticle because they don't need to prevent water loss.

VI. Have large, thin, floating leaves, reduced root system and poorly developed xylem tissue.

What is process of adaptation?

The process resulting from natural selection, by which populations become more suited in their environment over many generations.

TROPIC RESPONSES

Definitions

Sensitivity: The ability to detect and respond to stimulus.

Auxin: Plant hormones which controls the rate of growth in shoots and roots. It is effective in extremely low concentrations. Younger plants produce more auxin than older parts.

Features of auxin:

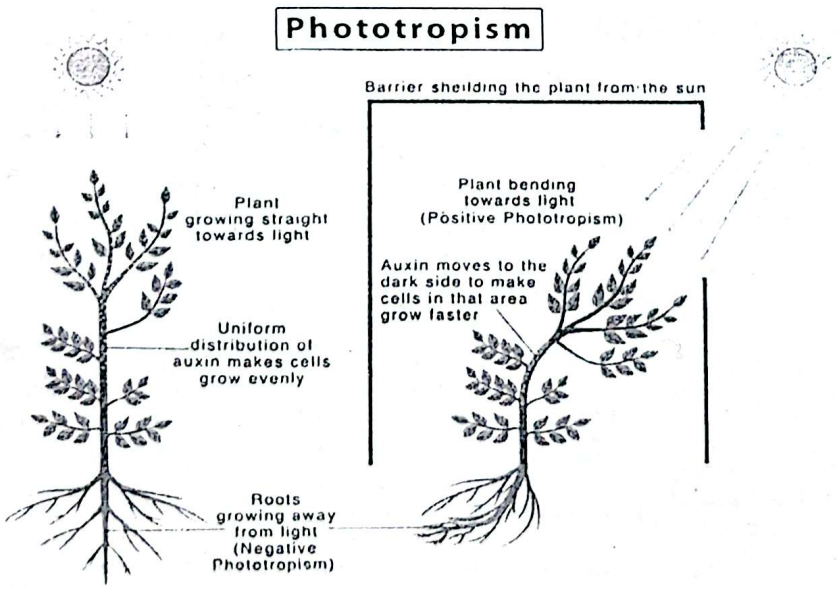
1. Plant growth hormones.
2. Involved in cell elongation thereby increase growth.
3. Light sensitive, which means when light is shown, they move towards the shady side.

Tropism: It is the growth movement of a part of the plant in response to an external stimulus. The response can be towards the stimulus (positive) or away from it (negative).

What is negative and positive phototropism?

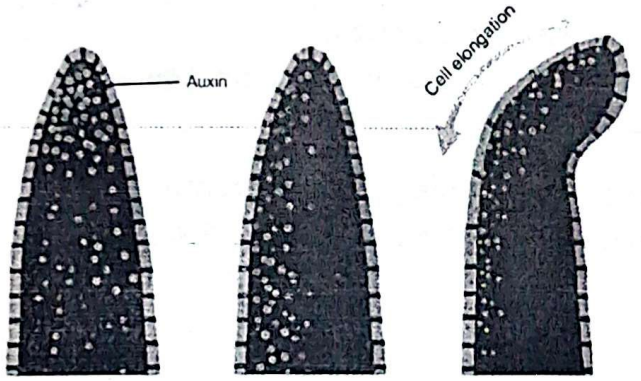
Positive phototropism: Growth of a plant towards the light is called positive phototropism.

Negative phototropism: Growth of the roots away from the light is called negative phototropism.



How do auxins work in plants?

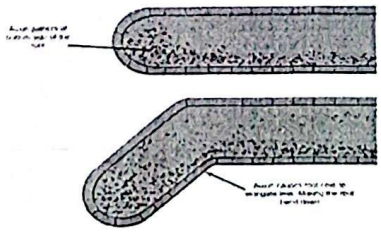
The side of the shoot exposed to the light contains less auxin than on the side which is not illuminated. The light causes auxin to move laterally across the shoot, producing a greater concentration on the unilluminated side. As a result, more hormones diffuse down the region of cell elongation on the dark side causing more growth than the illuminated side (differential growth). More auxins in turn causes uptake of water by osmosis, resulting in cell elongation hence the shoot bend towards the light.



However, auxins have a negative effect in root. When there are more of it, there will be less growth. High concentration of auxin stops the growth in the roots. So, it grows away from the light.

In a root

If a root is placed horizontally, the bottom contains more auxin than the top side. This makes the bottom side of the root grow less than the top side, causing the root to bend in the direction of gravity. This is the opposite of auxin in the shoot.



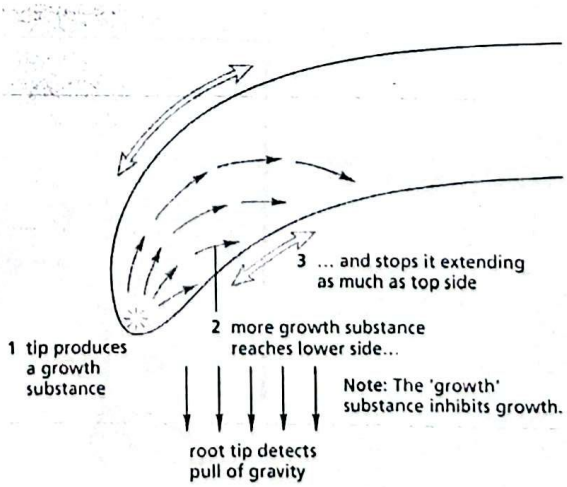


Figure 14.33 Possible explanation of positive gravitropism in roots

Describe an experiment to discover which part of a plant responds to a light.

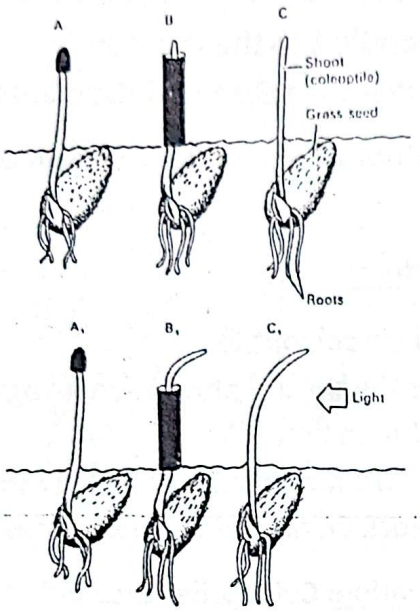


Fig. 11.2 Darwin's experiment to discover which part of a plant responds to light.

Procedure:

- Take three seedlings A, B, and C.
- Cover the shoot tip of seedling 'A' with a black paper cap.
- Except for the shoot tip, the whole seedling is covered in 'B' with a black paper.
- The seedling 'C' was left to grow uncovered, as a control.
- Place all three seedlings near the window where they receive sunlight from one direction only.
- Keep them for few weeks.

Observation: Coleoptile 'B' and 'C' grew towards the light. The seedling 'A' whose shoot tip was covered with a black paper cap grew straight up.

Conclusion: the shoot tip of a plant is sensitive to light.

Describe an experiment to demonstrate the growth-promoting properties of a coleoptile.

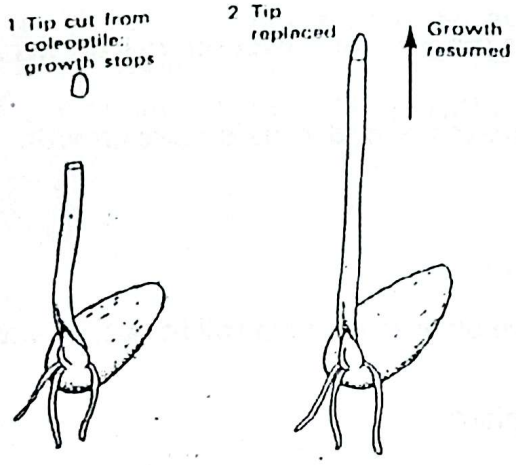


Fig. 11.3 Experiment to demonstrate the growth-promoting properties of a coleoptile tip

Procedure:

- Take two coleoptiles 1 and 2.
- Cut the shoot tip of both coleoptiles.
- Replace the shoot tip for coleoptile 2 and keep the coleoptile 1 without shoot tip.
- Keep both of them to a source of light.

Observation: The coleoptile 2 grows towards the light. The coleoptile 1 shows no response.

Conclusion: The auxins do not produce in coleoptile 1 as the shoot is removed and this indicates that auxins are produced in the tip of the plants.

Describe the experiment to show that a growth-promoting substance can be collected from the coleoptile tip.

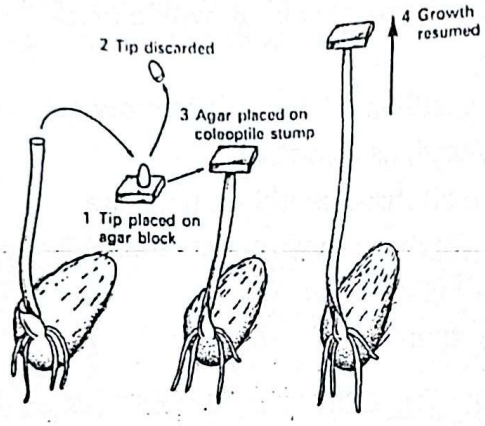


Fig. 11.5 Experiment to show that a growth-promoting substance can be collected from the coleoptile tip

Procedure:

- Take a coleoptile.
- Cut the tip and place it on an agar block for an hour.
- Discard the tip and place only the agar block on the coleoptile stump.

Observation: Coleoptile resumed normal growth.

Conclusion: Auxins can be collected from shoot tip.

Define Gravitropism or geotropism.

Gravitropism is a response in which part of a plant grows towards or away from gravity.

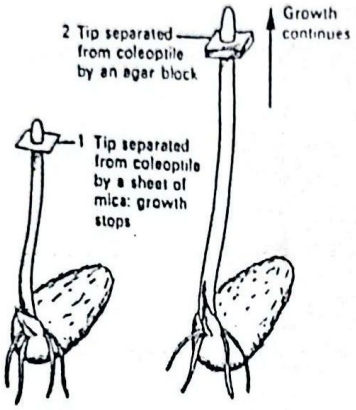
Write the importance of phototropism.

1. Positive phototropism keeps the plant well exposed to light to carry out photosynthesis.
2. More photosynthesis produce more food, causes more growth.

Write the importance of geotropism.

1. Positive geotropism helps the plant to gown in soil to obtain water and minerals.
2. Provides anchorage for the plant.

Describe an experiment to show that a growth-promoting substance or auxin diffuses from the coleoptile tip.



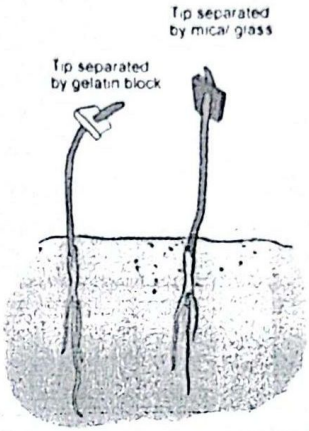


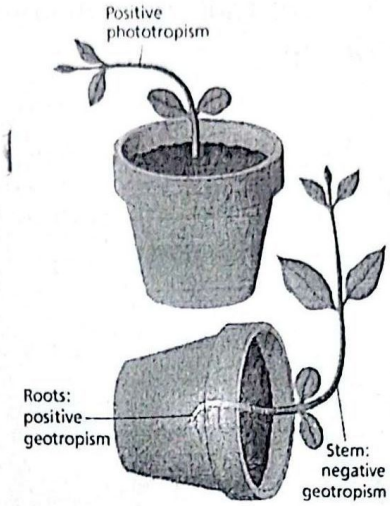
Fig. 11.4 Experiment to show that a growth-promoting substance diffuses from the coleoptile tip

Procedure:

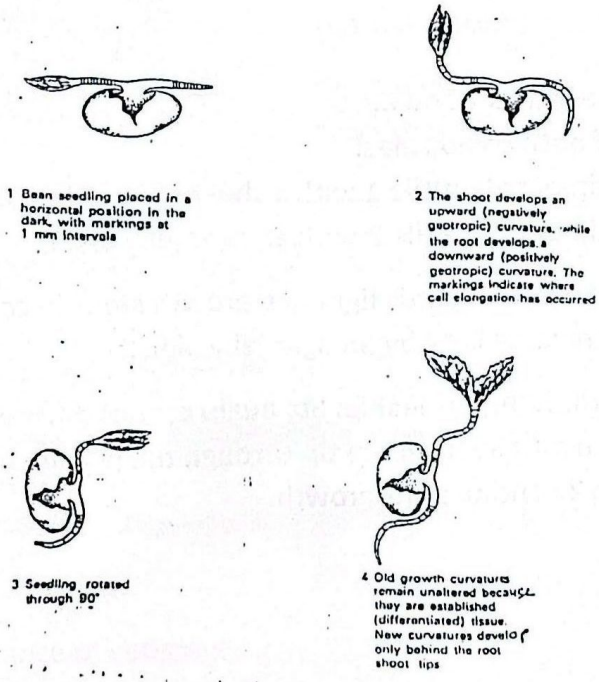
I. Take two coleoptiles 1 and 2.
II. Cut the tip of both coleoptiles.
III. Replace the tip of coleoptile 1 with a sheet of impermeable mica strip.
IV. Replace the tip of coleoptile 2 with an agar jelly block.

Observation: No response towards light and growth stops in coleoptile 1 and coleoptile 2 grows towards light by an agar jelly block.

Conclusion: Mica strip is impermeable. So, auxin cannot diffuse from the tip of coleoptile 1. Auxin diffuse from the tip through the permeable agar jelly block. So, coleoptile 2 continued its growth.



Describe an experiment to demonstrate gravitropism in root and shoot.



Describe the effects of synthetic plant hormone (2, 4, D) used as weed killers.

Large concentration are sprayed onto the plants. As a result, the leaves and stems are stimulated to grow rapidly resulting in uncontrolled growth. This will deplete the stored food quickly resulting the death of the plants. Also the growth of the root will be inhibited by high concentration of auxin. Dicotyledons are more sensitive than others. So weed killers mainly kill broad

leaved (Dicotyledon) plants and leave the narrow leaved (Monocotyledon) plants unharmed.

Describe an experiment of geotropism in pea radicles.

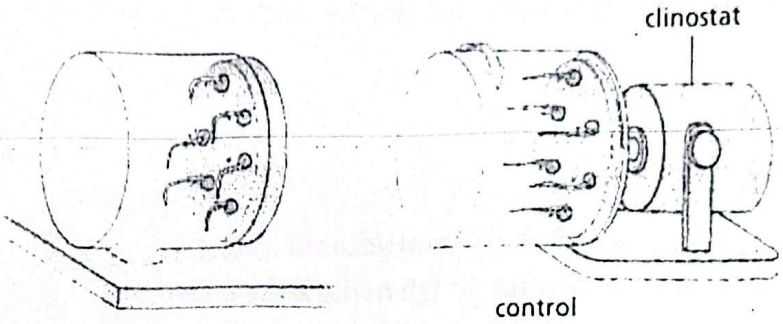


Figure 14.27 Results of an experiment to show gravitropism in roots

Procedure:

Soak about 20 peas for a day and let them germinate in a roll of moist blotting paper. After 3 days, select 12 seedlings with straight radicles and pin six of the seedlings in a turn able clinostat so that the radicles are horizontal. Pin another six seedlings to a cork which will fit in a wide mouthed jar. Leave the jar on its side. A clinostat rotates the seedlings slowly about four times in an hour.

Although gravity is pulling sideways on their roots, it will pull equally on all sides as they rotate.

Place the jar and the clinostat in the same conditions of lighting or leave them in darkness for 2 days. Make sure both sets of seedling are watered equally when needed.

Observations: The radicles in the clinostat will continue to grow horizontally but those in the jar will have changed their direction of growth, to grow vertically downwards.

Conclusion: The radicles are positive gravitropic. The radicles in the clinostat has allowed gravity to act on all sides equally and there is no one-sided stimulus, even though the radicles were horizontal.

DRUGS

DEFINITIONS

Drugs: Any substances taken into the body that modifies or affect chemical reactions in the body is called drugs. They may be used to treat diseases, reduce the sensation of pain or help us to calm down. It also may change our mood by affecting the brain. The liver is the primary site for drug metabolism.

Stimulants: Stimulants are drugs that stimulate the brain and spinal cord, speeding up communication between them. They change mood, increase feeling of well-being, increase energy and alertness. Stimulants can cause heart to beat faster, increases blood pressure and breathing rate.

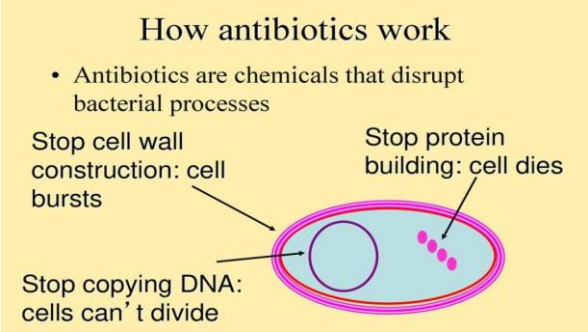
E.g. Caffeine, nicotine

Depressants: It has a relaxing effect because they depress the central nervous system, slow down the action of some parts of the nervous system. The users feels sleepy and less anxious but may become dependent on the drug.

E.g. heroin, alcohol.

What is antibiotics?

Antibiotic drugs are used to treat bacterial infections. Some antibiotics kill bacteria by destroying their cell wall, leading to the cell bursting, whilst others inhibit the growth of the bacteria. Viruses cannot be killed by antibiotics as they do not grow and reproduce in the same way as bacteria, and do not have the same structure.



Some bacterial strains become resistant to antibiotics as a result of natural selection:

1. A mutation occurs in a bacterial cell which makes it resistant to an antibiotic.

2. When that antibiotic is administered, this cell is not killed, whereas cells which have not become resistant are killed.

3. The resistant cell can therefore survive and reproduce, producing more resistant bacteria.

4. Antibiotics target process and structures that specific to bacterial (prokaryotic) cell; as such they do not generally harm animal cells.

Why antibiotics do not harm human?

- Antibiotics work by targeting prokaryotic features not found in eukaryotic cells.
- E.g. Penicillin targets the cell wall and breaks it down. Penicillin can be taken in large doses by human because it has no effect on our cells as human do not have cell wall.
- Antibiotics do not effect human body cells as the cells have large ribosomes, which synthesis proteins differently and under goes DNA replication differently as well.

Why bacteria becoming resistant?

Since the first antibiotic was discovered in 1928, many more have been discovered and developed and antibiotics were and are widely overused. Commonly prescribed antibiotics are becoming less effective due to a number of reasons:

- Overuse and being prescribed when not really necessary.
- Patients failing to complete the fully prescribed course by a doctor.
- Large scale use of antibiotics in farming to prevent disease when livestock are kept in close quarters, even when animals are not actually sick.
- Bacteria mutate very easily and makes resistant genes.

- Bacteria reproduce very quickly. So a bacterium with a beneficial mutation will spread quickly and becomes more common in future generations.
- Bacteria have the ability to pass copies of plasmids from one to another. So a mutation in one bacterium can quickly be copied to others, even others in different species.
- The use of antibiotics speed up the rise of immunity. If a bacterial population is continuously exposed to antibiotic not all the bacteria will die. As soon as a bacterium mutate the rest of the bacteria will be killed by the latest dose of antibiotic. So mutated bacterium can grow largely without competition.

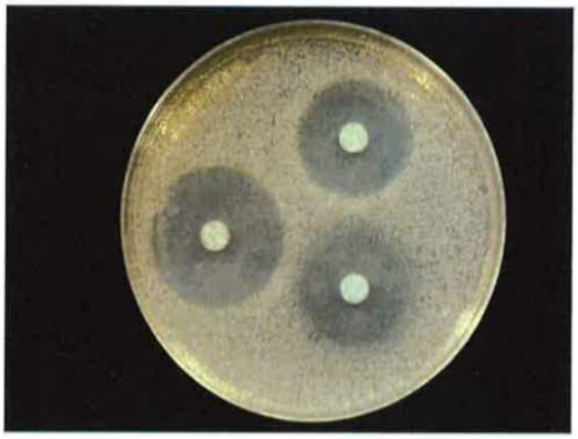


Figure 15.2 This Petri dish contains agar jelly on which the bacteria that cause typhoid fever are growing. The three white circles are little discs of filter paper soaked in different antibiotics. You can see how the bacteria are unable to grow close to the discs, showing that these antibiotics are effective against the bacteria.

Figure 15.3 Many farm animals are regularly given antibiotics. Unnecessary treatments should be avoided, to reduce the risk of resistant populations of bacteria arising.

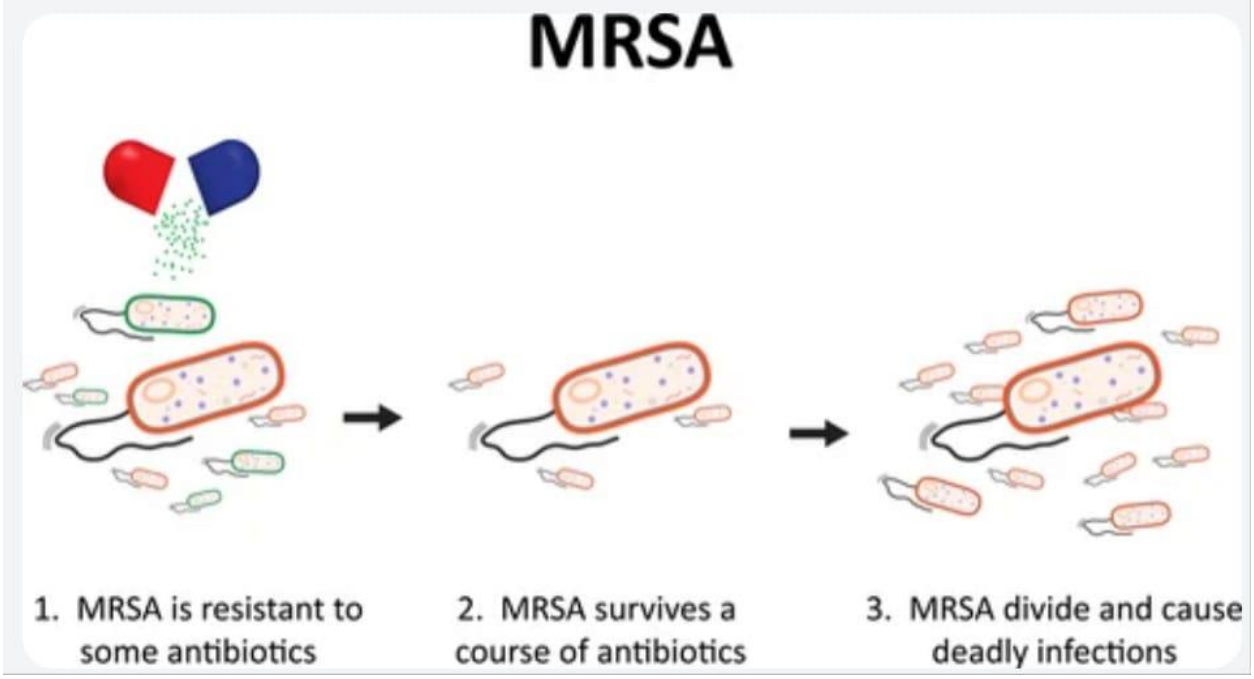
Describe the prevention of antibiotic resistance.

Ways individuals can help prevent the incidence of antibiotic resistance increasing include:

- Only taking antibiotics when absolutely essential.
- When prescribed a course of antibiotics, ensure that the entire course is completed even if you feel better after a few days.
- Use a few different antibiotics as possible.

What is MRSA?

MRSA or Methicillin resistant staphylococcus Aureus is a form of bacterial infection that is resistant to numerous common antibiotics. These bacteria are commonly known as superbugs.



Bangladesh International School, English Section, Riyadh

Biology Grade-9

Chapter -14 Reproduction in plants

9/1/24

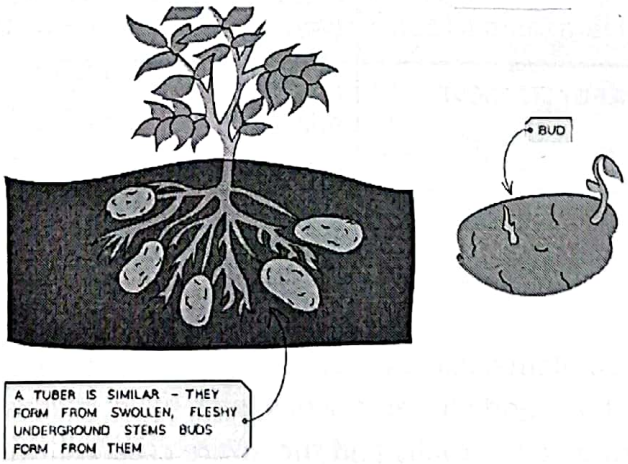
Q1. What is asexual and sexual reproduction, explain with examples and also write advantage and disadvantages of both types of reproductions.

Asexual reproduction: Asexual reproduction is defined as a process resulting in genetically identical offspring
from one parent. Asexual reproduction does not involve sex cells or fertilization. Only one parent is required so there is no fusion of gametes and no mixing of genetic information. As a result, the offspring are genetically identical to the parent and to each other (clones).

Examples of Asexual Reproduction:

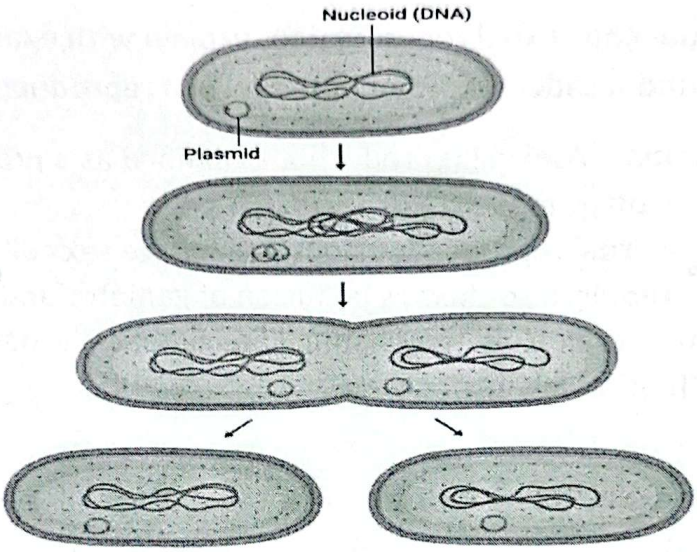
Plants can reproduce asexually using bulbs and tubers; these are food storage organs from which budding can occur, producing new plants which are genetically identical to the parent plant.

1. **Potatoes**: Reproduce using stem tubers. When it is warm enough, some of the plant's stem grow normally and produce leaves above ground. Other stems grow under the soil. Swelling called tubers form on them. Because each potato plant produces many tubers, one plant can give rise to many new ones.



2. **Bacteria:** Bacteria produce exact genetic copies of themselves in a type of asexual reproduction called binary fission, when cells splits into two cells.

Binary fission in Bacteria



Advantages & Disadvantages of Asexual Reproduction:

ADVANTAGES	DISADVANTAGES
POPULATION CAN BE INCREASED RAPIDLY WHEN CONDITIONS ARE RIGHT	LIMITED GENETIC VARIATION IN POPULATION – OFFSPRING ARE GENETICALLY IDENTICAL TO THEIR PARENTS
CAN EXPLOIT SUITABLE ENVIRONMENTS QUICKLY	POPULATION IS VULNERABLE TO CHANGES IN CONDITIONS AND MAY ONLY BE SUITED FOR ONE HABITAT
MORE TIME AND ENERGY EFFICIENT	DISEASE IS LIKELY TO AFFECT THE WHOLE POPULATION AS THERE IS NO GENETIC VARIATION
REPRODUCTION IS COMPLETED MUCH FASTER THAN SEXUAL REPRODUCTION	

Specifically in crop plants, asexual reproduction can be advantageous as it means that a plant that has good characteristics (high yield, disease-resistant, hardy) can be made to reproduce asexually and the entire crop will show the same characteristics.

Sexual reproduction:

Sexual reproduction is a process involving the fusion of the nuclei of two gametes (sex cells) to form a zygote (fertilised egg cell) and the production of offspring that are genetically different from each other. Fertilisation is defined as the fusion of gamete nuclei, and as each gamete comes from a different parent, there is variation in the offspring.

Gametes

- A gamete is a sex cell (in animals: sperm and ovum; in plants pollen nucleus and ovum)
- Gametes differ from normal cells as they contain half the number of chromosomes found in other body cells - we say they have a haploid nucleus
- This is because they only contain one copy of each chromosome, rather than the two copies found in other body cells
- In human beings, a normal body cell contains 46 chromosomes but each gamete contains 23 chromosomes
- When the male and female gametes fuse, they become a zygote (fertilised egg cell)
- This contains the full 46 chromosomes, half of which came from the father and half from the mother - we say the zygote has a diploid nucleus

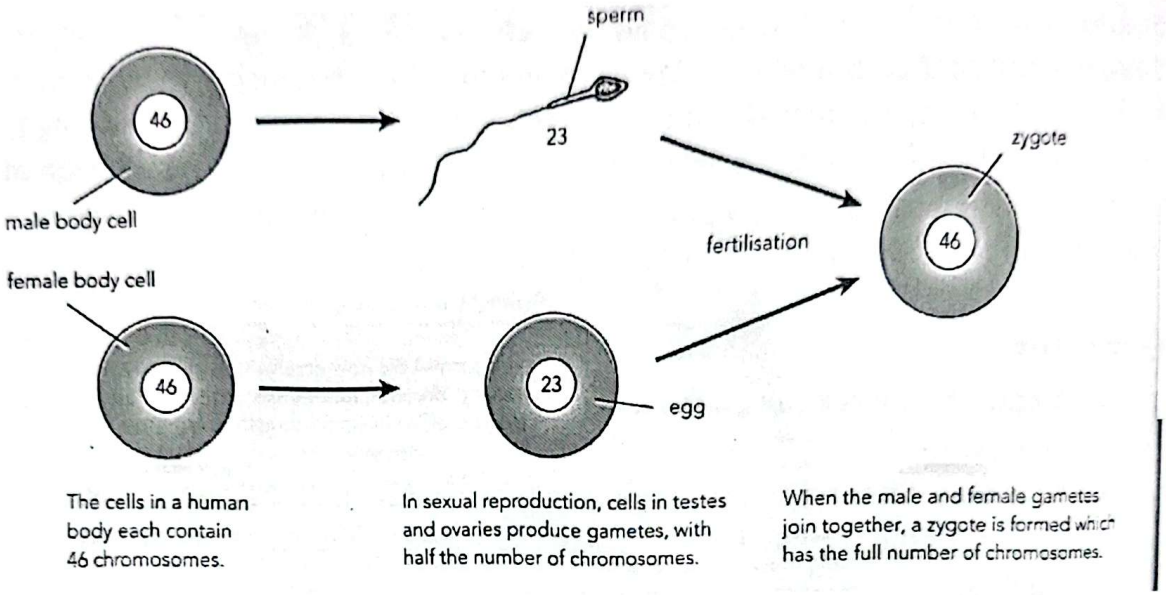
Haploid & Diploid Cells

The nuclei of gametes are haploid

- They contain half the number of chromosomes of a normal body cell
- In humans, this is 23 chromosomes

The nucleus of a zygote is diploid

- It contains the same number of chromosomes as a normal body cell
- In humans, this is 23 pairs of chromosomes
- The zygote continues to stay diploid as it grows into a fetus and embryo during pregnancy



Advantages & Disadvantages of Sexual Reproduction

ADVANTAGES	DISADVANTAGES
INCREASES GENETIC VARIATION	TAKES TIME AND ENERGY TO FIND MATES
THE SPECIES CAN ADAPT TO NEW ENVIRONMENTS DUE TO VARIATION, GIVING THEM A SURVIVAL ADVANTAGE	DIFFICULT FOR ISOLATED MEMBERS OF THE SPECIES TO REPRODUCE
DISEASE IS LESS LIKELY TO AFFECT POPULATION (DUE TO VARIATION)	

- Most crop plants reproduce sexually and this is an advantage as it means variation is

increased and a genetic variant may be produced which is better able to cope with weather

changes, or produces significantly higher yield

- The disadvantage is that the variation may lead to offspring that are less successful than

the parent plant at growing well or producing a good harvest

Mitosis

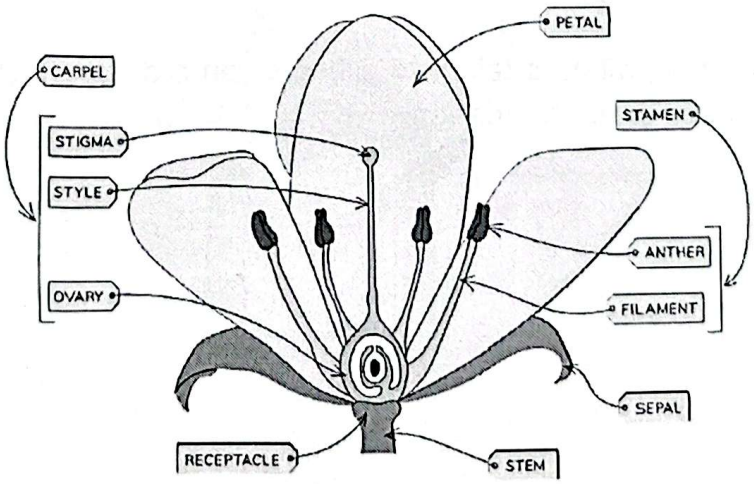
Mitosis is a type of cell division that results in two daughter cells each having the same number and kind of chromosomes as the parent nucleus, which is required for normal growth.

Meiosis

Meiosis is a type of cell division that results in four daughter cells each with half the number of chromosomes of the parent cell, as in the production of gametes or sex cells. Two sex cells combine to form a new offspring, in a process known as fertilization.

Q2. Explain the structure of the flower and its role in sexual reproduction of plants.

- Flowers are the reproductive organ of the plant
- They usually contain both male and female reproductive parts. Plants produce pollen which contains a nucleus inside that is the male gamete
- Unlike the male gamete in humans (sperm), pollen is not capable of locomotion (moving from one place to another)
- This means plants have to have mechanisms in place to transfer pollen from the anther to the stigma
- This process is known as pollination and there are two main mechanisms by which it occurs: transferred by insects (or other animals like birds) or transferred by wind
- The structure of insect and wind-pollinated flowers are slightly different as each is adapted for their specific function



Parts of the flower

STRUCTURE	DESCRIPTION
SEPAL	PROTECTS UNOPENED FLOWER
PETALS	BRIGHTLY COLOURED IN INSECT-POLLINATED FLOWERS TO ATTRACT INSECTS
ANTHER	PRODUCES AND RELEASES THE MALE SEX CELL (POLLEN GRAIN)
STIGMA	TOP OF THE FEMALE PART OF THE FLOWER WHICH COLLECTS POLLEN GRAINS
OVARY	PRODUCES THE FEMALE SEX CELL (OVUM)
OVULE	CONTAINS THE FEMALE SEX CELLS (FOUND INSIDE THE OVARY)

Q3. write the process of fertilization after pollination.

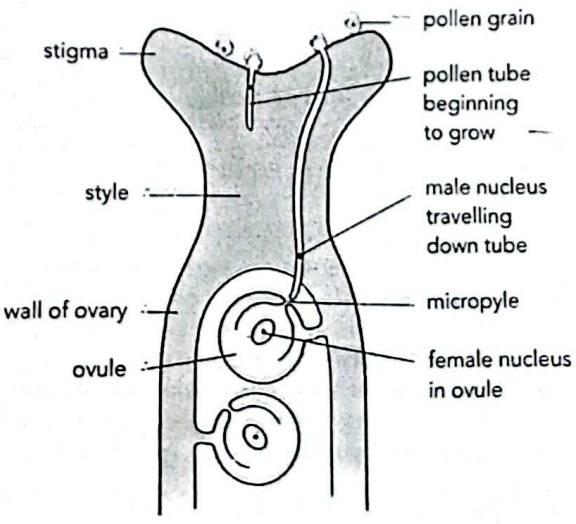
Pollination
Pollination is discussed above as the ways in which pollen grains can be transferred from an
anther to a stigma.

Self pollination: sometimes pollen is carried to the stigma of the same flower, or to another flower on the same plant, this is called self pollination.

Cross pollination: if pollen is taken to a flower on a different plant of the same species, this is called cross pollination.

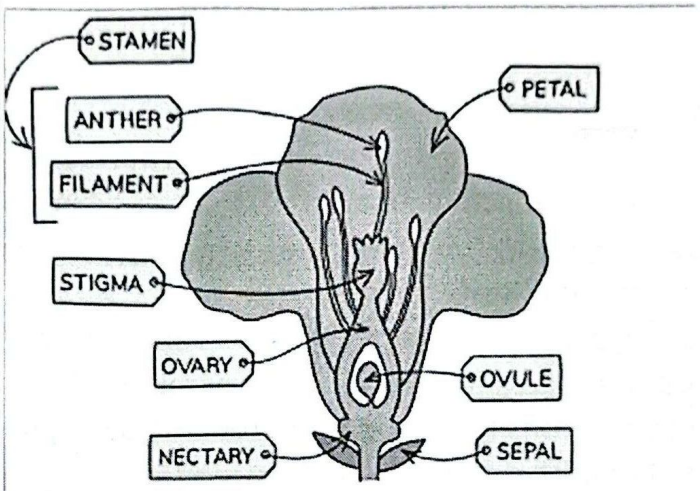
Fertilisation

- Fertilisation occurs when a pollen nucleus fuses with an ovum nucleus in the ovule
- As the pollen has no 'tail' to swim to the ovary of a plant, in order to reach the 'female' nucleus in the ovary it has to grow a pollen tube
- This only happens if the pollen grain has landed on the right kind of stigma (i.e. of the same species as the flower the pollen came from)
- The nucleus inside the pollen grain slips down the tube as it grows down the style towards the ovary
- The ovary contains one or more ovules which each contain an ovum with a female nucleus that a male pollen nucleus can fuse with
- Once the nuclei (pl) have joined together, that ovule has been fertilised and a zygote has been formed
- The zygote will start to divide and eventually form a seed within the ovule
- As different plants have different numbers of ovules, this explains why different fruits (which develop from the ovary) have different numbers of seeds (which develop from the ovules)

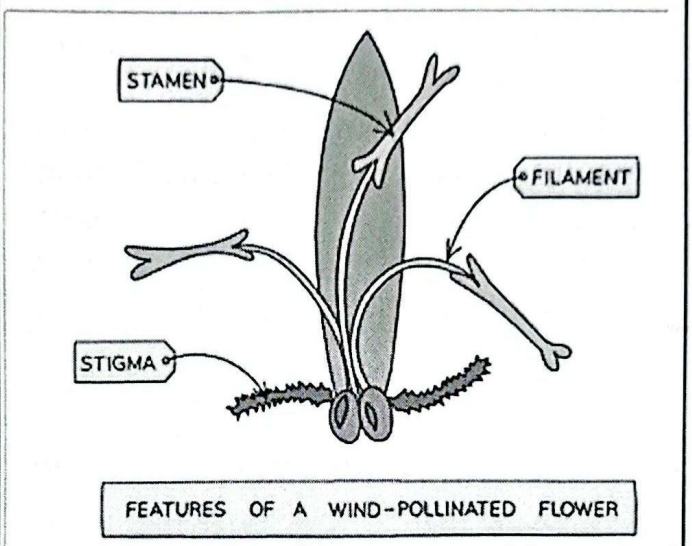


Q4. Discuss about the features of insect pollinated flowers and wind pollinated flowers.

Features of an insect-pollinated flower

FEATURE	INSECT-POLLINATED
	 FEATURES OF AN INSECT-POLLINATED FLOWER
PETALS	LARGE AND BRIGHTLY COLOURED TO ATTRACT INSECTS
SCENT AND NECTAR	PRESENT – ENTICES INSECTS TO VISIT THE FLOWER AND PUSH PAST STAMEN TO GET TO NECTAR
NUMBER OF POLLEN GRAINS	MODERATE – INSECTS TRANSFER POLLEN GRAINS EFFICIENTLY WITH A HIGH CHANCE OF SUCCESSFUL POLLINATION
POLLEN GRAINS	LARGER, STICKY AND / OR SPIKY TO ATTACH TO INSECTS AND BE CARRIED AWAY
ANTHERS	INSIDE FLOWER, STIFF AND FIRMLY ATTACHED TO BRUSH AGAINST INSECTS
STIGMA	INSIDE FLOWER, STICKY SO POLLEN GRAINS STICK TO IT WHEN AN INSECT BRUSHES PAST

Features of a wind-pollinated flower

FEATURE	WIND-POLLINATED
	 FEATURES OF A WIND-POLLINATED FLOWER
PETALS	SMALL AND DULL, OFTEN GREEN OR BROWN IN COLOUR
SCENT AND NECTAR	ABSENT – NO NEED TO WASTE ENERGY PRODUCING THESE AS NO NEED TO ATTRACT INSECTS
NUMBER OF POLLEN GRAINS	LARGE AMOUNTS – MOST POLLEN GRAINS ARE NOT TRANSFERRED TO ANOTHER FLOWER SO THE MORE PRODUCED, THE BETTER THE CHANCE OF SOME SUCCESSFUL POLLINATION OCCURRING
POLLEN GRAINS	SMOOTH, SMALL AND LIGHT SO THEY ARE EASILY BLOWN BY THE WIND
ANTHERS	OUTSIDE FLOWER, SWINGING LOOSE ON LONG FILAMENTS TO RELEASE POLLEN GRAINS EASILY
STIGMA	OUTSIDE FLOWER, FEATHERY TO CATCH DRIFTING POLLEN GRAINS

The pollen produced by insect and wind-pollinated flowers is also different:

- Insect pollinated flowers produce smaller amounts of larger, heavier pollen grains that often contain spikes or hooks on the outside so they are better able to stick to insects
- Wind pollinated flowers produce large amounts of small, lightweight pollen grains that are usually smooth

Q5. Describe the structure of a seed.

Ans: Inside the ovary, the ovules start to grow, each ovule now contain a zygote, which was formed at fertilization. The zygote divides by mitosis to for an embryo plant. The ovule is now a seed.
A seed contains very little water. When the seed was formed on the plant, the water in it was drawn out, so that the seed became dehydrated. Without water, almost no metabolic reaction can go inside it. The seed is dormant. This is very useful, because the dormant seed can survive harsh conditions, such as cold or drought, which would kill a growing plant.

Q6. Investigate the conditions necessary for the germination of seeds.

Germination is the start of growth in the seed
Three factors are required for successful germination:

- Water - allows the seed to swell up and the enzymes in the embryo to start working so

that growth can occur

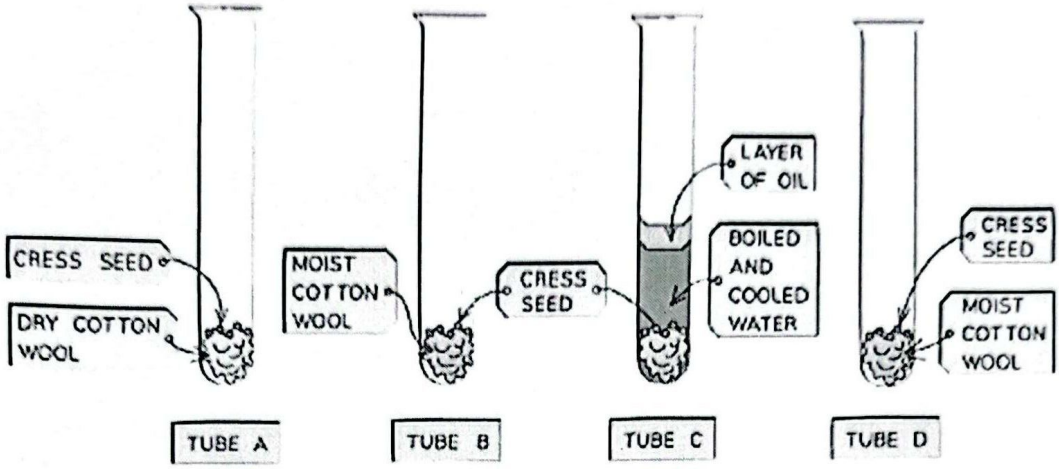
- Oxygen - so that energy can be released for germination
- Warmth - germination improves as temperature rises (up to a maximum) as the

reactions which take place are controlled by enzymes

- As carbon dioxide is not necessary for germination but also does not inhibit it, it makes no difference whether it is present or not

Investigating Germination

- Set up 4 boiling tubes each containing 10 cress seeds on cotton wool
- Set each test tube as shown in diagram below
- Leave tubes in set environment for a period of time: A, B and C incubated at 20°C; D placed in a fridge at 4°C
- Compare results and see which tube has the greatest number of germinated seeds



Conditions required for germination - results:

TEST TUBE	FACTOR BEING TESTED	SEEDS GERMINATED
A	WATER / MOISTURE	NO
B	CONTROL (ALL FACTORS PRESENT)	YES
C	OXYGEN	NO
D	WARM TEMPERATURE	NO