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Ministry of Education and Sports

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BIOLOGY

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This material has been developed as a home-study intervention for schools during the lockdown caused by the COVID-19 pandemic to support continuity of learning.

National Curriculum Development Centre
P.O. Box 7002,
Kampala- Uganda
www.ncdc.go.ug

FOREWORD

Following the outbreak of the COVID-19 pandemic, government of Uganda closed all schools and other educational institutions to minimize the spread of the coronavirus. This has affected more than 36,314 primary schools, 3129 secondary schools, 430,778 teachers and 12,777,390 learners.

The COVID-19 outbreak and subsequent closure of all has had drastically impacted on learning especially curriculum coverage, loss of interest in education and learner readiness in case schools open. This could result in massive rates of learner dropouts due to unwanted pregnancies and lack of school fees among others.

To mitigate the impact of the pandemic on the education system in Uganda, the Ministry of Education and Sports (MoES) constituted a Sector Response Taskforce (SRT) to strengthen the sector's preparedness and response measures. The SRT and National Curriculum Development Centre developed print home-study materials, radio and television scripts for some selected subjects for all learners from Pre-Primary to Advanced Level. The materials will enhance continued learning and learning for progression during this period of the lockdown, and will still be relevant when schools resume.

The materials focused on critical competences in all subjects in the curricula to enable the learners to achieve without the teachers' guidance. Therefore effort should be made for all learners to access and use these materials during the lockdown. Similarly, teachers are advised to get these materials in order to plan appropriately for further learning when schools resume, while parents/guardians need to ensure that their children access copies of these materials and use them appropriately.
I recognise the effort of National Curriculum Development Centre in responding to this emergency through appropriate guidance and the timely development of these home study materials. I recommend them for use by all learners during the lockdown.

Alex Kakooza
Permanent Secretary
Ministry of Education and Sports

ACKNOWLEDGEMENTS

National Curriculum Development Centre (NCDC) would like to express its appreciation to all those who worked tirelessly towards the production of home–study materials for Pre-Primary, Primary and Secondary Levels of Education during the COVID-19 lockdown in Uganda.

The Centre appreciates the contribution from all those who guided the development of these materials to make sure they are of quality; Development partners - SESIL, Save the Children and UNICEF; all the Panel members of the various subjects; sister institutions - UNEB and DES for their valuable contributions.

NCDC takes the responsibility for any shortcomings that might be identified in this publication and welcomes suggestions for improvement. The comments and suggestions may be communicated to NCDC through P.O. Box 7002 Kampala or email admin@ncdc.go.ug or by visiting our website at http://ncdc.go.ug/node/13.

Grace K. Baguma
Director,
National Curriculum Development Centre

ABOUT THIS BOOKLET

Dear learner, you are welcome to this home-study package. This content focuses on critical competences in the syllabus.

The content is organised into lesson units. Each unit has lesson activities, summary notes and assessment activities. Some lessons have projects that you need to carry out at home during this period. You are free to use other reference materials to get more information for specific topics.

Seek guidance from people at home who are knowledgeable to clarify in case of a challenge. The knowledge you can acquire from this content can be supplemented with other learning options that may be offered on radio, television, newspaper learning programmes. More learning materials can also be accessed by visiting our website at www.ncdc.go.ug or ncdc-go-ug.digital/. You can access the website using an internet enabled computer or mobile phone.

We encourage you to present your work to your class teacher when schools resume so that your teacher is able to know what you learned during the time you have been away from school. This will form part of your assessment. Your teacher will also assess the assignments you will have done and do corrections where you might not have done it right.

The content has been developed with full awareness of the home learning environment without direct supervision of the teacher. The methods, examples and activities used in the materials have been carefully selected to facilitate continuity of learning.

You are therefore in charge of your own learning. You need to give yourself favourable time for learning. This material can as well be used beyond the home-study situation. Keep it for reference anytime.

Develop your learning timetable to ca ter for continuity of learning and other responsibilities given to you at home.

Enjoy learning

Term 2

COVID-19 is a disease caused by the corona virus. The symptoms include: dry cough, sneezing/running nose, fever and difficulty in breathing. The virus is transmitted through droplets when an infected person coughs or sneezes. A person can also get infected by touching surfaces contaminated with the virus and then touching their face (eyes, nose or mouth). The spread of COVID-19 can be slowed down or prevented by following:

- Clean your hands often. Use soap and water, or an alcohol-based hand rub.
- Avoid overcrowded places. Maintain a safe distance (at least one meter) from anyone, more particularly one who is coughing or sneezing.
- Wear a mask when physical distancing is not possible.
- Don't touch your eyes, nose or mouth.
- Cover your nose and mouth with your bent elbow or a tissue when you cough or sneeze.
- Stay home if you feel unwell.
- If you have a fever, cough and difficulty breathing, seek medical attention and get tested.

Topic: Growth and Development in Plants

Lesson: Structure of a Seed

By the end of the sub-topic, you should be able to;

- describe the external and internal structure of a seed.
- draw and label the external and internal structure of a seed.

Introduction

We are all familiar with seeds. One of the common seeds that we see on a daily basis is the bean seed. Given right conditions, a seed can germinate into a new plant. Fruit wall protects seeds, though some seeds are not in fruits. Seeds do have other structures that offer protection.

In the following activity, you are going to find out structures on a seed.

Activity: Examining the external structure of a seed

Materials you will need

2 bean seeds (which are not damaged or eaten by weevils), water, plastic bottle, knife

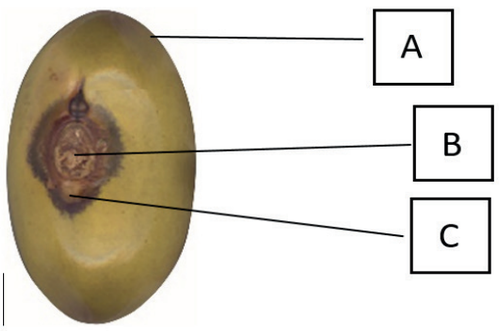
Procedure

i) Pick out 1 bean seed, put it in a bottle and label it A.
ii) Pour water in the bottle to cover the seed. (You will use this seed later)
iii) Hold the second seed between your thumb and fore fingers. Move it round

slowly.

iv) Describe the structures you are able to see on the seed.

v) Hold the seed so that the depression in centre of the seed faces you. See the picture below.



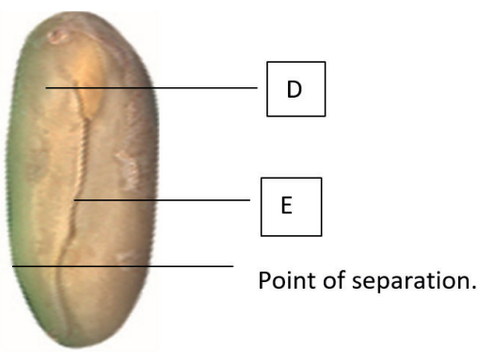
vi) Identify and name the parts A, B and C (using the terms: micropyle, hilum and testa).

vii) Draw and label the external structure of the seed.

viii) What do you think is the function of the parts you have labelled?

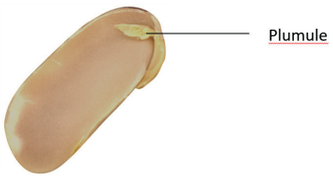
ix) Remove the soaked seed from bottle A.

x) Peel off the cover. Hold the seed so that the structures are as in the Figure below.



xi) Name the parts labelled (use the term: cotyledon, radicle).

xii) Open the seed at the point of separation. You now have two similar structures. These are the cotyledons. Take a closer look at one side of the cotyledon similar to the Figure below:



xiii) Plumule and radicle make up the embryo.
xiv) Draw and label one half of the cotyledons (use terms: cotyledon, plumule and radicle)

Summary

Fill in the blank spaces below by choosing from the following words; (scar, radicle, micropyle, protects, plumule)

The testa is the outmost structure of a seed. It _____ the internal structures of the seed. ..... is the small hole used for the passage of air and water into the seed. The remains of point of attachment to the wall of the fruit is the _____.

The embryo is made up of ..... and ..... which germinates into a new plant. Cotyledons protects the embryo. They also store food for the embryo. The embryo uses stored food for germination.

Lesson 2

Sub-topic: Germination

By the end of the lesson, you should be able to;

- list the factors / conditions necessary for seed germination.
- conduct experiments on conditions necessary for seed germination.

Introduction

A seed has a tough outer covering which protects it from heat, drought and extreme coldness. Inside a seed is a store of food, to be used later for growth. A seed therefore is a reproductive set which contains a plant embryo and a supply of stored food inside a protective coat. A viable mature seed normally grows into a new plant. The growth of a new plant from a seed is germination. Germination is possible in any environment as long as the necessary requirements are provided.

During the dry season, planting of seeds is limited. Some seeds planted in water do not grow.

What are possible reasons for these two occurrences?

Germination is the emergence of the embryo from the seed coat due to onset of growth and development of the seed.

A seed is a living structure. It requires all the necessities of life which are referred to as factors or conditions. A seed sprouts into a new plant when all the following factors

are provided; air, water and warmth. Absence of any one of the factors affects the germination process.

In the project below, you will investigate the effect of one factor on germination.

Project: Finding out if water is necessary for germination.

Materials you need

4 bean seeds, 2 empty plastic bottles, water, cotton wool/soil/ tissue paper

Procedure

i) Get 2 empty plastic bottles and cut approximately 5cm from the top.
ii) Label the bottles A and B.
iii) Put moist cotton wool in bottle A. Insert 2 seeds in between the moist cotton wool.
iv) Insert the remaining 2 seeds in between the dry cotton wool in bottle B (**make sure experiment B does not get any drop of water).**
v) Find a safe place in the home and keep the two experiments.
vi) Water the seeds in bottle A daily using 10mls of water.
vii) Allow the experiment to go on for 7 days. Check and record any changes each day.
viii) At the end of 7 days, write a scientific report basing on your experiment. Use the following format to write the repot:

Title: (This should describe the experiment)

Purpose: (Write a single sentence or a paragraph summarising why the experiment was carried out).

Hypothesis: (Predict the outcome of the experiment. use the format; "If...then... because...". E.g. "If we leave windows open at night, then mosquitoes will enter the house because they are attracted by the scent from humans").

Materials: (What equipment and materials did you need for this experiment? List the name and amount of each item used.)

Procedure: (List the steps you followed to accomplish this experiment).

Conclusion:(What did you learn? What conclusions can you draw from the results of this experiment? Compare the results of the experiment with your hypothesis.)

Self-check question

Seeds from guava and some chilli pepper plants are said to germinate only if they have been passed through the digestive system of an animal. How would you explain this?

Lesson 3

Sub-topic: Epigeal and Hypogeal Germination

By the end of the lesson you, should be able to name the type of germination in dicots and monocots.

Introduction

Different seeds germinate in different ways when the conditions for germination are available. There are two types of germination, which are determined by the position of the cotyledon in the seed.

In this lesson, you are to determine the two types of germination. The lesson is to be carried out as a project. Follow the instructions below.

Materials you need

2 bean seeds, 2 maize grains, 2 empty plastic bottles, soil/cotton wool and water

Procedure

i) Cut off the top of the bottles.
ii) Label the bottles A and B.
iii) Put soil in the 2 bottles.
iv) Pour water in the soil to make it moist.
v) Put bean seeds in soil along the wall of bottle A and likewise for maize grains in bottle B. (**You should be able to see the seeds through the bottle).**
vi) Put your experiment in a safe and shady place near the house. Water the seeds regularly.
vii) Observe and record changes in your seeds daily for the next for 7 days.
viii) Using records based on your experiment at the end of 7 days, write a scientific report. Use the following format:

Title: (This should describe the experiment).

Purpose: (Write a single sentence or a paragraph summarising why the experiment was carried out).

Hypothesis: (Predict the outcome of the experiment. Use the format; "If...then... because ...". E.g. "If we leave windows open at night then mosquitoes will enter the house because they are attracted by the scent from humans").

Materials: (What equipment and materials did you need for this experiment? List the name and amount of each item used.)

Procedure: (List the steps you followed to accomplish this experiment?).

Conclusion: (What did you learn? What conclusions can you draw from the results of this experiment? Compare the results of the experiment with your hypothesis.)

Summary

There are two types of germination: that is ..... germination in which the seed leaves remain _____ the ground and ..... germination where the seed leaves appear _____ the ground.

Lesson 4

Sub-topic: Fruit and Seed Dispersal

By the end of the lesson, you should be able to:

- explain fruit and seed dispersal.
- describe methods of fruit and seed dispersal.
- list the agents of fruit and seed dispersal.
- state the adaptations of fruits and seeds that aid their dispersal.
- explain the importance of fruit and seed dispersal.

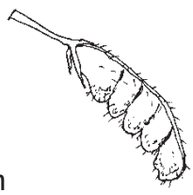
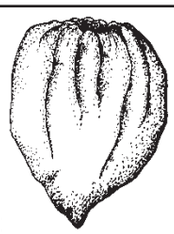
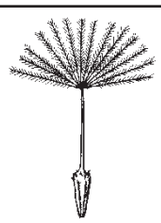
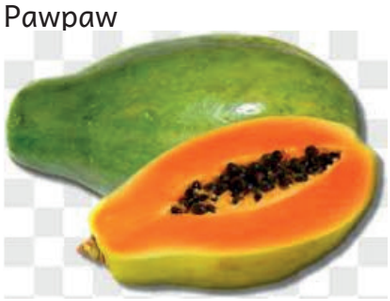
Introduction

In this lesson, we will study about fruit and seed dispersal.

Pollination is the only one part of the reproductive task for plants. After pollination, fertilization occurs. This leads to formation and development of fruits and seeds. Once fruits and seeds are mature, they are taken away from the parent plant. This is fruit/seed dispersal. Dispersal can occur by various methods depending on the nature of the fruit/seed.

From your experience, study the table below and fill in the blank spaces correctly. The first example is done for you.

Fruit	**Method of dispersal**	**Agent of dispersal**
Mango 	Carried physically from one place to another	Animals e.g. humans, monkeys
Cow peas 		

 Pineapple		
Desmodium 		
Coconut 		
Dandelion 		
Pawpaw 		

Adaptations of Fruits and Seeds for Dispersal

A keen look at structures of fruits and seeds indicate designs (adaptation) for dispersal.

Task

How is a black jack fruit (*Bidens Pilosa)* adapted for dispersal? Find this out.

Procedure

i) Visit a garden which has weeds or a bushy road side and brush your body against the fruits of black jack and note what happens.
ii) Pick four black jack fruits.
iii) Carefully observe a seed/fruit and note its characteristics.
iv) From the characteristics, state how the seed/ fruit is adapted for dispersal.

Questions

1. Which method of seed/ fruit dispersal do you think black jack is dispersed?
2. Which characteristics of the black jack aids the dispersal of the seed?

Importance of Fruit and Seed Dispersal

i) Spreads the fruits/ seeds in different areas to avoid competition.
ii) Deposits fruits/seeds in fertile areas.
iii) Avoids diseases and pests that may exist in the parent area.

Self-check question

Identify four animals that you think are "efficient "at dispersal of seeds and fruits. For each animal identified give reasons for selecting it.

Lesson 5

Topic: Growth and Development in Animals

Sub-topic: Life Cycles Insects

By the end of this lesson, you will be able to describe the stages of development in insects.

Introduction

The insects that we encounter in our everyday life include the housefly, bee, cockroach, mosquito, grasshopper and termite.

These insects affect our lives in one way or the other. They are always around us. Insects increase in population through sexual reproduction. The changes that take place after fertilization are termed life cycle (metamorphosis). Life cycle involves changes from egg, larva and pupa to adult. The appearance at any stage is different from the next. Insects undergo either complete or incomplete metamorphosis.

In the lesson today, you will learn about the life cycles in insects. There are two types of life cycles namely complete metamorphosis and incomplete metamorphosis. In complete metamorphosis, changes occur from egg to larva to pupa and lastly to adult. Four stages are involved. In incomplete metamorphosis, the changes occur from egg to nymph and lastly to adult. Only three stages are involved.

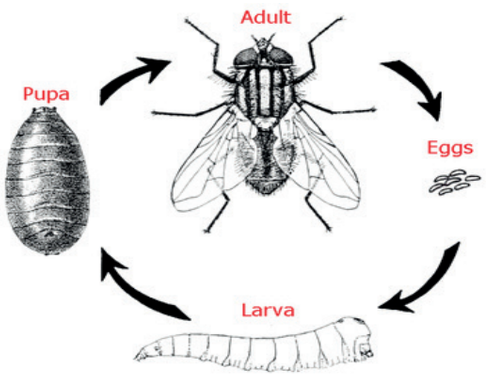
The housefly, bee and termite go through complete metamorphosis. The cockroach and grasshopper experience incomplete metamorphosis.

Let us study the stages in the life cycle of a housefly. This is an example of a complete life cycle.

A fertilized female housefly lays eggs in heaps of rotting rubbish or faeces. Rubbish provides warmth for the developing eggs. Within one day, the eggs hatch into white tiny maggots (larvae). Larva feeds heavily on the decaying organic matter. The larva moves around the organic matter and hides away from light. It grows rapidly and moults several times.

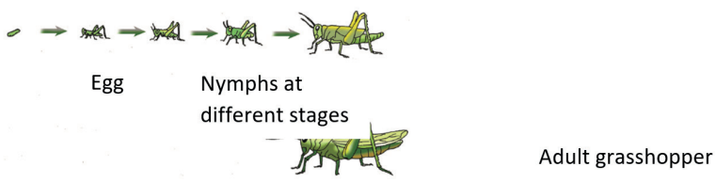
In five (5) days, it changes to a different stage, the pupa. The cuticle darkens and turns brown to form a pupal case. The pupa stays in a dark corner. It does not move or feed. At this stage, different organs of the body develop and become distinct. When mature, the pupal case bursts and a new housefly emerges. The wings harden and the housefly flies away.

The illustration below summarises complete life cycle:



Four distinct stages are noticeable. Now, we turn to the life cycle of a grasshopper. This will serve as an example of an insect that undergoes incomplete metamorphosis.

A fertilized female grasshopper digs a hole in the soil. It uses its abdomen and then lays batches of eggs. The eggs hatch into tiny nymphs after several days. The nymphs look like adults except that they bear no wings. Nymphs feed heavily on leaves of plants and get bigger at each moult. The cuticle shed off allows rapid growth to occur. The nymphs mature with all organs formed. At the last moult, the adult emerges and flies away. The picture below illustrates the life cycle of a grasshopper. This shows incomplete metamorphosis.



There are only three stages of development i.e. egg, nymph and adult.

Project

In this project, you are to study the life cycle of a mosquito.

Materials you will need

Small empty container (plastic bottle/ tin/ broken pot), water

Procedure

i) Put the container with some water in it in a shady area outside the house. This should provide a breeding place for mosquitoes.

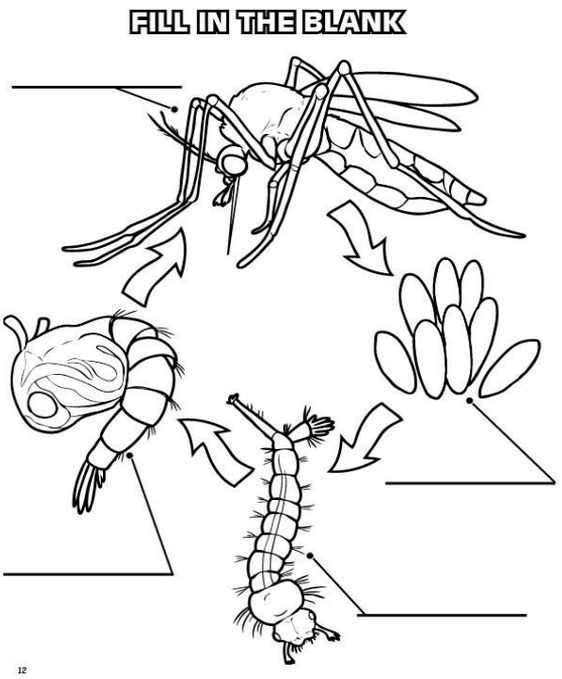
ii) Check after 3 days for larvae from the time the experiment was set up. Then do daily recording of any changes the larvae are undergoing.

iii) Once you identify the larvae, describe their behaviour. Consider the following:

- How does it move?
- How many days did the larva take to change into pupa? The pupa looks

like the diagram below.
- Describe the shape of the pupa.
- Observe daily and describe the changes the pupa undergoes.
- How long does it take for the adult mosquito to appear?

Using the results from your observations, complete the lifecycle below by filling in the blank spaces



Lesson 6

Topic: Reproduction in Plants

Sub- topic: Sexual Reproduction in Plants

By the end of this lesson, you should be able to:

- name types of pollination.
- list the agents of pollination.
- outline the characteristics of insect and wind pollinated flowers.

Introduction

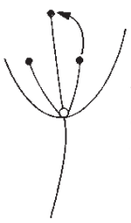
In this lesson, you will learn about different types of pollination and agents of pollination. Sitting quietly for a few minutes near a plant with flowers, you will notice many activities. You will see bees and butterflies moving about from flower to flower. You will see the limbs of the insects filled up with pollen.

You may also see birds flying about. The birds insert their beaks from flower to flower. Basically both the insects and the birds are sucking nectar. In the process, they transfer pollen grains from anther to the stigma.

Flowers of maize and palms on the other hand are pollinated by wind. Therefore, the nature of a flower determines which type of pollination takes place.

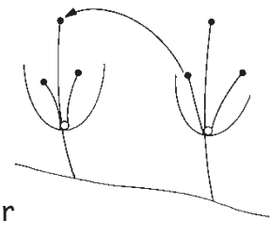
From the above, we notice that:

i) Pollen grains are transferred within a flower or to another on same plant. This is illustrated as:



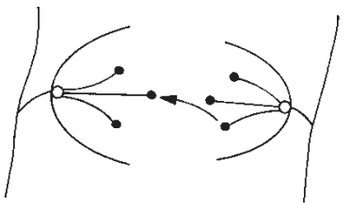
Transfer within a flower

or



Transfer from one flower to another on same plant

ii) Pollen grains are transferred from one flower to another on another plant.



Transfer of pollen between different flowers on different plants of same species

These are the two main types of pollination:

- Self-pollination.
- Cross-pollination.

Wind, insects, birds and occasionally human beings aid plants reproduce sexually. Therefore, they are agents of pollination.

Work to do:

1. List two examples of flowers that experience self-pollination.
2. List two examples of flowers that experience cross-pollination.
3. List the pollinating agents in your locality.

Adaptations of Flowers for Insect Pollination and Wind Pollination

Particular flowers attract particular pollinating agents. You must have noticed this during the course of doing the exercise above.

Pick a flower from a bean plant and from a maize plant. Check for the anther head and stigma, look at the colours, size and shape, and touch the stigma and anther head and pollen grains. Using all the structures on the flowers, identify the flower pollinated by:

i) insects
ii) wind

You must have noticed therefore, that flowers are adapted in specific ways for various agents of pollination. Use your observations to complete the table below. For each type of flower, explain why it is adapted in that way.

Adaptation/Characteristic	Insect pollinated flowers	Wind pollinated flowers
Size of flowers (large or small)		
Colour of flowers (dull or bright)		
Presence of a scent/ smell		
Presence of nectar		
Position of stigma in the flower (outside/ inside)		
Quantity of pollen (small/large)		

Lesson 7: Asexual Reproduction

Topic: Reproduction in Plants

Sub-topic: Asexual Reproduction in Plants

Objective: by the end of the lesson you will be able to:

- List plant structures used in vegetative reproduction.
- Explain vegetative reproduction

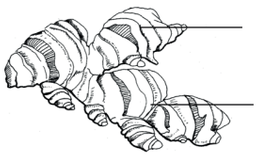
Introduction

A number of flowering plants do not produce seeds, yet they must multiply. This is possible by the plants using vegetative parts to reproduce. Vegetative parts do have meristem tissues which are able to divide rapidly producing new cells. The vegetative parts of the plants include: stems, leaves or roots. These parts besides their normal functions, will produce new plants. This is modification.

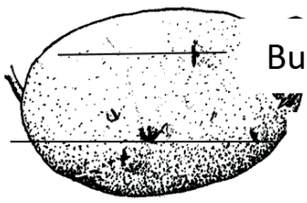
Examples of plant parts modified for reproduction include;

i. Ginger – the stem is underground. This stem stores food. It has buds and scale leaves at nodes. This group of stems that produce new plants are called rhizomes.

Node



Yam is included in this category.
Stem tuber in the Irish potato. The stem is underground. The stem is swollen with stored food. Scale leaf and bud can be seen on the stem. See illustration below.



Bryophylum – the leaves are modified for reproduction. These leaves are thick and succulent due to storage of food and water. At the notches of the leaves are buds. Buds on fallen leaves of the plant germinate into new plants.

Bananas - these reproduce by means of suckers. Suckers are outgrowths from parent plant. The stem of a sucker has terminal bud, adventitious root and scale leaves. In bananas, new plants grow from the short stem underground. The new plant obtains food from the old parent. It is this sucker that is transferred to a new point in the garden.

Artificial propagation

This method of reproduction is practiced using specific parts of a plant by humans. Many flowering plants may be multiplied artificially by stem cutting, budding, grafting and layering.

Grafting -this involves joining shoot system, scion very close to each other. They are cut diagonally and place onto each other.

Scion inserted into a cut portion of mother plant.

These are then taped and left to heal.

Stem cutting- part of the stem is cut enclosing two nodes. This has a bud that will germinate.

Layering- involves bending branches or stems to get in contact with the ground. The portion is covered with soil. When roots developed, the stem or branch is cut off. This is then termed a layer.

This method is used for plants that produce flowers but don't form seeds. For every cutting, the node must be present.

Artificial propagation is a scientific practice.

Examples; stem cutting (cassava, sugar cane, rose flower), grafting (grape fruits, the oranges and lemons), layering (bougainvillea).

Project: Observing artificial propagation of plants.

This lesson will require you to take a survey out of the home.

Material needed: note book, pens, pencils.

What to do: visit a plant nursery (the florist by the road side) or horticultural site (Agricultural center).

i. Observe the plants being developed by cuttings, budding, grafting and layering.
ii. Find out why such parts are being used for propagation.
iii. Find out how long it takes for the propagated part to be established.
iv. What care is given to the plants for proper growth

Self-check question

What are the advantages and disadvantages of vegetative reproduction in commercial agriculture?

Lesson 8: Human reproduction

Topic: Sexual reproduction in animals

Sub-topic: Male and female reproductive parts

Objective: By the end of the lesson you will be able to:

- Describe male reproductive parts of humans.
- Describe female reproductive parts of humans

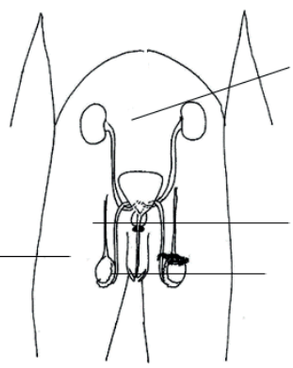
Introduction:

Reproduction is one of the life processes of living things. The male and female mammals are built differently. In humans, the structure of male is different from that of female. Reproductive systems are quite different in both male and female. We shall begin by looking at the male reproductive system.

The male reproductive system

The male reproductive system is illustrated below. The main function of the male reproductive system is to produce sperms. It also delivers sperms into the female reproductive system

Below is the structure of male reproductive system.



Kidney

Other structures include:

Cowper's gland and Prostate gland. Both are below the urethra. Release secretions that mix and activate sperms. The mixture is called semen.

Epididymis- are larger and highly coiled seminiferous tubules. It is located between

the testes and sperm duct. It stores sperms temporarily and also produces secretions that keep sperms alive.

The female reproductive system

The female reproductive system consists of many parts. See illustration below. The system carries out many functions including:

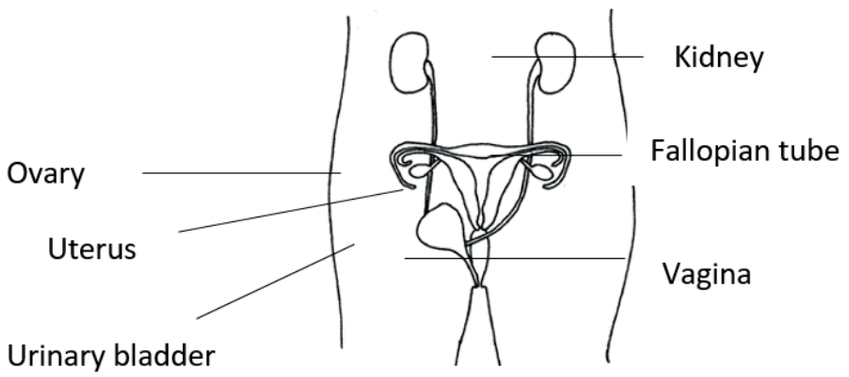
i) production of gametes and hormones.

ii) site for fertilization

iii) site for protection embryo

iv) site for nourishment of developing embryo.

The structure of female system.



Part	Function
Ovary Urinary bladder	Produce egg cells Produce female sex hormones; Oestrogen and progesterone
Fallopian tube (oviduct)	Conveys released ovum from ovary to uterus
Uterus (womb)	Muscular cavity where fertilized ovum develops into a baby

Lesson 9

Topic: Reproduction in animals

Sub topic: Menstrual cycle

Objective

By the end of the lesson, you will be able to describe the menstrual cycle.

Introduction

Human growth is not a steady and an even process. Growth occurs in spurts separated by periods of slower growth. A female adolescent, (about 10-18 years), experiences many changes occurring in the body. At the onset of puberty, sex organs mature and release eggs. This maturity are effects of hormones released by pituitary gland. The ovaries also secrete their own hormones. The hormones carry changes in other parts of the body. Hair grows in armpits and pubic region, breasts develop and hips widen. These changes in the physical appearances of girls are accompanied by emotional changes. Occasionally the uterine wall breaks down and is shed off. This loss of blood and other tissue is called menstruation.

Patterns involving development and release of egg and preparation of uterus to receive fertilized egg is menstrual cycle.

Menstrual cycle

The menstrual cycle takes on average about 28 days. This is repeated every month. As an egg develops in the ovary, the uterus gets prepared to receive it. The rest of the reproductive system must also be prepared.

If an egg is fertilized after ovulation, it gets implanted in the uterus. Further development then sets in.

If an egg is not fertilized, the egg along with lining of the uterus passes out of the body. This is menstruation.

The menstrual cycle is divided into four stages:

i) The stage of development of follicle (follicle stage). This occur when the level of Oestrogen in blood is low. This is detected by the hypothalamus. Hypothalamus causes Pituitary gland to release follicle stimulating hormone (FSH), and luteinizing hormone (LH). These hormones act on ovary. Stimulates follicle in ovary to mature. More Oestrogen is released. Oestrogen causes thickening of the uterus wall in preparation for fertilized egg.

ii) Ovulation. When the egg is mature, pituitary gland release LH. LH causes the wall of follicle to open, releasing an egg.

iii) The stage after ovulation (luteal stage). The point at which the egg was

released from begins to heal. It forms a structure called corpus luteum. This continues producing Oestrogen but in low amount. At the same time produces another hormone, progesterone in large amount.

Progesterone stimulates cell and tissue growth of uterus in preparation of pregnancy. Progesterone also inhibits release of LH and FSH. If egg is not fertilized, corpus luteum breaks down and Oestrogen level decreases.

iv) Menstruation. Occurs because of very low level of Oestrogen. Lining of uterus cannot then be maintained and breaks down. Blood, tissue of uterine wall and unfertilized egg are passed out of the body. Menstruation takes 3-7 days. When it ends, new cycle begins.

How does this occur?

The drop in Oestrogen that causes menstruation is sensed by hypothalamus. This signals Pituitary gland to release FSH. FSH starts the development of a new follicle in the ovary. Then the cycle begins all over again.

Lesson 10

Topic: Sexual Reproduction in Animals

Sub-topic: Pregnancy, birth and parental care

Objective: by the end of the lesson, you will be able to:

i) describe the process of fertilization of an ovum and the developments up to birth.

ii) state the role of the placenta during pregnancy.

iii) describe birth and parental care of the young.

Introduction

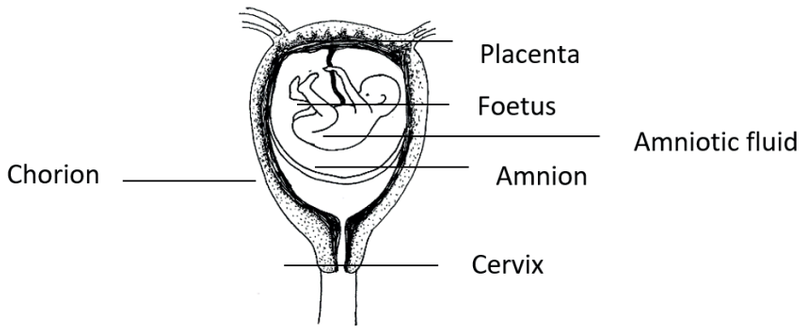
The process of fertilization

Fertilization is the fusion of the nuclei of the sperm and ovum. This leads to formation of a zygote.

How does fertilization occur in mammals?

During sexual intercourse, semen containing sperms is ejaculated into the vagina. The sperms swim through the uterus to the oviducts. Sperms are attracted by chemicals produced by eggs of the female. Only one sperm penetrates the egg membrane and fertilizes the egg. After fertilization, egg membrane develops hard coat that prevents further entry of more sperms. The fertilized egg is retained inside the females' uterus. This is where it develops into an embryo and eventually into a foetus. The wall of uterus thickens because of increase of blood supply. The zygote then implants itself in the wall of uterus. This is when a female gets pregnant. The zygote develops structures around it that offers protection. This include amnion and chorion

membranes. See the illustration below



Amnion is the inner most layer and encloses amniotic fluid. This protects the embryo. The outer membrane is the chorion.

The placenta is made up of tissues from mother and embryo. Embryo is connected to placenta by umbilical cord. The cord contains blood vessels which carry materials from mother through placenta to embryo. Also from embryo to mother via placenta. Blood vessels of mother and embryo do not mix. Thin membrane exists between mother's blood and that of the embryo. These arrangements facilitate passage of materials in both directions. The embryo therefore absorbs nutrients and oxygen from the mother by diffusion. Waste materials (carbon dioxide and urea) from the embryo pass into mother's blood circulation by diffusion.

Placenta also secrete hormones that prevent ovulation, menstruation and sustain pregnancy.

The period between conception and birth is called gestation period. Gestation period is 9 months in humans. By 7 months, the baby turns to face downwards towards cervix.

Birth begins with labour. During giving birth, the uterus begins to contract. The contractions burst the membranes surrounding the foetus. The amniotic fluid flows out through the birth canal and lubricates it. The cervix and vagina widen large enough to allow the baby out. This is birth.

Parental care

A newborn baby will naturally suck at the nipple of the mother's breast. The mammary glands inside the mother's breast secrete milk. This happens soon after birth. This is lactation. Mother's milk is perfect food for newborn because of the necessary nutrients. The mother's milk has antibodies. This protects the baby from diseases within first few months of life.

A newborn baby cannot take in solid food. Therefore, it feeds on milk from the mother. Humans provide parental care to the young for long periods.

Lesson 11

Topic: Sexual Reproduction in Animals

Sub-topic: Birth control methods

Objective:

By the end of the lesson you will be able to:

- list birth control methods.
- describe the use of each birth control method.

Introduction

Birth control method is also known as Family planning method.

The following are methods being used for birth control.

a) Sterilization- involves the tying or cutting fallopian tubes. This prevents uterus reaching the uterus or the sperm reaching the ovum.
b) Rhythm – this is a natural method. It depends on the studying the menstrual cycle to know when ovulation occurs. Sexual activity is the avoided during the expected days of ovulation.
c) Contraceptives. Contraception means the intentional method used or applied to prevent pregnancy. There are different methods used to achieve family planning. The methods work by preventing sperms from fertilizing the eggs. The common contraceptives are:
    i) Condom – is a thin rubber sheath. This is placed over the penis during sexual activity. It collects semen and so prevent fertilization.
    ii) Diaphragm – is a thin rubber cap. This inserted into the vagina before sexual activity. It covers cervix and prevent entry of sperms.
    iii) Intra – uterine contraceptive device (I.U.C.D). Is a device made of plastic and metal material. It is inserted into uterus by doctor and remains there all the time. This method does not prevent conception. Instead it interferes with and prevents implantation.
    iv) Pills – are synthetic chemicals that work like the female sex hormones. Pill is a combination of oestroegn and progesterone hormones. They work in preventing pregnancy by stopping ovulation.
    v) Depro-provera – is a contraceptive injection given to female, usually in the arm. This prevent ovulation by making the ovaries not to release eggs.
    vi) Spermicide – is a chemical that kills sperms when they come into contact.it is inform of creams or foam.

Lesson 12

Topic: Sexual reproduction in humans

Sub-topic: STDs and STIs, Transmission and Prevention

Objectives:

By the end of the lesson, you will be able to:

i) Name the types of STDs and STIs.

ii) State the causes of STDs and STIs.

iii) Explain the mode of transmission of STDs and STIs.

iv) List preventive measures for each disease (STD).

Introduction

Sexually transmitted diseases and infections are diseases passed from an infected person to another during sexual intercourse.

Field excursion

Visit a nearby health facility and request the health worker to tell you about types, causes, mode of transmission and prevention of common STDs/STIs

STDs include gonorrhea, syphilis, herpes and acquired immune deficiency syndrome (AIDS). Below are the causes, symptoms and probable treatment of the same common STDs.

Common STDs

1. **Gonorrhoea** - This is caused by the bacterium known as coccus.

Gonorrhoea is transmitted through sexual intercourse with an infected person.

Symptoms: Causes itching of urethra. A yellow discharge of pus from the penis occur. A burning sensation when urinating is experienced.

Precaution

i) Infected person should seek medical treatment
ii) (b) Abstain from sex, until after thorough check up and marriage.
iii) (d) Discourage promiscuous sexual behaviour.

Control

There is no natural immunity resulting from attacks of such infections. If untreated, it spreads to other organs e.g. spinal cord, urinary bladder causing sterility.

2. **Syphilis**

Is caused by bacterium. Infection always occurs during sexual intercourse with an infected person. Syphilis may also be transmitted by transfusion of infected blood. Therefore, blood donated must be thoroughly screened.

Treatment

Qualified medical personnel must be consulted to administer treatment

It is advisable for all people to adjust behavioural patterns in relation to sexual activity.

People must therefore learn to protect themselves and refrain from irresponsible behaviour.

3. **Herpes**

This is a viral infection that affects the genitals. It is a highly contagious sexually transmitted disease.

Symptoms include: painful blisters on the penis and vagina. May also affect the side of the face and back of the head.

Treatment

No known treatment. Does not respond to antibiotics.

4. **Hepatitis B**

This is a viral disease transmitted by sexual intercourse with infected person. It can also be spread by getting into contact with contaminated blood products and other bodily fluids. It may also affect the liver.

T**reatment**

Poor response to antibiotics. A vaccine against hepatitis B is available.

5. **AIDS (Acquired Immuno Deficiency Syndrome)**

It is caused by a virus called human Immuno deficiency virus (H.I.V). It is passed through sexual contact with an infected person. May also be through blood transfusion of infected blood.

Precaution and control

i) Avoid intimate sexual activities; only have sex after thorough medical screening and getting married.
ii) Avoid sharing contaminated needles, razors and any other sharp instruments.

iii) There is no cure for AIDS as yet.

7. *Candida*

This is a yeast like fungus. It causes candidiasis in human; along the reproductive tract, even in the mouth, where it causes thrush.

Prevention and Control

i) Avoid oral sex.
ii) Avoid unnecessary sexual activity with infected person.
iii) Seek medical treatment.
iv) Never ignore itching in private parts.

Knowledge of STDs/STIs is important for awareness and better decision making. Knowledge empowers the individual and the community. Once this is achieved, better health is attained.

Lesson 13

Topic: Genetics

Sub-topic: Mendel's Monohybrid Ratio

Objective: By the end of the lesson you will be able to:

i) Define genetics.

ii) Explain Mendel's Monohybrid ratio.

iii) Work out Mendel's Monohybrid ratio.

Introduction

Children usually resemble their biological parents. It is also true that tall parents usually have tall children. Cats will always produce cats. This science of resemblance and differences between individuals in a family is **genetics**.

This same basic principles of genetics apply to a variety of organisms including flowering plants, human beings and goats.

Genetics is the study of characteristics or qualities of inheritance. The set of characteristics of parents are transmitted to offspring (children) through gametes. The information transmitted are contained in specific structures called **genes** located on **chromosomes**.

Chromosomes are thread like structures in the nucleus of a cell that contain genes.

Gene is a unit of heredity made up of deoxyribonucleic acid (**DNA**) material on the chromosome.

In our study, we remember a scientist called **Gregor Mendel**. This scientist is credited for establishing the first laws of genetics.

Unknowingly or even knowingly you have practiced genetics in your homes. The types of crops and animals you reared for their qualities, was genetics in practice. Doctors are treating and preventing many diseases by using principles of genetics.

The following terms are important as we study of genetics:

Phenotype – the physical characteristics that make up the appearance of an organism.

Genotype – the genetic makeup of an organism. This determines the phenotype.

Alleles – these are different forms of the same gene on the same location.

Dominant allele – an allele that expresses itself in both homozygous and heterozygous condition. This is represented as a capital letter.

Recessive allele – an allele that only expresses itself in a homozygous condition. This is represented as a small letter.

Homozygous – a description of a character controlled by identical alleles. (Note: the prefix homo- means "same" and the suffix –zygous means "joined together").

Heterozygous – a description of a character controlled by two different alleles. (Note: prefix hetero- means "different").

Hybrid - is an offspring of parents with different characteristics.

Trait – is an observable characteristic of an organism that distinguishes it from another.

Gene – is a unit that determines a trait.

Haploid – having one set of unpaired chromosome in the nucleus. Represented as (n).

Diploid – having two sets of chromosomes in the nucleus. Represented as (2n).

The work of Mendel lays the foundation for the study of genetics. He did much study on pea plants. Studying different traits and how the traits are transmitted to the offspring.

Let us start by studying the inheritance of one pair of contrasting character. The pair is separated from each other and only one enters each gamete. Examples of contrasting characters include: tallness or shortness, white or black or red colour, etc.

This is **monohybrid inheritance.**

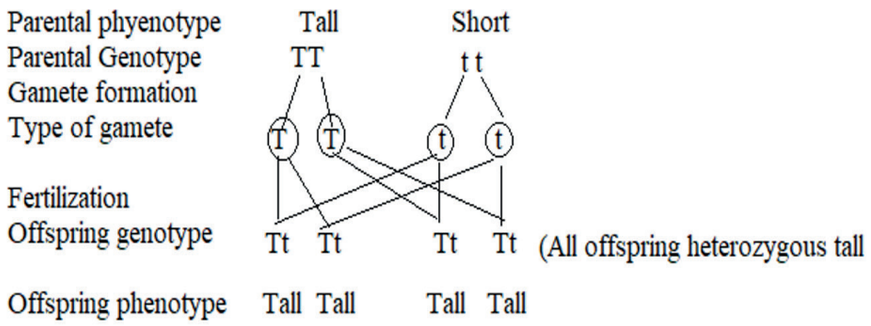
In studying of reproduction, male organism produces X- carrying and Y- carrying type of gamete while female only X- carrying type of gamete. The type of gamete refers to sex cells; egg and sperms in animals or ova and pollen grains in plants.

Following Mendel's working, if tall pea plants (homozygous) are crossed with short plants (homozygous), all resulting offspring in the first generation (filial generation, F1) will be tall. **Note**: Pick a letter of your choice; capital to represent dominant gene

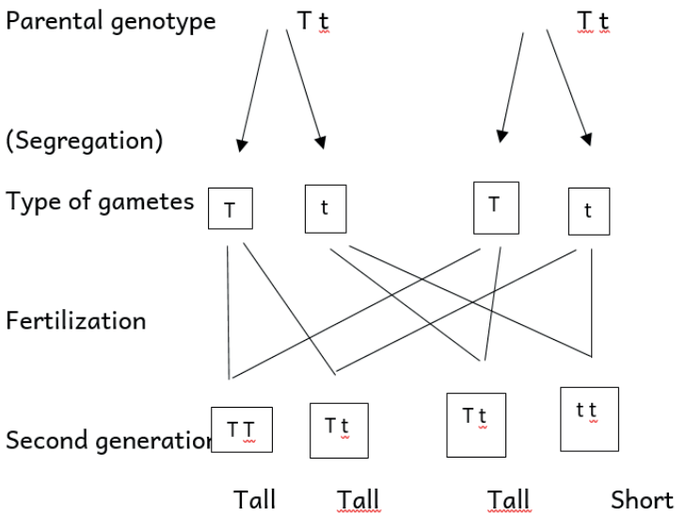
and lowercase to represent recessive gene.

The working is shown as:

(Let **T** represent allele for tallness and **t** represent allele for shortness)



If the F1 generation are crossed with each other (selfed), a second generation is obtained. The working is as shown:



Genotype: T T is homozygous tall: T t is heterozygous tall: t t is homozygous short

Phenotype ratio; 3 are tall**:** 1 short

Activity:

1. a. Work out a cross between a grey and white mouse. Grey colour is dominant over white colour. Represent gene for grey colour with letter G and letter g for white colour.

b. state phenotype of the offspring

c. state genotype of the offspring

Monohybrid inheritance in humans can be demonstrated by inheritance of albino trait.

Albinism is a state where there is a failure to produce skin pigments. This is caused when a recessive gene, represented by 'a' is crossed with the normal allele for skin pigmentation (normal skin) represented by 'A'.

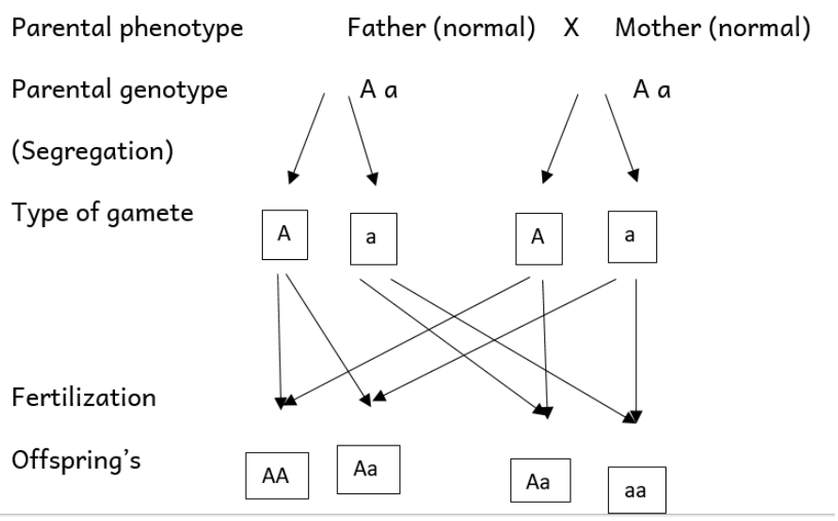
Remember genes are always in pairs. Therefore, a normal organism may carry alleles 'AA' or 'Aa', because their physical appearance is determined by dominant allele 'A'.

'AA' is homozygous dominant

'Aa' is heterozygous.

'aa' is homozygous recessive. This is when true albino physically will be noticed.

The working is as shown:



Phenotype A A homozygous normal; A a heterozygous normal; a a homozygous (albino)

Genotype ratio A A : 2 A a : a a

From the above working, we logically see that:

i) both parents are normal therefore both must have a normal allele (A)
ii) to produce an albino child, both parents must also have a recessive allele(a)
iii) both parents are heterozygous Aa.

Activity.

Work out a cross between a man homozygous for normal skin colour and a woman heterozygous for normal colour. Let normal skin colour, dominant, be represented by (B) and the recessive (b).

Lesson 14

Topic: Genetics

Sub-topic: Mendel's Monohybrid Ratio

Objective: By the end of the lesson you will be able to:

i) Explain co-dominance.

ii) Explain co-dominance in blood groups, sickle cell anaemia.

Introduction

You recall under topic transport, that we studied blood groups. How many types of blood groups do we have?

There are four types of blood groups i.e. Blood group **A**, **B**, **AB** and **O**. Blood group is determined by presence or absence of antigen in red blood cells and antibodies in blood plasma.

Everybody belongs to one of these blood groups. Which is your blood group? You need to find out your blood group type.

What is the importance of knowing your blood group type?

Blood saves life. In case of accidents or during surgery or when a pregnant woman is delivering and there is much loss of blood.

A person is transfused to bring back optimum quantity of blood required by the body.

Inheritance of blood group is controlled by three alleles, represented by symbols **A**, **B** and **O.**

Note: only two of these alleles can be present in any one individual, one received from each parent.

This is termed multiple alleles. These multiple genes are responsible for the presence of antigen types in red blood cells. The alleles **A** and **B** are equally dominant, referred to as co-dominant.

Co-dominance is a condition that arises when both alleles in a heterozygous organism are dominant and are fully expressed in the phenotype.

If a person is **AB**, it means both alleles have effect. The person's is blood group is **AB**.

Blood group **A** and group **B** are however dominant to allele **O**. This means if a person is **AO** or **BO**, the **O** has no effect. The person is therefore, blood group **A** or blood group **B** respectively.

In summary,

Antigen on RBC	Blood group	Genotype
A	A	AO or AA
B	B	BO or BB
A and B	AB	AB
None	O	OO

Now, let us work out monohybrid inheritance of blood group in humans.

Example: A man of heterozygous blood group A marries a woman of heterozygous blood group B, what will be the blood group of the children?

The working is as shown:

Parents Male X Female

Parental phenotype blood group A blood group B

Parental genotype AO BO

Segregation ----------

Gametes A O B O

Fertilization

Offspring AB AO BO OO

All blood group types are possible from a marriage between the two heterozygous individuals.

NOTE: Codominance also occurs in skin colour of cattle, colour of bean seeds, colour of plant flowers.

Lesson 15

Topic: Genetics

Sub-topic: Mendel's Monohybrid Ratio

Objective: By the end of the lesson you will be able to:

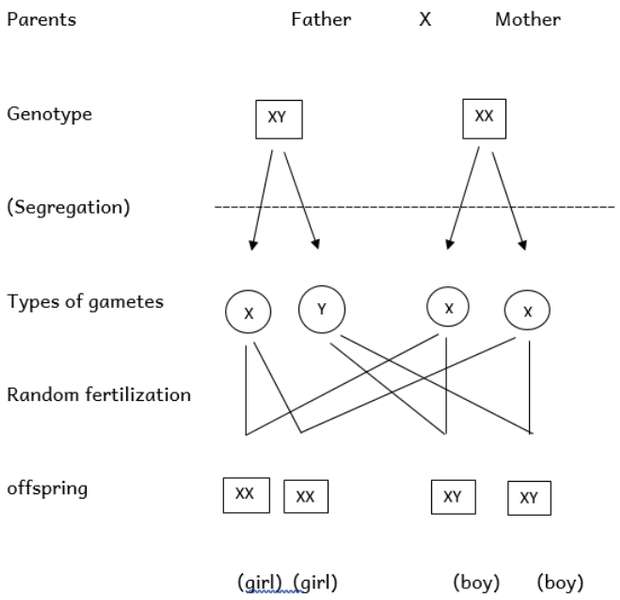
Describe the following concepts Sex determination, sex linkage, variation, natural selection

Introduction

In human beings, the sex of an individual is controlled by genes. These genes are located on specific sex chromosomes. The sex chromosomes are the X and Y. there are a total of 46 chromosomes in each human cell. A total of 44 chromosomes in both male and female are similar. The remaining two chromosomes are called the sex chromosomes. In female, the sex chromosomes are identical. Each is an X chromosome. Female mammals have two X chromosomes. Therefore, all the eggs contain an X chromosome. In males the sex chromosomes are not identical. Male has one X chromosomes and one Y chromosome. Therefore, during cell division some of the sperm will have an X chromosome only while other sperm will have the Y chromosome.

Sex is determined at fertilization. It is the chromosomes of the man that determines the sex of a child.

This is represented as shown:



Therefore, 50% are female and 50% are male.

Sometimes characteristics in an individual are inherited together. This happen when the genes responsible for such characters are carried on the same chromosome. Such characteristics occur more frequently in one sex than in the other. This phenomenon is termed sex linked.

Examples of sex linked traits include:

i) Colour blindness

ii) Haemophilia

The traits for colour blindness and haemophilia are carried on the X chromosome.

iii) Baldness

iv) Hairs on the ear lobe (pinna)

The traits for baldness and hairs on the ear lobe are carried on the Y chromosome.

Case study

A man married a woman and they gave birth to sons and daughters who had normal colour vision. However, their grandsons were colourblind while their granddaughters had normal colour vision. Describe and use illustrations to show how this could have happened.

Note: Allele for normal colour vision is dominant.

Variation

Amongst your family members you can easy see differences between each other. You see tall and short members, dark skin and light skin, long fingers and short fingers etc. a family therefore is a blend of so many differences in characteristics. The same happens with your crops and other animals. This is variation.

Variation describes the differences in characteristics shown by organisms of the same species. Factors inherited determine the genetic make-up of an organism. The factors then get expressed in the structural and physiological characteristics. The degree to which these characteristics develop may be influenced by the environment. The influence of the environment is usually not transmitted to the offspring from the parent.

Causes of variation

Some characteristics are inherited, while others are acquired as a result of environmental influences.

Examples of inherited characteristics include: blood group, skin colour, eye colour, baldness, height, albinism.

Examples of variation due to influence of environment include: scars, knowledge,

language etc.

There are two types of variation:

a) Discontinuous variation: it is also called qualitative variation. There is a clear cut position in the difference e.g. sex, you are either a male or a female. You cannot be in between.

b) Continuous variation: it is also called quantitative variation. There is no clear cut position in a character. For example, height, skin colour. The change in the character is continuous.

Self-check question

Name examples of discontinuous and continuous variations in animals and plants

Lesson 16
Interrelationship (Ecology)

Topic: Ecology (Interrelationships)

Sub topic: Components of ecosystems

Specific objective: By the end of the lesson you will be able to:

i) Describe the components of ecosystem.
ii) Describe types of ecosystems.
iii) Describe food chains and food webs in an ecosystem.

Introduction

Ecology is one of the branches of biology. This involves the study of interrelationships between plants and animals and their environment. It calls for observation of the positive and negative effects of living things on their surroundings. The environment too does have effects on living things.

The word ecology comes from Greek “oikos” meaning “house”. It is the study of living things in their home environment.

An ecosystem is a life supporting environment. It includes all living things interacting with the environment, the cycling of nutrients with all the habitats and the influence of the physical and chemical environments on the living organisms.

Knowledge of ecology and ecosystem is very helpful to many disciples. For example, in agriculture, farmers can use knowledge of soil type and vegetation to decide on best crops to be grown in an area.

Components of ecosystem

Living things interact amongst themselves and with the physical environment. The components of an ecosystem are always in constant communication with each other. These components are the abiotic factors (the physical factors e.g. sunlight, temperature, soil type, rain, pH of water) and the biotic factors (the living components e.g. herbivores, carnivores and decomposers). In the study of the ecosystem, the following scientific terms ought to be learnt. The terms are specific and include:

i) Environment- the physical features of the ecosystem
ii) Habitat – natural home where an organism lives.
iii) Niche- the role or way of life of an organism in its habitat.
iv) Community- all the populations of the different species of animals and plants living in a habitat.
v) Population – total of all the organisms of a single species living in a habitat at a particular time.
vi) Producers- are organisms in the environment that are able to make their own food. Plants are the major producers and they do this through photosynthesis. Plants possess chlorophyll. All other living things depend on plants for their food and oxygen.
vii) Consumers – other living organisms apart from plants that depend on others for their food (energy source).
viii) Decomposers – those organisms that feed on the decaying organic matter. They convert organic matter into nitrogen and carbon dioxide. Decomposers simply, recycles nutrients within the ecosystem so that producers can use them again.

Types of ecosystem

Ecosystem can be broadly divided into two major types:

i) Aquatic ecosystem – the environment is water. This vary from a pond, stream, river, lake to the seas. The environment harbours many different types of living organisms. Each organism getting adapted to living in each habitat. *(aquatic refers to water)*

ii) Terrestrial ecosystem – the land environment. This vary according to the type of vegetation, ranging from grassland, forests to deserts. In terrestrial ecosystem, vegetation depends on physical factors (rainfall, temperature and soil type). (*terrestrial refers to land)*

Food chain and food webs

Food is the most important aspect of an organism's environment. Organisms eat each other thereby forming feeding relationships. These feeding relationships can be expressed in form of food chains and food webs.

Organisms in a particular habitat are linked through their feeding habits. Plants are eaten by animals and these animals are in turn eaten by other animals and so no. This series of eating make up a **food chain**.

A food chain therefore is a series of organisms in an ecosystem which are linked through their feeding habits. Energy is transferred from one organism to another.

Energy in food chain originates from the sun. Green plants incorporate this energy into organic compounds by the process of photosynthesis. Green plants manufacture their own organic food because of these, they are called producers. Producers form the base of all food chains. Animals feed on plant and other animals in order to obtain energy. Animals are therefore consumers. Herbivores are called primary consumers because they are the first consumers in the food chain. Primary consumers are eaten by carnivores (flesh eaters). Flesh eaters are the secondary consumers. The secondary consumers are fed on by other group of animals called the tertiary consumers. In the food chain, some animals have mixed diet i.e. feed on both plant and animals. These are called omnivores.

In study of ecology, a food chain always follows the same pattern;

Producer → primary consumer → secondary consumer → tertiary consumer

The arrow indicates direction of energy flow. It also means 'is eaten by'.

NOTE: the different feeding levels in a food chain are called trophic levels e.g. producers form a trophic level.

Activity

A pond contains the following organisms interacting with each other and the environment; frog, water lily, water boatman, earth worm, bacteria, dragon fly larvae, water flea, silver fish, spirogyra and water weed (Elodea). The pond is in an open area where sunlight (sun energy) reaches it easily.

What to do.

i) Group these organisms into (i) producers and (ii) consumers.

ii) Show how each group depends on the other

iii) Construct a food chain using the organisms in the pond.

Food webs

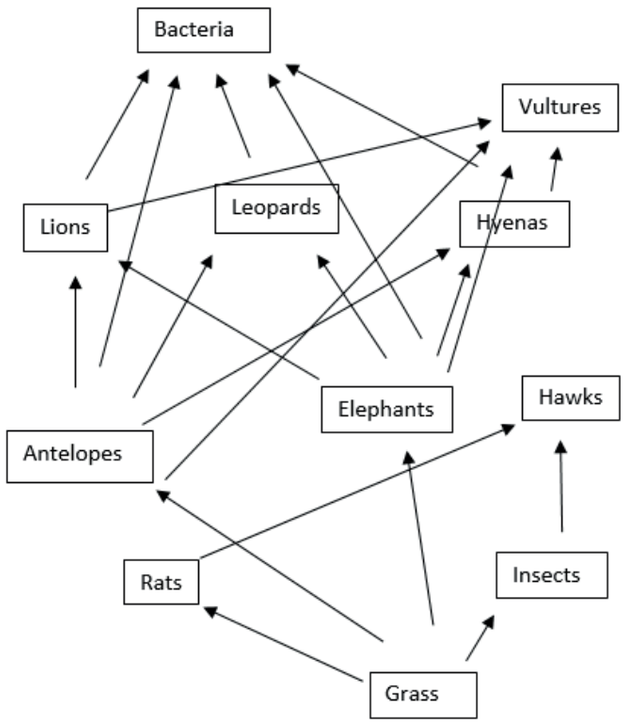
In real life very few organisms eat only one type of plant or animal. Therefore many organisms appear in many different food chains.

Interactions in a community involves simple food chains linked to each other forming a complex food web.

Food web is a number of food chains linked to each other where some organisms will have more than one source of food.

Grass is eaten by insects, rats and by many large herbivores. Antelopes are eaten by lions, leopards and hyenas. Elephants feed on grass, shrubs and trees. These relationships cannot be shown in simple food chains so we use food webs. See the illustration of a food web below.

Illustration of a food web



Competition

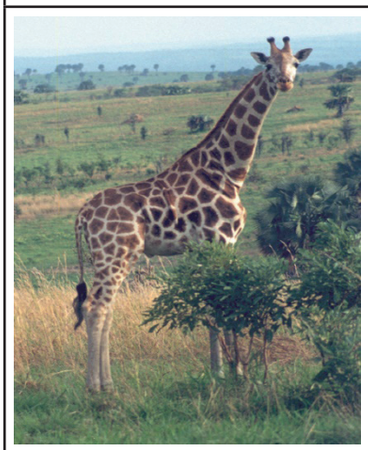
Organisms in ecosystems have specific needs that must be met. Plants and animals need water. Plants need sunlight in order to grow. Competition may be directly for resources such as sunlight, minerals and food or may be for mates.

Competition does exist between members of the same species. In the process some members may not survive. If it is within a population, some of the population may not survive. They may not reproduce and so growth slows down. If resources are plenty, there will be very little competition and therefore population will increase as fast as possible.

Different species in a community also compete with others for the same scarce resources. The end result in this type of competition is slow population growth. If one species has a high density at the start, the other members of different species may get removed. They die out of lack of food (starvation).

Activity

Study each image in the left column of the table. For each image, identify the resource that is being used by the organism (s). Then determine whether the resource is abiotic (non-living) or biotic (living). Finally read each scenario in the final column of the table. Predict how and why the scenario will affect parts of the ecosystem, and fill in the blanks with your answers.

	Resource	Abiotic or biotic	Scenario
			The large number of rats move into the ecosystem. Competition for ..... will increase because .....
			The population size of Hippo increases dramatically. the ..... Population will decrease because .....
			The ecosystem experiences a drought and all the shrubs dried up. The Giraffe population will ..... because .....


CORONAVIRUS (COVID-19) PREVENTION
20 SEC
WASH HANDS WITH SOAP
USE A MASK
USE HAND SANITIZER
SNEEZE INTO ELBOW
AVOID TRAVELLING
KEEP OBJECTS CLEAN
AVOID CONTACT
STAY AT HOME
AVOID CROWD PLACES

National Curriculum
Development Centre,
P.O. Box 7002,
Kampala.

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