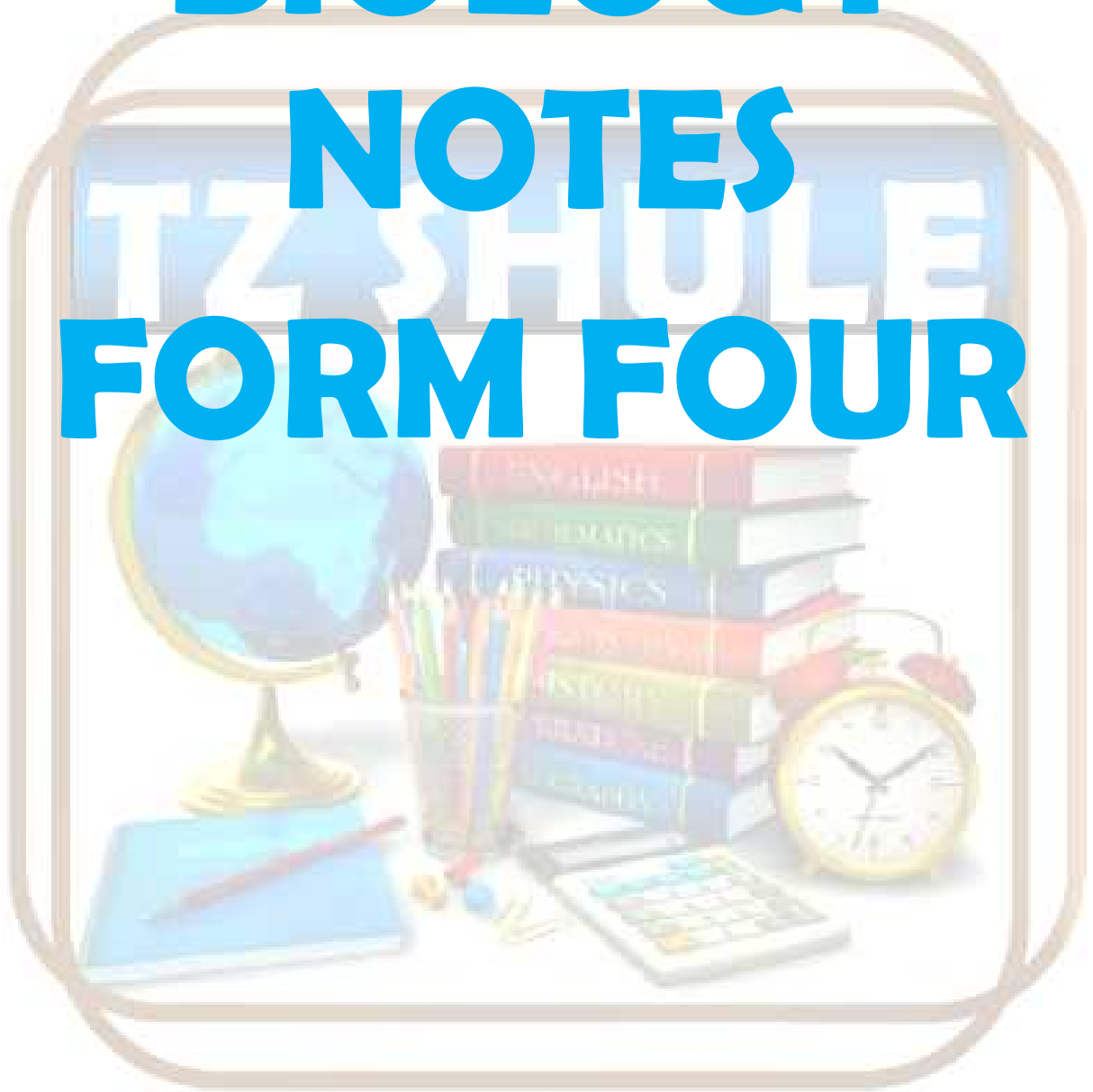


BIOLOGY NOTES FORM FOUR



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GROWTH AND DEVELOPMENT

GROWTH

Refers to the irreversible (permanent) increase in size and mass of an organism.

- Reproduction results in the formation of new organisms. Every newly produced organism is usually small in size, with time the organism increase in size and weight.
- In multicellular organisms the increase in size and weight is a result of the increase in the number and size of body cells. As the number of cells increases various organs are formed.
- The changes can take place only if energy and raw materials are available. The energy and raw materials are derived from food. Because raw materials are used, growth brings about an increase in the mass of an organism.
- In some multicellular organisms as new cells are formed some old cells usually die off. In such cases there is therefore a continuous addition and loss of cells. But for growth to occur the rate of cell increase must exceed the rate of cell loss.
- When the rate of cell increase is higher than the rate of cell loss growth is referred to as

POSITIVE GROWTH.

- When the rate of cell increase is lower than the rate at which cells are lost from the body, the organism decrease in size and weight. This is also growth and it is referred to as **NEGATIVE GROWTH**. It may be caused by an illness or starvation.
- It should be noted however that negative growth cannot go on indefinitely. An organism cannot resume the size, weight and body shape of a newly born body. For this reason growth is said to be irreversible.

IMPORTANCE OF GROWTH IN LIVING THINGS

i. Life usually starts as a single cell e.g a human zygote (fertilized egg) give rise to billions of different cells etc.

ii. During growth and development the cells divide and enlarge giving rise to a more complex and elaborate multicellular organism.

iii. Growth give rise to various cells specialized in various specific functions.

- Examples; - Red blood cells carry oxygen
- White blood cells fight pathogens
 - Palisade cells carry out Photosynthesis
 - Guard cells close and open stomata etc.

iv. This specialization brings about effectiveness and organisms are therefore able to adapt different environments.

v. During growth sexual organism in mammals develop with fully developed sex organs, an organism is capable of reproduction and hence perpetuation of the species.

DEVELOPMENT.

Refers to the changes in the complexity of an organism. It involves differentiation and formation of various tissues that perform specialized functions.

Note: Growth is brought about by:-

- i. Cell division
- ii. Cell enlargement
- iii. Cell differentiation

TYPES OF GROWTH

i. Diffuse Growth

This is the type of growth whereby growth occurs all over the body of an organism e.g in animals.

ii. Localized Growth

This is the type of growth whereby growth occurs in certain regions, e.g in plants growth takes place at the tips of roots and shoots, These tips are called meristems.

iii. Intermittent Growth

This is a type of growth in arthropods in which growth takes place in a series of stages called instars. E.g in insects an egg hatches into a larva which then develops into a pupa and finally into an adult (image).

iv. Isometric Growth

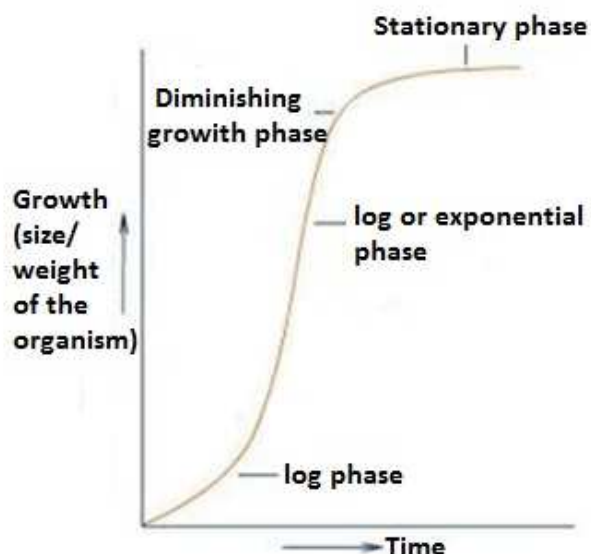
This is the type of growth whereby all body organs grow at the same rate e.g in fish, locust.

THE GROWTH CURVE

Growth can be measured using a curve. A growth curve is a graph obtained when data collected during stages of growth is plotted against the time.

- A growth curve shows growth pattern of the organism. In most organisms growth pattern is almost the same where by first shows slow then speeds up and finally slows down.

- This pattern gives an S-shaped curve known as **sigmoid curve**.



Lag phase

Lag phase is a period when the rate of growth is very slow, during the stage the number of cell dividing through mitosis are few

Log phase /exponential phase

This phase involves very rapid growth where by the number of cell division is higher than the dead cells.

Linear growth /declaration phase.

This phase involves the decline in the rate of growth as maturity is approached the rate of cell division decrease.

Stationary phase/plateau phase

This phase marks the period of no further changes in the size of the organism the organism has attained maturity, new cells are formed only to replace those worn out or dead cells.

MEASUREMENT OF GROWTH

Growth can be estimated by measuring any suitable parameter of an organism at suitable intervals of time. Some of the common parameter measured include, Length, Width, Area, Fresh mas and Mass of an organism.

(i) Length

- This method is reliable if growth occurs mainly in one direction.
- Increase in length denotes growth. In plants for example leaves, stem and internodes on stems can be measured.

Advantages

- The change in length is easy to work out.
- The same organism is used throughout the investigation.
- The organism are not harmed.

Disadvantages

- It ignores growth in other directions such as width and girth, which can be significant.

(ii) Total fresh weight (mass)

- This method involves weighing the whole organism at regular intervals.
- This is an easy method used to estimate growth in large animals including man.

Advantages

- Weighing is easy
- It does not involve injury to the organism.

Disadvantages

- Fresh weight measurement method are influenced changes in water content of the body and therefore do not always give accurate results.

(iii) Dry mass (Weight)

- Is used to measure growth of small organisms such as germinating wheat.
- It involves killing the organism and heating it at 110°C to a constant weight to remove water.
- This method is more accurate since it indicates the increase in weight due to synthesis of different materials irrespective of water content.

Disadvantages

- The method involves killing the organisms and thus has limited usage.
- A large number of organisms are used, hence the method is wasteful.

(iv) Width

- The width of parts of an organism can be measured over a period of time.

Advantages

- Width is easily measured
- The same organism is used to monitor growth.

Disadvantages

- Increase in width interpreted as the only aspect of growth occurring.

INTERNAL FACTORS THAT REGULATE GROWTH IN PLANTS.

1) Heredity factors.

- These are internal factors that affect the growth of plants. They affect the physical appearance and the size of a plant.
- Hereditary units called genes are found in chromosomes inside the nucleus of all plant cells. These units control the various characteristics of plants such as flower colour, number of floral parts, growth pattern and so on.
- Genes are passed from parents to offspring. For example tall plants produce tall offspring and vice-versa.

2) Growth hormones.

- Hormones are chemical substances that influence physiological processes. Growth hormones affect growth which is brought about by cell division and enlargement.
- Plant hormones called auxins promotes growth in plants.
- Examples of plant hormones are, Indole Acetic Acid (IAA), Gibberellins, Cytokinins, Ethylene (ethene), Absciscic acid (ABA), Indolebutyric acid.

3) Apical dominance

- Is the inhibition of the growth of lateral buds by the presence of the growing apical bud.
- Apical bud is found at the top of the plant which is responsible for increase in plants height (Apical growth).
- Lateral buds are found on the sides of the plant which are responsible for the formation of branches.
- The apical bud produces auxins that diffuse to the lower parts of the plant. These auxins retard the development of lateral buds. The lateral branches of such a plant are short.

EXTERNAL FACTORS AFFECTING GROWTH IN PLANTS.

These are also called environmental factors, they include the following;

1) Plant nutrition

- There are several plant nutrients which are needed for better growth of plants.
- The basic nutrients required for plant growth are divided into two main categories namely micro-nutrients and macro-nutrients.

i. Macro-nutrients

Are nutrients that are required by plants in larger quantities. There are six elements in the soil that are termed as macro-nutrients. These are,

- Nitrogen
- Potassium
- Magnesium
- Calcium
- Phosphorous, and
- Sulphur.

ii. Micro-nutrients

Are nutrients that are required by plants in smaller quantities. There are eight elements in the soil that are termed as micro-nutrients. These are,

- Iron

- Zinc
 - Molybdenum
 - Manganese
 - Boron
 - Copper
 - Cobalt, and
 - Chlorine.
- Nitrate for instance are an important component for synthesis of proteins. Proteins are needed for plant growth. Absence of nitrate cause plant to look shorter than their real age (stunning).

2) Water

- Water is one of the most essential factors required in growth of plants. It plays a crucial role for efficient photosynthesis, respiration, transportation and transpiration of minerals and other nutrient through the plant.
- Water is also responsible for proper functioning of the stomata opening leaves.

3) Light

- Light is necessary for photosynthesis to take place. Plants make their own food through the process of photosynthesis. Food is necessary for plant growth.
- Absence of light makes plant leaves yellow. It also makes the stems thin, long and the spaces between internodes longer than usual. This condition is referred to as etiolation.

4) Temperature

- Optimum temperature, both of the surrounding atmosphere and soil is one of the important factor for many of the plant processes, like photosynthesis, metabolism, germination and flowering.
- Temperature affects the rate of metabolism hence growth. Warm temperature increase the rate of metabolism, thus plants grow better in warm climate.
- Extremely high temperature kill cells and enzymes, thus metabolism cannot take place.
- Very low temperature slow down metabolism.

5) Amount of carbondioxide and oxygen

- The manufacturing of sugar by plants requires the presence of carbondioxide. It is thus one of the vital elements for plant growth.
- Oxygen is essential for plant respiration and utilization of the by-product of photosynthesis.

6) Soil

- Soil with proper humidity and the right balance of all the minerals and nutrients is one of the essential factors in plant growth.

INTERNAL FACTORS AFFECTING GROWTH IN ANIMALS.

The following are the internal factors that affecting growth in animals.

- i. Genetic make up
- ii. Hormones

i. GENETIC MAKE UP

- Genetic make up of parents for instance, determine the height of their children.
- Genes you inherited from your mother and father contribute to your growth. Because each children receive a different combination of genes, growth patterns of children within the same family may differ considerably.

ii. HORMONES

- Secretion of hormones also affect growth in animals.
- Over secretion of growth hormones during childhood results into Gigantism (giantism).
- Under secretion of thyroxine during development slows physical and mental development in human beings. This leads to a condition called Cretinism. Cretinism is a condition in which a child become stunted and mentally retarded due to under-secretion of thyroxine).

EXTERNAL FACTORS AFFECTING GROWTH IN ANIMALS.

i) Temperature

- Since optimum temperature increase the rate of metabolism and very low temperature slow down metabolism, therefore animals grow faster in optimum temperature (warm climate). For example, a tadpole will grow faster in a warm pond than in a cold pond.

ii) Oxygen

- The amount of oxygen has no much effect on the growth of terrestrial animals as it is readily available in the atmosphere.
- However it can have an impact on the growth of aquatic animals if its amount in water varies.

iii) Nutrition

- Nutrition is very important for animal growth.
- Nutrients, especially proteins are very vital for growth. Inadequate amount of protein leads to stuning.

iv) Diseases

- Communicable diseases or infections, especially in children interrupt growth. E.g a disease like diarrhea inhibits absorption of nutrients in the body that are necessary for growth.

MITOSIS AND GROWTH

Depending on the number of chromosomes found in the nucleus, all cells in the body can be classified into two categories;-

- (i) Somatic (body) cells
- (ii) Reproductive cells (gametes)

(i) **Somatic cells**, contain chromosomes that occur in pairs. The number of chromosomes in a body cell is referred to as diploid number, denoted as $(2n)$. A human being has 46 chromosomes.

(ii) **Reproductive cells**, are those which give rise to the formation of gametes (sex cells) and are found in reproductive organs (testes for males and ovaries for females). Each gametes has half the number of chromosomes as those of the parent cell. This ensures that the number of chromosomes in every succeeding generation remains the same.

- Animals or sexually producing plants start as just a single cell which is formed after fusion of male and female gametes. That fused single cell is called zygote.
- This single cell then grows and divides to form two cells which are identical in everything. Each of the two newly formed cells will divide to form two cells. This process goes on until a whole organism is formed.
- The newly formed organism is still very young and the cells keep on dividing until the organism becomes fully.

Meaning of mitosis

Mitosis is the process or an event in which the cells divide during growth to form new cells which are similar to the parent cells.

- Therefore mitosis is very important for growth because it leads to increase in the number of cells within an organism.

NOTE: Meiosis occurs in reproductive cells during gamete formation while mitosis occurs in somatic cells during the growth of an organism.

- During mitosis, two daughter cells (new cells) are formed. Each daughter cell has the same number of chromosomes that is 46 and therefore diploid just like the parent cells.

NOTE: - Chromosomes are thread like structure found within the nucleus of cells of both plants and animals.

- The chromosomes become visible when a cell is dividing.
- Chromosomes are composed of chromatin threads that are spread out within the nucleus of the cell.
- It carries the genes that determine an individual's characteristics.

PHASES (STAGES) OF MITOSIS

- It consists of 5 phases namely;

1. Interphase
2. Prophase
3. Metaphase
4. Anaphase
5. Telophase

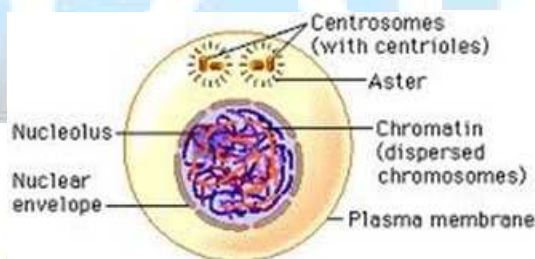
1. INTERPHASE

- This is the phase where the cell is engaged in many cellular activities to prepare for the cell division.

- The entire process takes about 1 hour. It is incorrectly referred to as resting phase.

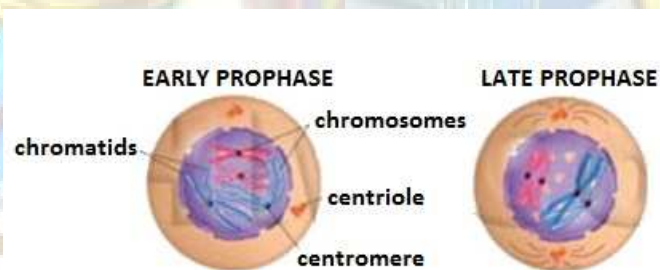
- The following are observed

- DNA replicates
- Chromosomes appear
- Centriole replicates
- Energy is synthesized and stored



2. PROPHASE

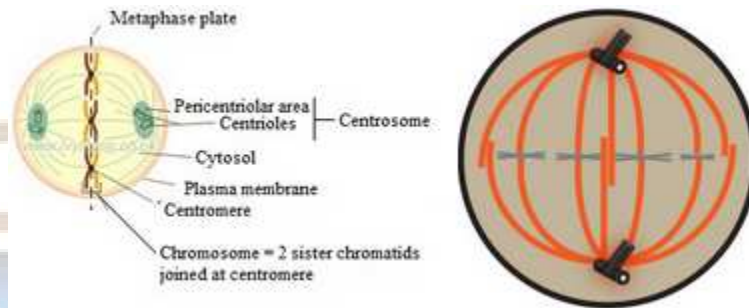
- In this stage centrioles separate and migrate to opposite cell's poles.
- Chromosomes become visible, thicken and shorten
- Each chromosome divides into two along its length except at the centromere. Chromosomes now called **chromatids**.
- The nucleus membrane and nucleolus gradually disappears.
- A network of fibres starts to form



3. METAPHASE

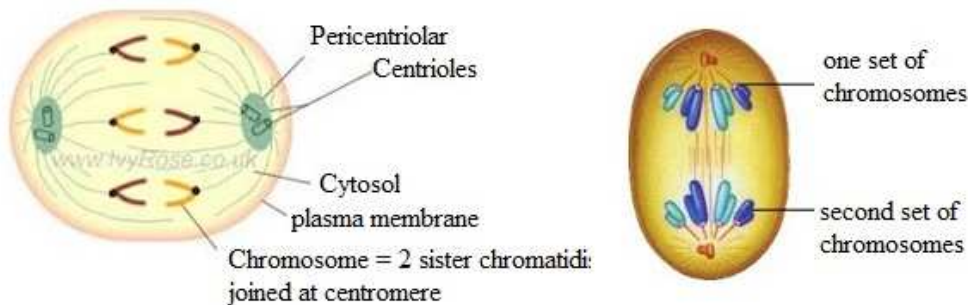
- The chromatids move to the centre of cell.

- The chromatids become arranged and attached to spindle fibres by centromeres.
- The chromatids draw apart at the centromere region



4. ANAPHASE

- In this stage, after the sister chromatids divide at centromere, they migrate to the apposite poles of the spindle, the centromere leading it.



- Chromatids reach their destination towards the poles of the spindle. Now chromatids are called **chromosome**

5. TELOPHASE

- In early telophase, the spindle fibres disappear,
- A nuclear membrane is formed enclosing the newly formed chromosomes.

- At this stage, in animal cells, the cell starts to constrict across the middle into two new cells.

- In plant cells a cell wall is formed across the middle of the cell



CYTOKINESIS

This is the division of the cytoplasm. It is through the formation of a new cell wall in plant cell or the constriction of the animal cell.

SIGNIFICANCE OF MITOSIS

- It is the basis of asexual reproduction
- It maintains the diploid state of the organism
- It is the basis of growth i.e it brings about growth in terms of increase in number of cells.
- It help to recovery of dead worn out cell

DIFFERENCE BETWEEN MEIOSIS AND MITOSIS

SN	MEIOSIS	MITOSIS
	Occurs in reproductive cells to form gametes	Occurs in body cells during grow and tissue repair (somatic cell)
	Gametes fuse to form a zygote	New cells do not fuse to form a zygote
	Variation occurs through chromosomes recombination	No variation, all are like parents.

	Takes place in two phases to complete	Take place in one phase to complete a successful cell division
	New formed daughter cells are in haploid state	Newly formed daughter cells are in diploid state
	Results in four daughter cells (haploid)	Result in to two diploid daughter cells

GROWTH AND DEVELOPMENT IN HUMAN BEING.

Human beings like other animals show growth and development. Human beings show diffuse growth where growth occurs all over the body.

- Development is an increase in the complexity of an organism. It includes growth, differentiation, wound healing, tissue regeneration, ageing and death.
- Growth and development in humans can be;-(i) Pre-natal or (ii) Post-natal.

(i) Pre-natal growth and development takes place in the womb before a body is born.

(ii) Post-natal growth and development occurs after the body is born.

HUMAN POST-NATAL GROWTH AND DEVELOPMENT.

The human beings post-natal growth and development comprises of five main stages. These stages are;

- (1) Childhood
- (2) Adolescence
- (3) Adulthood
- (4) Old age (senescence)
- (5) Death

1) CHILDHOOD (Infancy stage).

- Is the period from the time the body is born up to sexual maturity (about 11 years).
- Childhood stage has several stages. These stages are;
 - * Neonatal
 - * Older baby
 - * Toddler
 - * Early childhood
 - * Late childhood, and
 - * Pre-adolescence

*** NEONATAL STAGE**

Is the from birth up to 5 months. New babies are also called neonates.

Changes

- The following are the physical, physiological, behavioral and psychological changes which occur at this stage of growth and development.

i) The baby can lie on its back and tries to roll over. It can do a number of things such as crying, moving their arms, legs, heads, swallowing and sucking.

ii) Babies at this stage suck anything and put in their mouth.

iii) Neonates can see but only a short distance of about 20cm. They can also hear, smell and feel. They spend most of their time sleeping.

iv) Babies at this stage express their feelings mainly through crying. They cry to show hunger, thirst, pain, tiredness, fear and discomfort such as wet nappies, cold and lot of heat and sickness.

v) The immune system is immature and the baby depends on the immunity from his or her mother through breast-feeding.

Advantages of breast-feeding.

The milk produced by mother in the first days after delivery is called **colostrum**. The colostrum is usually sticky and yellow and contains more proteins and antibodies than white milk produced later.

- Mother milk contains nearly all the nutrients needed for growth and development of the body. The following are the advantages of breast feeding.

(i) Breast-feeding creates a special bond between the mother and the baby. i.e it has psychological benefits.

(ii) Breast milk is at the right temperature for the baby.

(iii) Breast milk is well balanced. i.e it contains nearly all nutrients needed for normal functioning.

(iv) Breast feeding (milk) does not require preparation.

(v) Breast milk is safe and free from contamination.

(vi) Colostrum contains a lot of antibodies needed to protect the baby against infection.

Reasons for substitution of Mothers milk with others foods like cows milk.

(i) Death of Mother.

(ii) Inability of the Mother to produce enough milk.

(iii) In case of multiple births e.g twins, triplets etc.

(iv) In case the Mother has easily transmitted diseases like tuberculosis.

*** OLDER BABY STAGE**

This is the stage from 6 to 12 months.

Changes

(i) At six months, a baby can completely control his/her head and sit without support.

(ii) At 7 months the baby learn to crawl.

- (iii) He or She can hold and drop objects and stand while holding things like tables or chairs.
- (iv) Teething occurs at this period.
- (v) From 9 to 12 months the baby start to walk.
- (vi) The baby responds to his or her own name and other words that are familiar to him.

*** TODDLER STAGE**

This is the age between 1 to 3 years.

Changes

- (i) Brain develops by 90%
- (ii) The child is able to control micturition and defaecation as urinary and anal sphincter control become possible.
- (iii) The baby can see everything that an adult can see.
- (iv) All the 20 milk teeth appear by the age of 2.5 to 3 years.
- (v) Immune system becomes mature.
- (vi) Hearing has developed well.
- (vii) At 12 to 14 months, the child uses gestures to express his or her feelings. For example raising arms when he/she wants to be picked up.
- (viii) At 15 months, the child copies what adults do .

For example, a child may imitate "cooking" by taking a spoon and "stirring" it in a bowl.

- (ix) At 15 to 18 months a child feeds him or herself.
- (x) At 19 to 24 months a child likes to play with others (socialization), likes to dress and undress himself or herself. He mimics social behaviours such as holding and feeding a toy.
- (xi) At 25 to 36 months, emotional children may feel jealousy, for example toward a new born baby. They also show fear for particular things like fear of some insects, scary noise.

*** EARLY CHILDHOOD**

This is the age from 4 to 6 years. At this stage children go to kindergarten.

Changes

- (i) A child has good appetite and therefore grows rapidly, Good appetite is important as children at their stage are very active and play a lot.
- (ii) Motor coordination has developed well and therefore the child can walk, jump and skip.
- (iii) The child becomes curious and imaginative.
- (iv) He or she understands right and wrong.
- (v) He or she becomes curious.

*** LATE CHILDHOOD**

This is the age from 7 to 9 years. At this stage children are in primary school.

Changes

- (i) Children become very active.
- (ii) The child can assume simple responsibilities like looking after the house when parents are not at home.
- (iii) The child is very social and likes to socialize and belongs to groups.
- (iv) He or she can help with household chores like washing dishes, setting the table, fetching

water.

(v) The child likes to associate with peers of similar interest.

(vi) This is the time children have friends and best friends. However they prefer friends of the same sex.

(vii) Children at this stage can listen to peers opinion but still value opinions of their parents.

*** PRE - ADOLESCENCE**

This is the age from 10 and 11 years

Changes

(i) Growth starts to increase

(ii) Appetite increase

(iii) Secondary sexual characteristics start to show. For example growth of breast and growth of public hair and hair under armpits.

(iv) Children still prefer friends of the same sex.

(v) Children are very social and tends to value peers opinion.

Common problems in Infancy (Childhood)

i) Constipation

This is the difficulty in passing out faeces. This can be solved by giving fruit juice, vegetables and by increasing the baby's intake of water.

ii) Excessive crying

It indicates illness, pain, hunger, thirst, need for love and attention or the baby may be uncomfortable due to excessive heat or wetness.

iii) Heat rash

Heat rash results to a roughing itching skin, which may be painful caused by excessive heat. Putting the baby in a cooler place and loosening the tight clothes may relieve this.

iv) Nappy rash

The nappies should be changed frequently to avoid the nappy rash. The baby's skin should be kept clean, dry and well oiled. Use of powder on the skin is recommended.

v) Diarrhoea

Diarrhoea may be a symptom of a disease or may be caused by overfeeding, infection or reaction to particular kind of food.

- The baby should be given plenty of liquid to avoid dehydration.

- In case of excessive diarrhoea, the baby should be taken to the nearest health center for treatment.

vi) Colic

- A baby is said to have colic if it seems to be uncomfortable from pain in its abdomen. This causes the baby to cry out loudly.

- The pain is caused by air swallowed at feeding time.

- The baby should be held up with its abdomen leaning on the mother's shoulder to force the air

out gently a condition known as winding up.

Services required to meet the needs of children

The services required to meet the needs of a child can be categorized into two;-

- (a) Essential (basic) services
- (b) Supportive services

(a) Essential (basic) services are necessary for baby's survival. Basic services include;-

- Healthy.
- Warmth.
- Shelter.
- Clothing.
- Protection against illness and injury.
- Excessive and rest.

(b) Supportive services are services that will help a child to grow well socially, emotionally and mentally. Supportive services includes;-

- Love
- Care and comfort
- Security
- Training of habits and skills
- Older children need to be disciplined
- Trained to independent and useful to others and be responsible.

2. ADOLESCENCE

- Is a period in human developed between childhood and adult hood.
- It generally occurs between the ages of 12 and 18 years.
- At adolescence boys and girls attain sexual maturity (puberty),puberty is a term used to refer to the period when secondary sexual characteristics develop.
- Girls attain puberty at the ages of 11- 13, boys attain puberty at the age of 12-14.
- During adolescence, an individual experiences a lot of changes which includes emotional, social and physical changes. These changes occur in both boys and girls to prepare their bodies for parenthood.
- At puberty the boys secrete the male sex hormone known as androgen that brings about the development of male secondary sexual characteristics.
- The girls secrete the female hormone called oestrogen that brings about development of female secondary sexual characteristics.

Changes in Boys only at Puberty.

- (i) Shoulders and chest become broader (wider).
- (ii) Muscles get stronger.
- (iii) Beard grow.
- (iv) The voice breaks (becomes deep).
- (v) Enlargement of sex organs and they occasionally emit some fluid from the penis at night (wet dream).
- (vi) Sperm production starts.

Changes in Girls only at Puberty.

- (i) Enlargement of breasts.
- (ii) Widening of pelvic girdle (leads to enlargement of hips).
- (iii) Ovulation starts.
- (iv) Menstruation begins.
- (v) Enlargement of uterus and vulva.

Changes in both Boys and Girls at Puberty.

- (i) Hairs grow in public region and under the armpits.
- (ii) Sex hormones are secreted.
- (iii) The skin sweats more often.
- (iv) Attraction by members of the opposite sex.
- (v) Pimples may appear on the face but later disappear.
- (vi) Body increases in size due to rapid growth.

Personal Hygiene during Adolescence.

Puberty is a period of rapid growth with so many changes occurring in the body. As a result the body produces a lot of waste products such as sweat, wet dream in boys and menses in girls.

- Adolescence should therefore maintain high level of cleanliness to avoid stinking and infections.
- It is important that they should bathe daily and change into clean clothes.
- When bathing, one must pay extra attention to genitals, armpits and areas between the toes.
- If the armpits sweat a lot shave the public hair to reduce warmth and sweating.
- After bathing apply deodorant to kill germs and prevent foul smell.
- For sweaty feet, clean between the toes, dry well and if it can be afforded, dust the areas with talcum powder. The powder absorbs the sweat, prevents bad smell and athlete's foot.
- In case acne (pimples) strikes, it should not worry anybody. Avoid breaking the pimples, just keep the face clean, avoid applying oily creams, avoid diet that has a lot of oil.
- Boys need to keep their beards trimmed or well styled.
- Girls need to bathe more than once during the menstruation flow to avoid foul smell of blood.
- Girls need to wear sanitary towels (pad) to avoid staining their clothes with blood. The sanitary towels (pads) must be changed regularly to avoid development of foul smell.
- If commercial sanitary towels cannot be afforded, home made pads can be prepared by folding clean cotton cloth to make pads.

Services required to meet the needs of Adolescence

Adolescence requires;

- Healthy food for their growing bodies.
- Peaceful home
- Security emotional support.
- Caring
- Physical exercise
- Social skills

3. ADULTHOOD

Adulthood starts at 20-55 years. Adults are physiologically, Psychologically and Physically mature

to make families.

Changes

- (i) Growth has stopped, only maintenance of body parts, for example repair of worn out cells taken place. A person may gain weight due to deposit of fats but not due to growth and development.
- (ii) At this stage people are in their best physical conditions that is very strong, energetic, have good memory capacity, sharp senses and stamina.
- (iii) People at this stage are very ambitious and want to succeed. They work hard to meet their goals, for example to finish studies, get a job, start a family.
- (iv) They have the desire to be socially independent.
- (v) In the late forties or early fifties, the rate of deterioration becomes significant.
- (vi) The ability to do tasks that require a lot of energy and high speed decrease, sharpness of vision decreases and memory loss may occur.
- (vii) Hair starts to turn grey, skin starts to lose elasticity.
- (viii) Women reach menopause and their desire to have sex is reduced.

4. OLD AGE

Old age starts from 56 years and over. This is the age of senescence simply after menopause in women. Men tend to diminish their sexual activity but they are not actually sterile.

Changes

- (i) The ability to focus on objects, smell and hear decreases.
- (ii) Hair turns grey as a result of reduced production of hair pigment. Some men may develop a bald head.
- (iii) Loss of memory due to death of brain cells.
- (iv) Kidney functioning slows down and the frequency of urination increases.
- (v) Decreases blood flow to the brain and death of nerve cells.
- (vi) Elasticity of the skin decreases. The skin gets looser and wrinkles develop.
- (vii) Bones may become weak especially for those who have been taking food with less calcium in young age.
- (viii) By the age of 70, about two thirds of taste buds in the mouth die, making a person feel like food is tasteless.

- The above features do not apply to all aged people. Healthy life style during young age may delay occurrence of the above features and make a person lead a normal life even in older age.
- A healthy life style is achieved by eating healthy food, avoiding smoking, alcoholism, overeating, drug abuse and inactivity.

5. DEATH

This is the end of life. The cells and all body processes stop to function.

FACTORS AFFECTING THE RATE OF DETERIORATION OF THE HUMAN BODY

Some people may live a happy health life up to their old age and until they die. Others get very old while they are still very young.

- Factors affecting the rate of deterioration of the human body have been categorized into:-

- a. Psychological factors
- b. Environmental factors
- c. Genetical factors

a) PSYCHOLOGICAL FACTORS

(i) Smoking

Smoking reduces life span by 12 years. Smokers suffer more illnesses such as cancer than non-smokers. Smokers leads to permanent building, skin wrinkling.

(ii) Alcoholism

The ability to metabolize alcohol decrease with age. Prolonged use of alcohol leads to damage of the central nervous system and brain and increase the risk of heart stroke and breast cancer for women.

(iii) Drug abuse

Drug abuse weakness the immune system and causes premature ageing. It thus reduces life span.

(iv) Stress

Stress may cause heart problems and high blood pressure. It also causes impairment of the immune system, thus making a person sick often.

- Other problems that may result from stress are failure to sleep (insomnia), fatigue, headache and migraine.

(v) Inactivity

Sedentary work and inactivity such as spending a long time watching TV or doing office work that involves sitting most of the time results in being overweight and its associated risks.

- People who are inactive have more changes of developing health problem such as obesity and high blood pressure than those who are active.

b) ENVIRONMENTAL FACTORS.

(i) Poor diet

Poor diet includes both underfeeding and over-feeding. Under-feeding cause malnutrition which reduces life spar over-feeding leads to obesity and diabetes obesity cause premature age.

(ii) Diseases and infections

Pathogens produce toxins that accelerates deterioration. They also deprive our bodies the necessary nutrients needed for good health.

(iii) Chemical and radiations

Some chemicals such as those found in cosmetics, medicines, insecticides, pesticides, foodstuffs and sprays may have adverse effects in the human body.

- These chemicals speed up deterioration or shorten life span.

- Some radiations for example x-rays may affect our lives by killing body cells or causing deadly diseases like cancer.

C) GENETIC FACTORS

A small number of individual carry a defective gene that causes Werner syndrome.

- Werners syndrome is a very rare diseases that causes premature ageing. It causes a 20 or 30 years old person may look several decades old.

SOCIO-CULTURAL FACTORS THAT AFFECT GROWTH AND DEVELOPMENT.

(i) Trading beliefs

They affect the kind of food one should eat. For example in some tribes pregnant women are not supposed to eat eggs, which contain proteins needed for growth and development of the unborn baby.

(ii) Poverty

People having low income may fail to provide the basic needs for proper growth. Poor or insufficient diet and lack of medical care result into poor growth and even death especially at infancy.

(iii) Religion

Some religious sects bar certain groups of people e.g pregnant women from eating certain food. For example Muslims do not eat pork on religious ground.

- Some religious sects do not allow their followed to go for treatment in hospital resulting to poor health and even death.

(iv) Ignorance

Lack of knowledge about proper diet, proper medical care and education contribute to poor health. Most people do not know how to care for themselves, and do not know what is good and bad for them.

GROWTH AND DEVELOPMENT IN FLOWERING PLANTS

Development are changes that occur in an organism from the time of fertilization to the formation of an adult body.

- In flowering plants, development starts with the growth of zygote into an **embryo**.

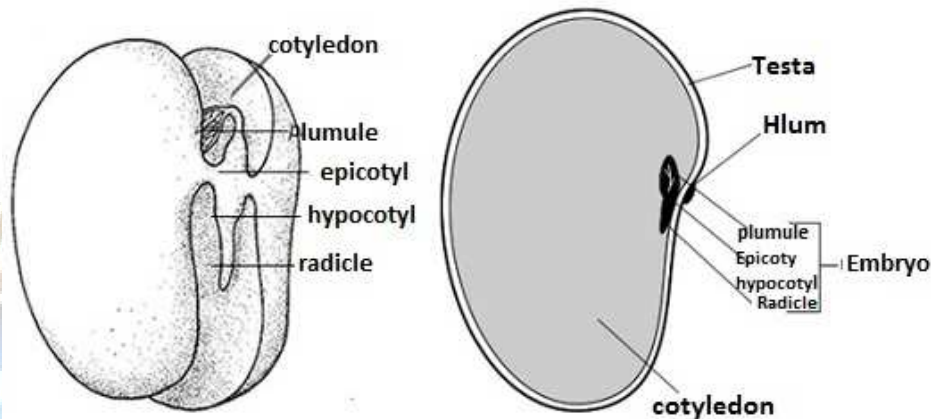
- In most flowering plants growth starts when the seed begin to germinate.

- **Germination** is the process by which the seed develops into seedling (young plants).

A summary of changes which occur during seed germinating

- The seed absorbs water through micropyle and enlarge.
- Later on the testa bursts and the radicle emerges. Radicle continues to elongate and gives rise to many roots.

- Then the plumule emerges. at this stage the young plant is called a *seedling*.



CONDITION NECESSARY FOR GERMINATION

1. WATER

- It is a suitable medium of enzymes to break down the stored food into suitable form.
- It hydrolyze food substance into glucose
- It is used to transport food materials between the cell/ to where they are used as source of energy.
- It softens the seed coat/testa so that it ruptures (bursts easily)

2. OXYGEN/ AIR:

In the dormant condition the seeds respiratory rate is very low and so oxygen is required in very small quantities. But for germination, oxygen is needed in large quantities. The seeds obtain oxygen that is dissolved in water and from the air contained in the soil. If soil conditions are too wet, an anaerobic condition persists, and seeds may not be able to germinate

3. TEMPERATURE:

Germination can take place over a wide range of temperature and is specific to individual crop types, and can be specific to varieties. The optimum for most crops is between 65-75°F, but exceptions do apply. For example lettuce germinates best at 65°F and can be inhibited at temperatures over 68°F while peppers and eggplants prefer warmer temperatures around 80°F and will not germinate well at cooler temperatures. If your soil is too cold or too hot, your seeds may not sprout. Check your seed packet to find the best temperature needed for your seeds.

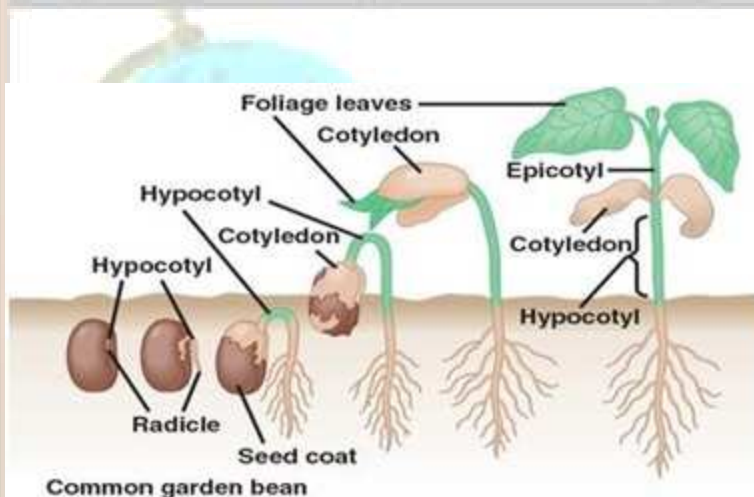
4. LIGHT:

Light has varied effects on germinating seeds of different plants. Some seeds need light for germination, while in some seeds germination is hindered by light. Most wild species of flowers and herbs prefer darkness for germination and should be planted deep in the soil while most modern vegetable crops prefer light or are not affected by it, and are planted shallowly to allow small amounts of light to filter through the soil.

TYPES OF GERMINATION

1. EPIGEAL GERMINATION

- In epigeal germination the hypocotyl elongates first, plumule and cotyledons are brought above the soil surface.
- Seeds showing epigeal germination generally have small cotyledons, which once exposed to light develop chlorophyll and start to photosynthesis e.g. beans and sunflower.



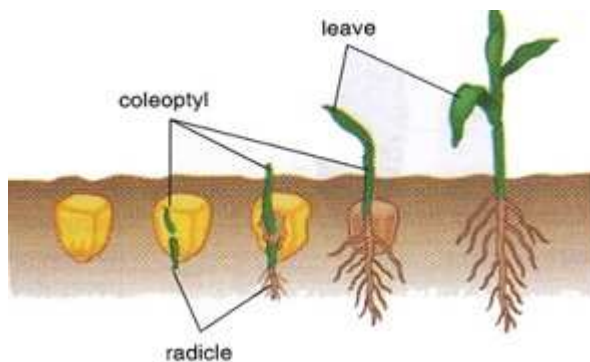
epigeal germination diagram

2. HYPOGEAL GERMINATION

In hypogeal germination the epicotyl elongates first and plumule is pushed upwards out of the ground.

- These seeds have large food reserved in their cotyledons
- Example of the seeds are maize and wheat

hypogeal germination diagram



NOTE:

Germination occurs only in a seed which is **viable** (whose embryo is alive)

MERISTEMS

- Meristems are regions in plants where growth and development takes place.
- Main meristems are located at the tip of shoot and at the tip of roots.
- Active cell division and cell elongation takes place in meristems.
- The growing region of the radicle and hence the root has three main regions, including regions of cell division, elongation and differentiation.

Types of Meristems

1. Apical meristems
2. Lateral meristems

- **Apical meristems** bring about an increase in length and height of roots and shoots.
- **Lateral meristems** give rise to branches of shoot. Lateral meristems bring about the increase in growth of the shoots and roots.

SEED DORMANCY

Seed dormancy is an inhibition of growth of an organism or part of it.

Some viable seeds will not germinate even when supplied with proper amounts of heat, water and oxygen. This is the period of reduced activity during which growth does not occur.

Factors which bring about seed dormancy

- Nature of the testa
- Presence of certain chemicals
- After ripening
- Food and water
- Climate
- Embryo may not be full develop
- Lack of moisture and oxygen

1. NATURE OF THE TESTA

Some seeds the testa may be impermeable to oxygen and water. In such seeds time is required before the testa becomes permeable. The testa may also be hard – preventing the radicle and plumule from emerging.

2, Presence of certain chemicals

Certain chemicals present in either the seed or fruit are known to prevent seed germination. These chemicals are removed by **leaching**.

3. AFTER – RIPENING

Some seeds will not germinate immediately after harvest. It has been found out that at that time embryos are not fully developed. Such seeds have to go to be stored for some time so that the embryo develop fully. The period is called **after-ripening**.

WAYS OF BREAKING SEED DORMANCY

- Provide water
- Provide air
- Provide suitable temperature
- Ensure seed embryo is mature

IMPORTANCE OF SEED DORMANCY.

- Seed dormancy has a survival value to plants seeds can survive for a long period especially in adverse environmental conditions such as drought, extreme temperature and shortage of food.
- If all seeds germinate at the same time in such conditions all seedling would perish.

- Seed dormancy helps an organism to with stand unfavourable conditions such as cold and drought shortage of water etc

It allows time for dispersal of seeds by agents such as water and wind

Seed viability

The seed which retains its capability to germinate are known as viable and the ability is known as viability

FACTORS AFFECT THE VIABILITY OF SEEDS

1. Seed maturity.
2. Environmental condition.
3. Nature of a testa
4. Availability of moisture.
5. Temperature.
6. Light intensity.
7. Storage condition.

GROWTH REGIONS OF A SEEDLING

- The growth of the radical and the plumule causes the elongation of the seedling. The rate of the growth can be measured at the tip of the root and shoot cells at the root and shoot tips have high capacity to divide.
- The dividing cells are known as meristematic cells, these cells make a tissue known as apical meristem. These cells rapidly undergo mitosis to provide growth which increases in size of the shoot and root.
- Growth in the tip of the root and shoot is known as **primary growth**.
- Widening of the plant to form the trunk and hard wood is called **secondary growth**.

NOTE: Meristems are regions of the plant in which plant cells divide.

GENETICS AND VARIATION -1

Genetics is a branch of science which deals with the study of inheritance and variation.

Definition of terms

1. Heredity

Is a passing of features from parents to their young.

2. Variation

Possessing of characteristics which are different from these of the parents and other offsprings.

3. Genotype

Is the genetic constitution or make up of an organism

4. Phenotype

Is the outward or physical appearance of an organism

5. Dominant gene

Is a gene that prevents the expression of another gene.

6. Recessive gene

Is a gene that is masked by another gene.

7. Homozygous

Is a condition where by the two genes for a given trait are similar/ alike

8. Heterogeneous

Is a condition where the two genes for a trait are different.

9. Gene

Is a part of chromosome that carries the genetic material called DNA. Are also referred to as nucleotide chemical units of inheritance arranged along the chromosomes. They are called hereditary factors.

10. Trait

Are characteristics inherited by individual from their parents

11. Allele

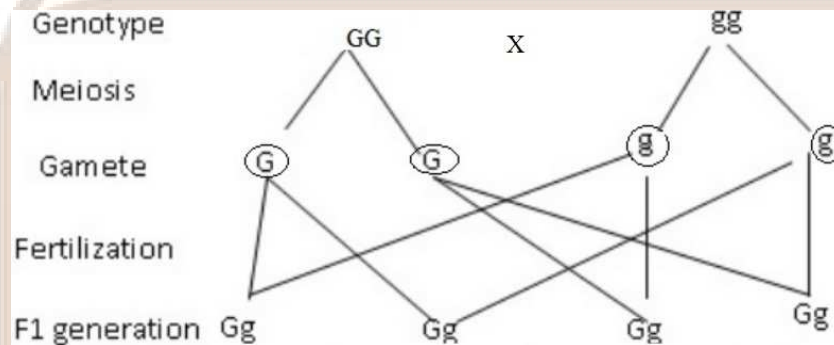
Is an alternative form of a gene controlling the same characteristics but produce different effect

Example: T-tallness and t- shortness

12. MONOHYBRID CROSS

Are offspring produced by crossing two individual with different character

e.g. homozygous green podded plant (GG) and homozygous yellow podded plant (gg)



13. FIRST FILLIAL GENERATION (F₁)

Is the first generation of offsprings produced after crossing the parental genotypes.

14. SECOND FILLIAL GENERATION (F₂)

Are offsprings produced by selfing the F₁ generation

15. MONOHYBRID INHERITANCE

This is inheritance of one pair of contrasting (different characteristics e.g height where an individual is either tall or short).

16. DIHYBRID INHERITANCE

This is inheritance of two pairs of characteristics

Example: - pure tall pea plant with colours flowers and dwarf pea plant prossesing white flowers.

17. EPISTASIS

It is the interaction between the two different known as allelic dominant genes

18. PEDIGREE

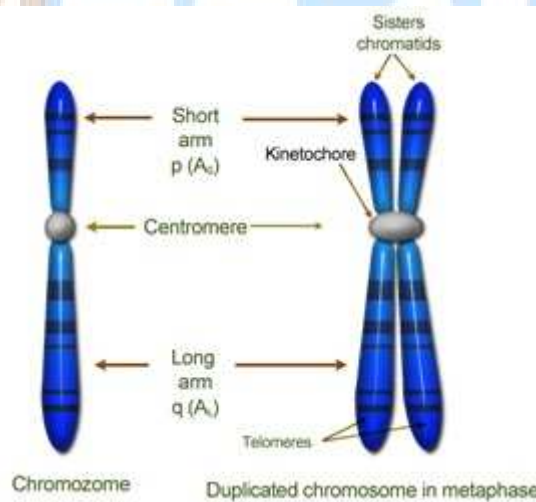
Is the historical or ancestral record of individuals shown in a chart ,table or diagram

19. CHROMOSOMES

They are thread like structures found in the nucleus of the cell they are only visible when a cell nucleus is about to divide. Every nucleus of the cell of the same species has a constant number of chromosomes e.g.

Drosophila has 8 chromosomes, fruit fly pea plant has 40 chromosomes sheep has 56 wheat has 14 chromosomes maize has 20 chromosomes.

Each member of the chromosome pair is known as homologous chromosome



Types of chromosomes

There are two types of chromosomes in the human body

1. Autosomes
2. Heterosomes

Autosomes

These are also known as autosomal chromosomes. They carry all genetic information except that of sex. In humans autosomes are 44 in numbers forming 22 pairs

Heterosomes

These are also known as sex chromosomes these chromosomes determine the sex of the organism in humans. One pair is responsible for the determination of sex

Diploid and haploid nuclei

Diploid nucleus has the chromosomes occurring as homologous pair e.g 23 pairs in the human this is denoted as $2n$ diploid nuclei are found in the gametes

Haploid nuclei have only one set of unpaired chromosomes. In 23 chromosomes are there haploid nuclei are denoted as n diploid cells are formed after fertilization

GENETIC MATERIALS

Genes are nucleotide chemical units of inheritance arranged along the chromosome and are capable of being replicated and mutated.

Each gene occupies a specific location on a chromosome this location is known as locus (plural is loci) each chromosome contains many genes.

Homologous chromosomes when paired together will have similar or different genes called alleles.

An allele is an alternative form of gene controlling the same character but producing different effects. The gene can control color of the skin

NUCLEIC ACID

Nucleic acids are polymeric macromolecules, or large biological molecules, essential for all known forms of life. Nucleic acids, which include DNA (deoxyribonucleic acid) and RNA (ribonucleic acid), are made from monomers known as nucleotides. Each nucleotide has three components: a 5-carbon sugar, a phosphate group, and a nitrogenous base. If the sugar is deoxyribose, the polymer is DNA. If the sugar is ribose, the polymer is RNA.

Together with proteins, nucleic acids are the most important biological macromolecules; each is found in abundance in all living things, where they function in encoding, transmitting and expressing genetic information—in other words, information is conveyed through the nucleic acid sequence, or the order of nucleotides within a DNA or RNA molecule. Strings of nucleotides strung together in a specific sequence are the mechanism for storing and transmitting hereditary, or genetic, information via protein synthesis.

DNA (deoxyribo nucleic acid)

- DNA has a double stranded shape or coil twisted like a ladder to form a double helix.

- DNA is the genetic material contained in the genes.

COMPONENTS OF DNA

- Deoxyribose sugar
- Phosphate group
- Organic base or Nitrogenous bases.

Nitrogenous base

- Adenine (A)
- Guanine (G)
- Uracil (U)
- Cytosine (C)
- Thymine (T)

Functions of DNA

1. There are genetic material which are responsible for genetic characteristics
2. They assemble the amino acids to form a protein molecule

RNA (ribonucleic acid)

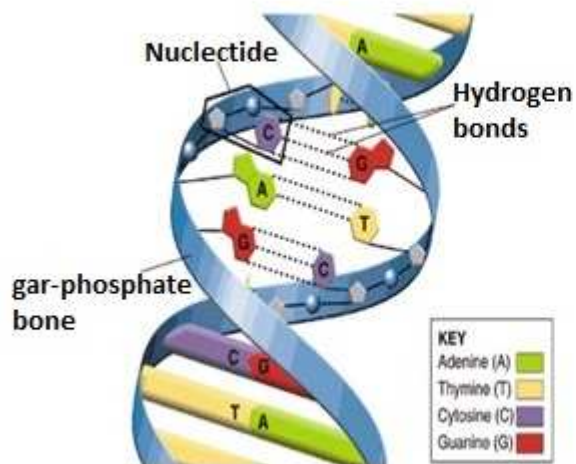
The RNA molecule is responsible for carrying genetic information from the DNA molecule to the ribosome which is the site of the protein synthesis

TYPES OF RNA

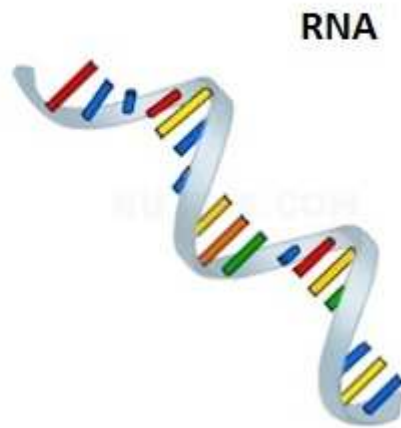
Messenger RNA – carries information from the nucleus in form of base triplets.

Transfer RNA – It transfers the appropriate amino acids to the ribosome.

STRUCTURE OF DNA



STRUCTURE OF RNA



DIFFERENCE BETWEEN DNA & RNA

DNA	RNA
Has a deoxyribose sugar	Has a ribose sugar
Has a double strand	has a single strand
Found in the nucleus, mitochondria and chloroplast	Found in nucleus and cytoplasm.
Has organic bases, cytosine, guanine adenine and thymine	Has organic bases, cytosine guanine, adenine and uracil

PRINCIPLES OF INHERITANCE.

Concept of inheritance.

Historical background of genetics

Father of genetics is Gregory Mendel

Mendel's experiment

Mendel has selected garden pea plants [pisum sativa]

Reasons for selecting pisum sativa

1. The garden pea has many contrasting and easily recognized characteristics.
2. The hybrid obtained from the cross fertilization was fertile
3. The flowers of a garden pea are bi sexual and naturally self pollinated
4. The garden pea plant matures relatively fast producing many off springs (seeds)

MENDELIAN INHERITANCE.

1. LAW OF SEGREGATION

It states that “characteristics of an organism are controlled by internal factors (genes) occurring in a pair is carried in each gamete”

2. LAW OF INDEPENDENT ASSORTMENT

“ Each of the 2 alleles of one gene may combine randomly with either of the alleles of another gene independently”

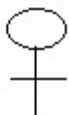
PUNNET SQUARE

- Is a chart showing the possible combination of factors among the offspring of a cross.
- It is used to show the formation of zygotes.

Female gametes are placed on the right while male gametes are placed on the left side.



Male



Female

Example:

A cross between homozygous tall (TT) and homozygous dwarf (tt) plant can be illustrated as follows:

Let assume tall is male and dwarf is female

$\begin{array}{c} \text{♂} \backslash \text{♀} \\ \text{ } \end{array}$	t	t
T T	Tt Tt	Tt Tt

Test cross

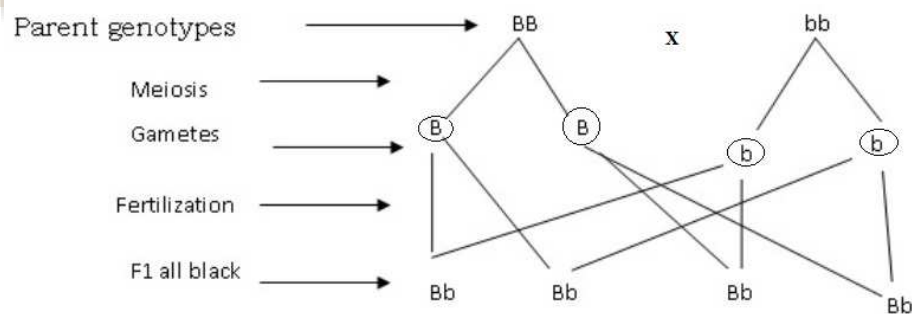
A cross used to cross an individual of unknown genotype with a homozygous recessive individual

Example:- A homozygous dominant individual (TT) will phenotypically appear the same.

BACK CROSS

In the crossing of individual of unknown genotype with the homozygous parent.

This is another form of test cross, but the difference is that in test cross, it is crossed with any individual while in back cross with a parent.g: if the individual is homozygous (bb)



DOMINANCE

Dominance is a state of one character /gene from one parent masking the corresponding character from another parent.

Types of dominance

1. Mendelian inheritance - Complete dominance
2. Non-Mendelian inheritance - Incomplete dominance

- Co-dominance

1. COMPLETE DOMINANCE

- Is the dominance where by one gene masks the expression of the other gene.
- A dominant gene always masks a recessive gene when the two occur together.

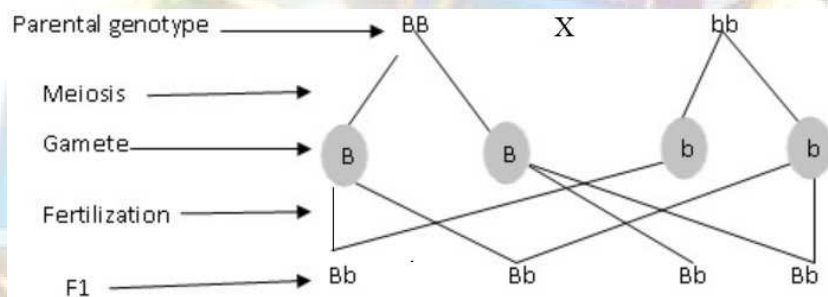
EXAMPLE:

1. A man homo zygote for brown iris marries a women who has blue iris. Show the results of F_1 . What colour would the iris of the cross between 2 members of F_1 ?

Solution: -

The gene for brown iris is completely dominant over gene for blue iris in woman.

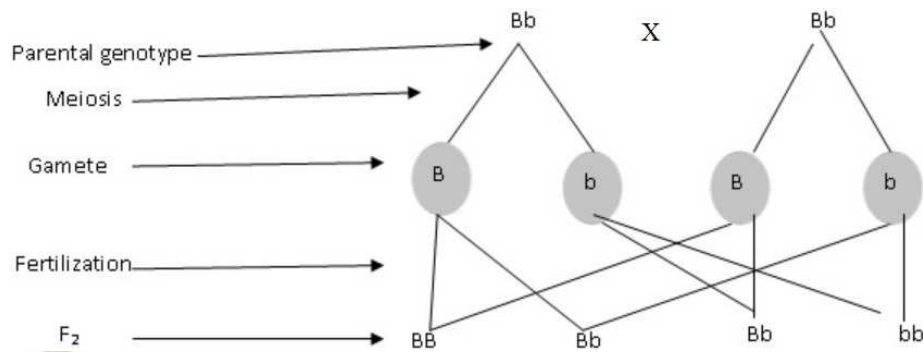
Let gene for brown be B and b for blue



Genotypes - All are Bb.

Phenotype - All have brown iris.

Selfing F_1



Genotypes - BB, Bb, bb

Phenotypes - 3 Brown iris, 1 brown iris

Genotypic ratio - $1 : 2 : 1$

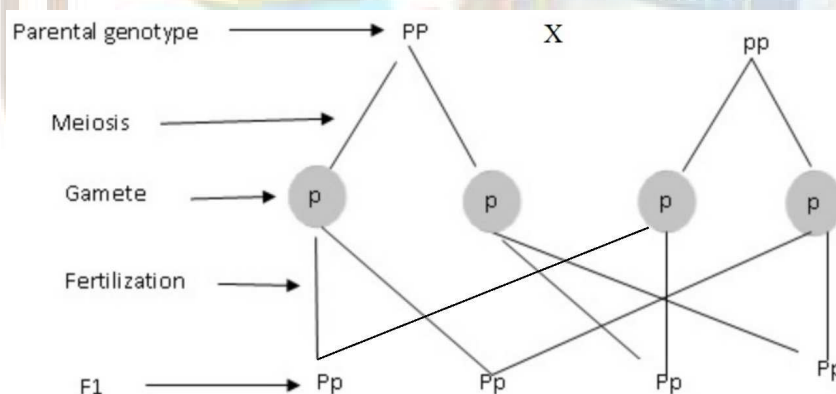
Phenotypic ratio - $3:1$

$BB Bb bb$

2. A pure purple flowered pea plant was crossed with pure white pea plant. Offsprings for F₁ were phenotypically all purple flowered plants when F₁ was selfed a mixture of purple pea flowered and white pea plant were produced at an approximate ratio of $3:1$

Solution: -

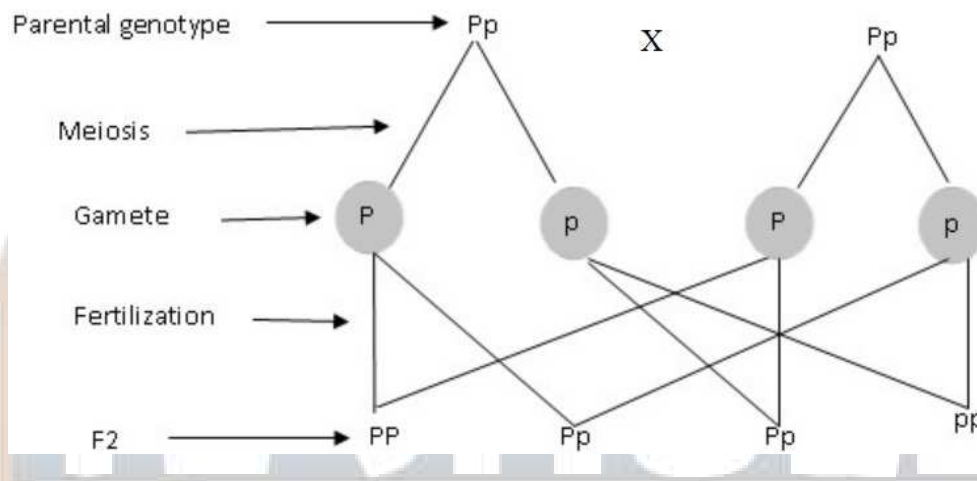
Let gene for purple be P and white be p



Genotypes : all are Pp

Phenotypes : all have purple flower

Self F_1



Genotype - PP, Pp, pp

Phenotypic ratio - $3 : 1$

Genotypic ratio - $1 : 2 : 1$

2. INCOMPLETE DOMINANCE

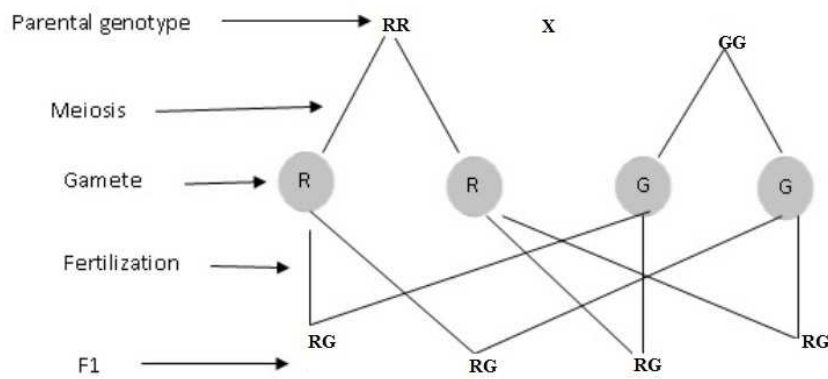
In incomplete dominance there is no dominant or recessive gene, but both express themselves equally. It results in a heterozygous individual which does not resemble any of the heterozygous individual which does not resemble any.

Example: -

1. A red flowered rose was crossed with white rose and all members of F_1 were pink. When pink were selfed, a mixture of red, pink and white flowered plants were obtained.

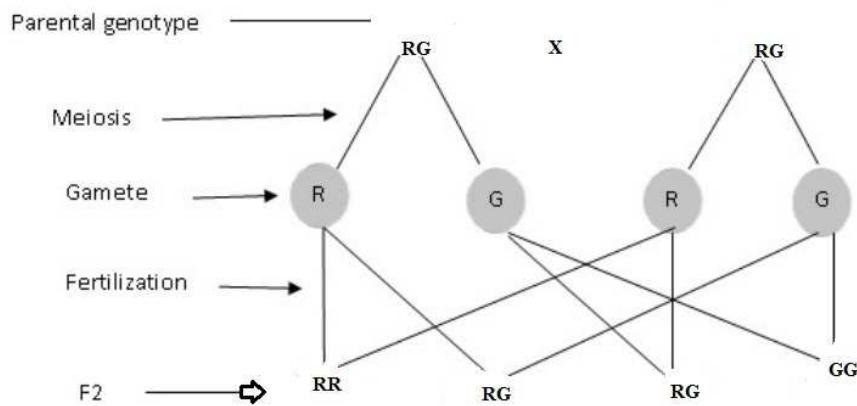
Solution:-

Let, R – Red, G – White



Genotypes : all are RG

Phenotype : all are pink



Genotypes - RR, RG, GG

Genotypic ratio - RR : RG : GG

1 : 2 : 1

Phenotypic ratio - 1 red : 2 pink : 1 green

3. CO-DOMINANCE

In co- dominance genes from both parents are dominant and are phenotypically expressed in the offspring.

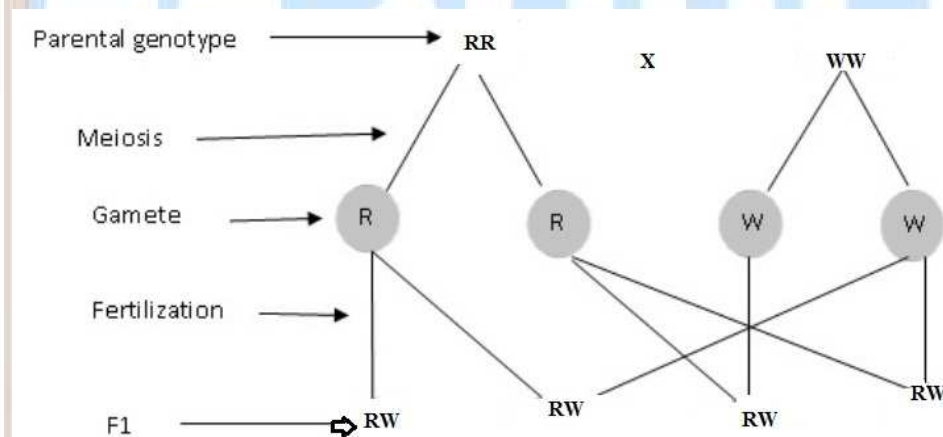
Example: A red cow is mated with white bull. In F1 generation all of offsprings have equal patches of red and white fur. Therefore neither red or white gene is dominant over the other such cattle and called *Roan*.

When a roan cow is mated with roan bull, offsprings may be red, roan or white mated in the ratio of 1 : 2 : 1

Let;

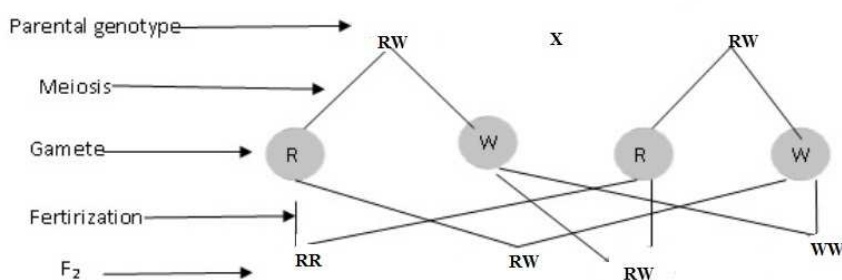
W - white bull

R – Red cow



Genotypes – all are RW

Phenotype – all are Roan



Phenotypes ratio - 1 Red : 2 Roan : 1 White

Genotypic ratio - RR : RW : WW

GENETICS AND VARIATION -2

SIMPLE MENDELIAN TRAITS

The following are example of mendelion's traits in man

1. ALBINISM

Albinism is absence of pigmentation melanin in human skin/ animals or plants. This pigmentation is responsible for dark colour of the skin. As a result the person has white hair, pink eyes and light skin. In plant are characterized by lack of chlorophyll

It is controlled by a recessive gene. Human showing this disorder must be homozygous recessive. Heterozygous are normal but carrier.

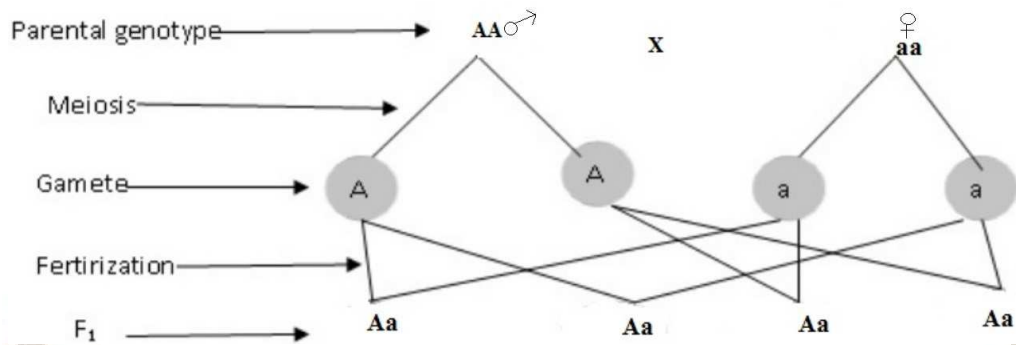


Examples

1. What will be the result of normal man who married an albino woman?

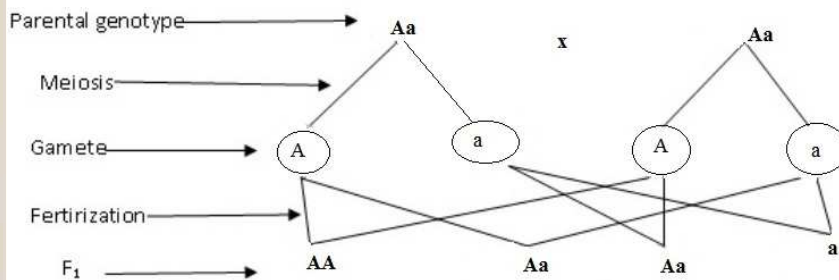
Solution: -

Let gene for normal be A and Albino be a



Phenotype - all are normal (Heterozygous)

2. What would be the result of a cross between heterozygous parents?



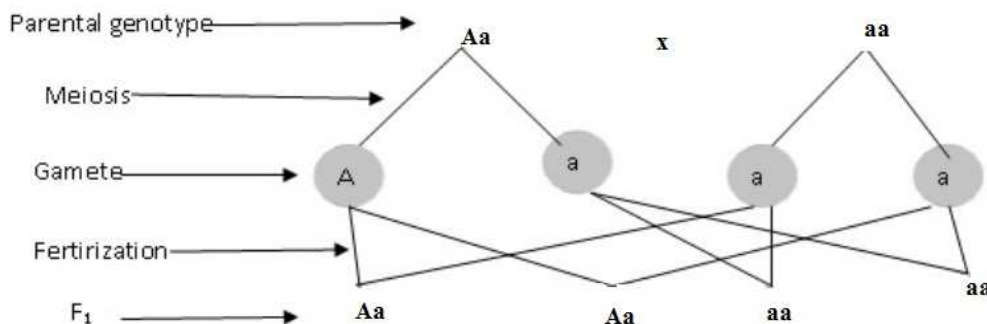
Genotype – AA , Aa and aa

Phenotype – normal man, carrier and albino

3. What would be the result of crossed between heterozygous parent with an albino parent.

Solution: -

Gene : Aa - heterozygous parent
 aa - albino parent



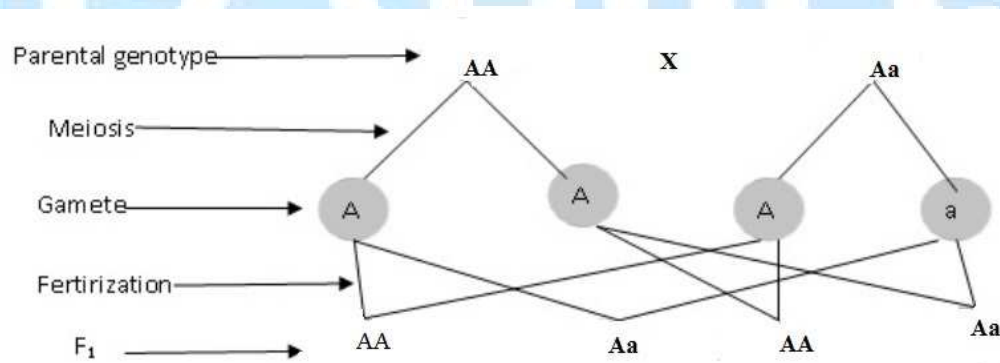
Genotypes - Aa and aa

Phenotypes - half normal/ carriers and albinos.

4. What would be the result of crossed between heterozygous parent and homozygous normal parent

Solution:-

Heterozygous Aa, homozygous AA



Genotypes - AA, Aa

Phenotypes - all are normal (normal, carriers)

2. ACHONDROPLASIA

Achondroplasia is a disorder that is characterized by a shorted body, legs and hands. It is controlled by a dominant gene. Individuals with this disorders are Homozygous dominant or Heterozygous. Homozygous recessive are perfectly normal

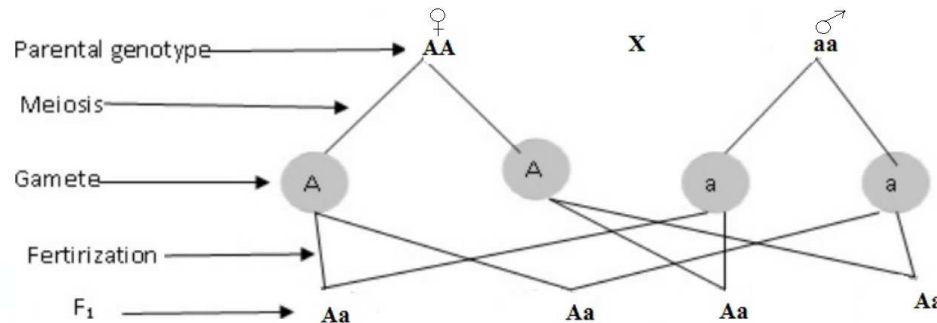
Examples: -

1. What would be the result of a normal man who married an achondroplasiawoman.

Solution: -

Genes for normal man - aa

Genes for achondroplasia women - AA

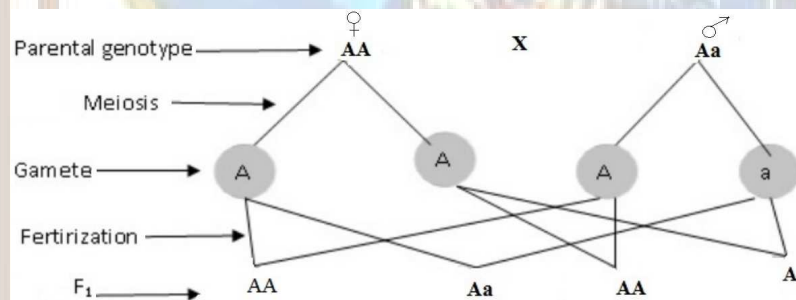


Phenotypes - All are achondroplasia

Genotypes - Aa

2. What would be the result of a cross between an achondroplasia woman who is homozygous and achondroplasia man who is heterozygous?

Solution: -

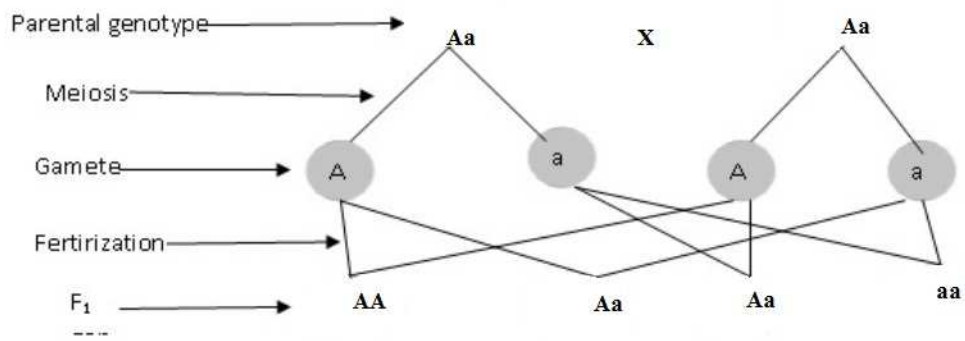


- AA, Aa

Phenotypes - All achondroplasia

3. What would be the result of a cross between heterozygous parents?

Solution: -



Phenotypes - 3 Achondroplasia, 1 Normal

Genotypes - AA , Aa , aa

Phenotypic ratio - 3:1

Genotypic ratio - 1:2:1

3. HAEMOPHILIA

Haemophilia is a hereditary trait characterized by delayed blood clotting. The result is prolonged bleeding even small injuries can lead to death. The haemophilic girl rarely live beyond puberty because of excessive menstrual bleeding. It causes high mortality rate.

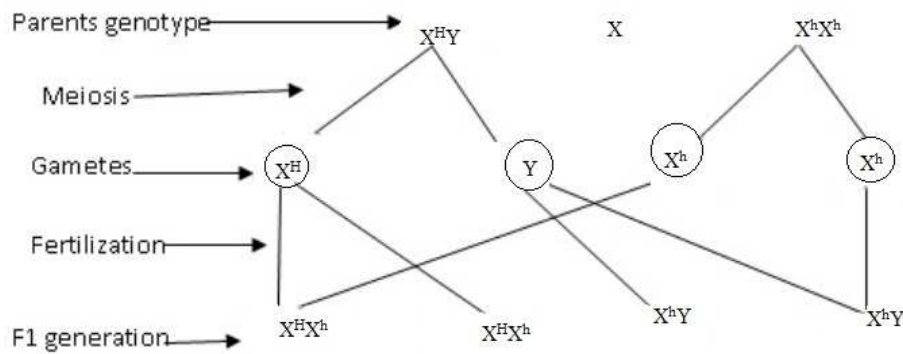
It is controlled by recessive gene. Heterozygous are normal/carriers but homozygous individuals are haemophilic.

Worked example: -

If a normal man married a haemophilic woman, the offsprings would be

Solution: -

Let genotype for the man $X^H Y$ and woman $X^h Y^h$



- A haemophilic man will be $X^h Y$
- Haemophilic female will be $X^h X^h$
- H – not suffering from haemophilic while h – haemophilic

4. COLOUR BLINDNESS

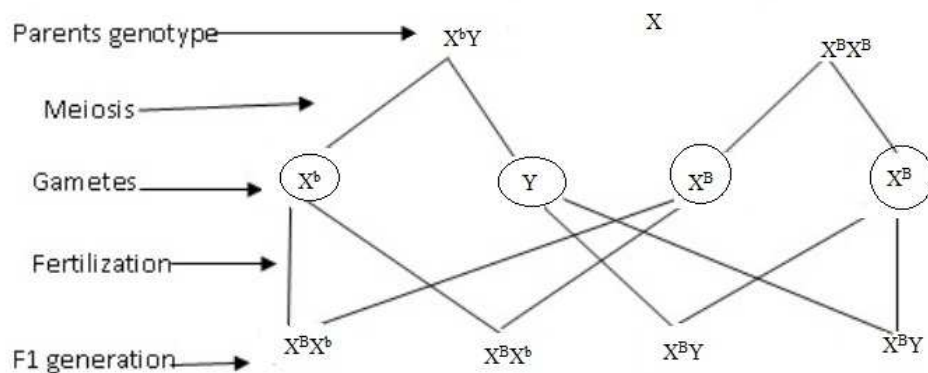
Is the hereditary trait characterized by inability to detect certain colours of the spectrum. The common colour blindness is inability to distinguish between red from green.

It is controlled by a recessive gene. Homozygous individual are colour blind while heterozygous are normal or carrier.

e.g. If a colour blindness man marries a normal woman, the offspring will be as follows.

Let B – normal

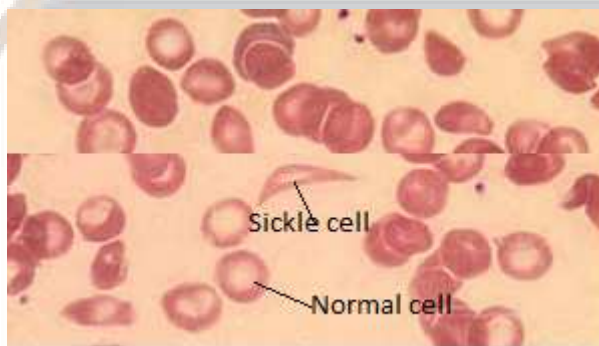
 b - Colour blind



5. SICKLE CELL DISEASE

This is a genetic disorder which makes the red blood cell acquire sickle shape under certain conditions. It may occur when the person is attacked by certain diseases. e.g. malaria. Also when oxygen tension in the atmosphere is very low. The sickled cells ability to carry oxygen is reduced

It is controlled by a Recessive gene. Homozygous individuals are sickled cell while heterozygous individuals are normal/ carriers.

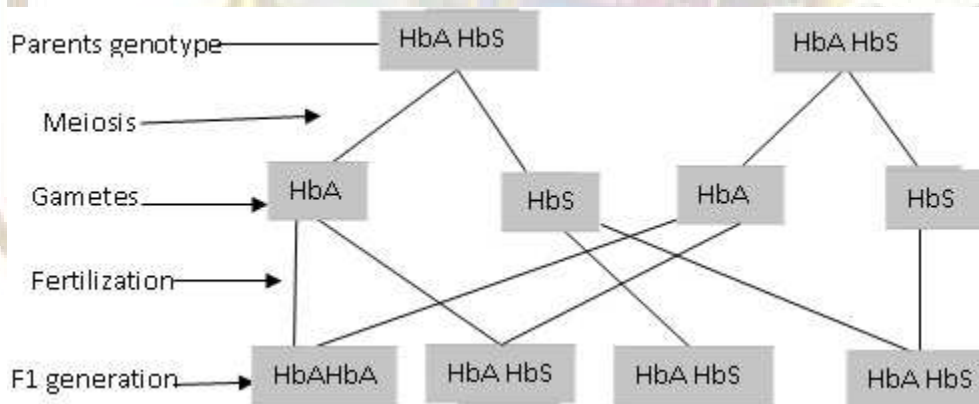


NOTE:

HbA – perfect normal

HbS - sickle cell trait

* If a carrier man marries a carrier woman the offspring will be - **sickle cell anaemia**



6. TONGUE ROLLING

This is a hereditary trait which is characterized by rolling a tongue into a U – shape. It is controlled by a dominant gene. Heterozygous and homozygous individuals are tongue rollers. Recessive are not tongue rollers.

TRAITS/ DISORDERS AND THEIR CONTROLLED GENE

	DOMINANT GENE	RECESSIVE GENE
	Achondroplasia	Haemophilia
	Tongue rolling	Colour blind
	Night blindness	Sickle cell
	Brown iris	Blue iris
	Having more than 5 fingers & toes	Normal night vision
		Albinism
		Normal number of finger and toes.

HOW TO SOLVE GENETIC PROBLEMS BY USING PUNNET SQUARE

1. In human beings normal skin pigment (melanin) is dominant over albinism. An albino male mates with a heterozygous female. If the female gives birth to 6 fraternal twins what will be the probable genotypic and phenotypic ratio of the offspring?

Solution: -

i) Let letter A - dominant gene

a - recessive gene (albinism)

- Write the genotypes of the parents

(male) aa x Aa (female)

ii) Use these genotype to complete the punnet square

Female gamets		a	a
		Aa	Aa
A	a	aa	aa

iii) Summarize the genotypic and phenotypic ratios

Genotypic ratio - Aa : aa = 1Aa: 1aa

Phenotypic ratio - ½ normal skin pigmented : albino = 1:1

2. In human beings normal skin pigment is dominant (A) over albinism (a) one couple with normal pigment mate and produce six fraternal twins. Out of 6, 4 have normal skin pigment and 2 are albino. What are the genotypes of the parents?

Solution: -

1. Write complete/partial parents genotypes and offspring

Parents A

Four normal skin offspring A

Since normal skin is dominant, each of parent and 4 children must have at least one dominant gene

2. Since albino gene is recessive, 2 albino offspring are homozygous recessive (aa)

Two albino offsprings (aa)

A - (Normal skin parent) x A - (normal skin parent)

A - (4 normal offspring) aa - (2 albino offspring)

Since one gene for albino comes from each parent. Therefore each parent is heterozygous (Aa)

RHESUS FACTOR

About 85% of the human population has a gene located on the chromosomes number one that produces a function protein called ANTIGEN & (Rhesus factor)

Individuals with rhesus factor are rhesus positive (Rh^+) and the remain 15% do not have this factor are rhesus negative (Rh^-). Rh^+ is dominant over Rh^- .

Rhesus antibody is normally absent in plasma of human blood. The Rh^- people produce this antibody if Rh^+ blood is transfused to them. These Rh^+ antigens react with rhesus antibody causing agglutination. The present or absent of Rh factor gives the blood groups the + or - signs.

The table below shows the reactions of blood types with and without Rh factor.

recipient

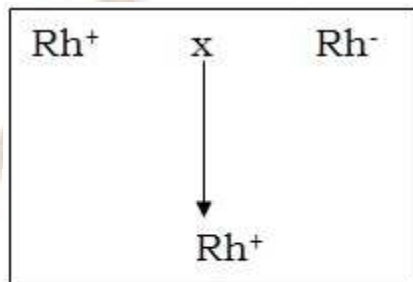
Recipient \ Donor	O-	O+	A-	A+	B-	B+	AB-	AB+
O-	✓	✗	✗	✗	✗	✗	✗	✗
O+	✓	✓	✗	✗	✗	✗	✗	✗
A-	✓	✗	✓	✗	✗	✗	✗	✗
A+	✓	✓	✓	✓	✗	✗	✗	✗
B-	✓	✗	✗	✗	✓	✗	✗	✗
B+	✓	✓	✗	✗	✓	✓	✗	✗
AB-	✓	✗	✓	✗	✓	✗	✓	✗
AB+	✓	✓	✓	✓	✓	✓	✓	✓

KEY: (✓) - No agglutination

(✗) - Agglutination

WORKED EXAMPLE

A Rh^+ man marries a woman who is Rh^- and produces 10 children, what will be the phenotypes of the children

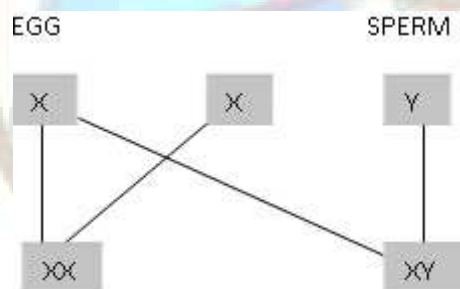


All children will be Rh^+

SEX INHERITANCE

Sex is a phenotypic character, it is dependent upon the genotype and environment. In sexually reproducing organisms, each individual is a product of a male and a female. Each individual receives an equal number of chromosome from male and female body. For example each individual receives 23 chromosomes from the mother and 23 from the father.

- In many species female chromosomes (sex) are XX and male are XY



The chromosomal mechanism of sex determination varies in different organisms

Example: -

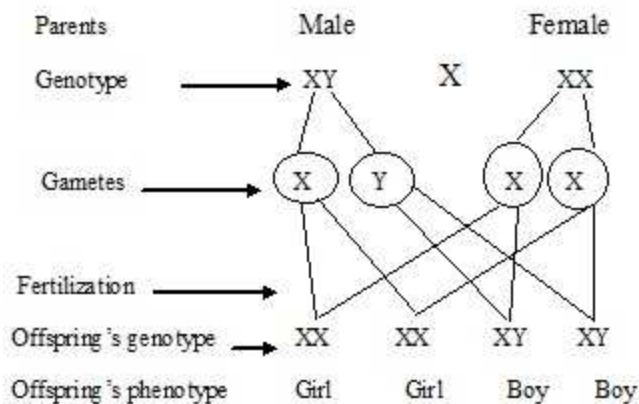
Organisms	Gametes		Zygotes	
	Ova	Sperm	Female	Males
Drosophila, Human beings, Grasshoppers, Birds, Moths, Butterflies	XX	XY	2X	XY
	XX	XO	2X	XO
	XY	XX	XY	2X

SEX DETERMINATION AND INHERITANCE

Sex of a child (man) is determined by sex chromosomes. Human being have 46 chromosomes (23 pairs of homologous chromosomes) in every body of these, 2 are sex chromosomes while 44 are referred to as autosomes. Autosomes determine physical characteristics such as height and body size. There are two types of sex chromosomes which are X and Y. These chromosomes determine the sex of a child.

- The male carries X and Y chromosomes which are different in shape and size and are said to be Heterogametic. The male genotype is XY.
- The female carries two X chromosomes which are similar in shape and size and are said to be Homogametic.
- A sperm (male gamete) has either an X or Y chromosomes while the ovum (female gamete) always contain the X chromosomes.
- Secondary sexual characteristics of females are controlled by genes on the X chromosomes.
- Male secondary sexual characteristics are controlled by genes on the Y chromosomes.
- The sex of a child is a matter of chance and depends on whether the sperm that fertilizes the ovum carries a Y or a X chromosomes. The chances of a baby being a girl or a boy are 50:50.
- Maleness depends upon the presence of Y chromosomes and Femaleness depends upon the absence of the Y chromosomes.

Sex determination in human.



The ratio of boys to girls is 1:1. This means that the probability of getting a boy or a girl is 50%.

SEX - LIMITED CHARACTERS.

These are characters that are restricted to only one sex, either males or females.

Examples of sex-limited characters;-

- i. Growth of facial hairs (Beard and Moustach) in males.

This develops as a result of production of male hormones. The gene for beards growth is also present in females but it is not expressed.

- ii. Baldness in males.

- iii. Breast development in females (lactation).

- iv. Long hairs of male lions (Male: lion, Female: lioness)

- v. Comb plumage of hens (Male: cock, Female: hen)

- vi. Hairy ears and nose is a common characteristics among males especially those of Asiatic descent.

The fact that the characteristics are only present in the males, suggests that the gene responsible for the trait is located on the Y chromosomes.

SEX - INFLUENCED CHARACTERS.

Are the characters that are expressed as dominant in one sex and recessive in the other. These are characters or traits that tend to be more conspicuous in one sex than the other. An example of sex - influenced characters is the presence or absence of horns in some breeds of sheep.

- The horned condition behaves as dominant in males but as recessive in females.

- The hornless state is dominant in the female sex but recessive in the male.

Note: The dominance difference of sex-influenced characters is mainly the result of hormonal

interaction with the genotype.

SEX PREFERENCE AND SEX SELECTION.

- Sex preference is favouring one sex (gender) and not the other.
- Sex selection means choosing the sex (gender) of the baby to have.
- Therefore, sex preference and selection result into people to like one type of sex more than other. This tendency is very common in African countries and some parts of Asia. Basically, both males and females are equal and depend on each other in many aspects of life. However, there has been a tendency of some people to prefer one type of sex over the other. Some people in families prefer having boys than girls while others prefer girls over boys.
- Those who prefer boys do so in a belief that boys will perpetuate the lineage and take care of the parents when females are living far away with their husbands.
- Those who prefer girls argue that, girls are kind and mercy, therefore they can take care of their parents at old age.

Socio - cultural factors that influence sex- preference and sex selection.

(i) Man power generation.

Some societies, especially pastoralists prefer boys over girls because boys help in animal grazing.

(ii) Generation and protection of wealth.

In some societies girls are more preferred than boys because they generate wealth upon getting married. A family will get a lot of cattle or money as a bride price.

(iii) Land ownership.

In some societies a woman can not own land, thus females prefer to have more sons than girls so that they can somehow benefit indirectly through their sons.

Conclusion;-

- Sex preference and selection have negative impact as it may result into in equality and discrimination. In many societies, sex preference and selection has led to boys being educated and given ample time to play and learn while girls stay at home and do house chores.
- Government and NGO'S have to take measures to rectify the situation.

SEX LINKAGE

Sex linked genes carried on sex chromosomes but have nothing to do with sex. Traits whose expression is governed by sex linked traits are called sex linked traits .

One kind of colour blindness is an example of sex linked trait in human beings located on the X – chromosome. Example of other linked are haemophilia (bleeder's diseases).

VARIATION

The difference that exist between living organisms is called Variation. It is the possession of characteristics which are different from the parent and other offspring.

Types of variation.

1. Continuous variation

Is the variation which show intermediate form between any two extremes i.e there is no clear cut distinction between two extremes.

Example in group length ranges from shortest to tallest with several intermediaries continuous variation arises from interaction between genes and environment.

2. Discontinuous variation

Is the variation which show clear cut distinction from one form to another form.

Example: -

In human population an individual is either a male or a female, ability to roll the tongue, albinism, blood group (A,AB,O) and rhesus factor.

Environment does not influence the characteristics that show discontinuous variation.

Example blood group can not be altered by environment.

Cause of variation

1. Environment Factors

Food – lack of food of a certain diet leads to deficiency diseases such as Kwashiorkor. Lack of enough food causes starvation. Also pathogens causes diseases in organism making the individual different from the normal ones.

2. Genetic factors

(a) Meiosis– during meiosis there is segregation of different gametes.

- This reduces the chance of pairs of chromosomes producing a wide variety of different gametes. This reduces the chance of individuals being the same.

(b) Fertilization – during fertilization the nuclei of male and female gametes fuse.

- This permits parental genes to be brought together in different combinations.
- This may lead to desirable and undesirable qualities of parents be combined in the offspring.

(c) Mutation- This is a sudden change in gene which can be inherited are caused by mutagens as x rays, cosmic rays, chemicals as mustard gas. The individual is called a mutant after undergoing mutation and appears different from the rest of the population.

3. Migration

As species are not normally informally distributed but occurs in small isolated population called demes. If members from the deme migrate and mate with members of another deme the offspring that results have characteristics that are different from those of both parents.

TYPES OF CHARACTERS

1. Acquired characters

These are traits an individual develops as a result of adaptation to the environment. **Example:** - Walking style. They are never inherited and are also know as no-heritable characteristics

2. Inherited characters

Are traits passed on from parents to the offsprings through sexual reproduction. Are also called heritable characteristics.

Difference between acquired and heritable

ACQUIRED CHARACTERISTICS	HERITABLE CHARACTERISTICS
1.Are due to the environment	1.Are due to genes
2.Can not reappear in offspring.	2.Re-appear in offsprings
3.Sometimes are changeable in life time (one way lose weight)	3.Mainly unchangeable in life time (height)

GENETIC DISORDERS.

MUTATION

Mutation are changes in the genetic material in the gametes.

- It includes appearance of new characters that have never been before in that population
- Individuals who undergone mutation are called **Mutants**
- Mutation can be due to
 1. Change in a gene itself
 2. Change in arrangement of genes
 3. Loss of chromosomes (due to unbalanced meiosis)
- Mutation can be caused by agents known as **Mutagens**
 - X-rays
 - Cosmic rays
 - Heavy metal (lead & mercury)

TYPES OF MUTATION

1. Gene mutation
2. Chromosomal mutation

1. GENE MUTATION

Gene mutation occur as a result of altering the chemical structure of genes

- There is a change in the sequence of nucleotides in the segments of DNA corresponding to one gene. This in turn alters the sequence of amino acids required in synthesis of a particular protein.
- The protein formed will be different from the normal ones and produce a profound effects on both the structure and development of an organism Example: sickle cell, dwarfism.

TYPES OF GENE MUTATION

1. Substitution
2. Insertion
3. Deletion
4. Inversion

i. SUBSTITUTION

This is the replacement of one or more portions of a gene with a new one. E.g. A thymine (T) on ATA on the DNA molecule is replaced by cytosine (C) and result to ACA on the DNA

This is exemplified in sickle cell anaemia only one nucleotide is changed. This kind of mutation involving the change of one nucleotide is called Point Mutation.

ii. INSERTION

This involves adding a new portion of a gene to an existing one. Example: If the base Guanine (G) is inserted between two Adenine result into AGA which does not code for any amino acid.

iii. DELETION

Deletion is the remove of a portion of a gene Example: -If base Guanine (G) is deleted in a base triplet CGC resulting into alteration of base sequence reducing the number of amino acids.

iv. INVERSION

A portion of DNA strand cuts and rotates through 180° the inversion results in alteration of the base sequence at this part.

Example: -A base triplet CTA can have its base thymine (T) and Adenine (A) cut and rotated. The result is CAT which is different from amino acid.

2..CHROMOSOMES MUTATION

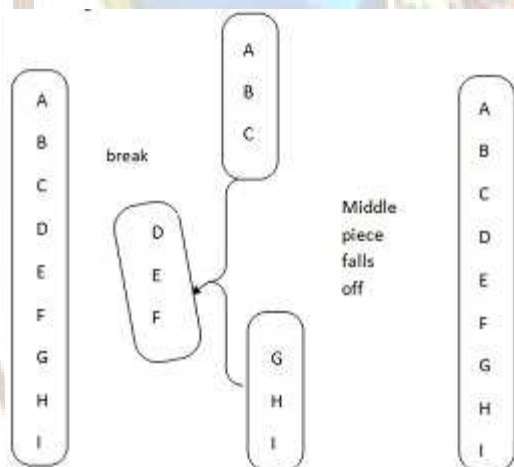
Chromosomes mutation involves changes in the structure of the chromosomes. During meiosis homologous chromosomes interwine at several points called chiasmata and create opportunity for various changes on the chromatids leading to mutation.

TYPES OF CHROMOSOME MUTATION

1. Deletion
2. Duplication
3. Inversion
4. Trans location
5. Non-disjunction
6. Polypoidy

1. **DELETION** :This occurs when a portion of the chromosome breaks off and fails to reconnect to any of the chromatids, The result is the loss of genetic materials.

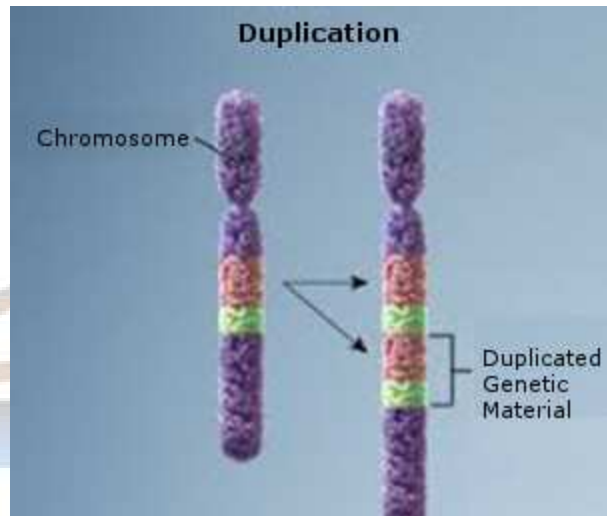
Deletion can be caused by error in chromosomal crossover during meiosis. These causes serious genetic deceases



2. DUPLICATION

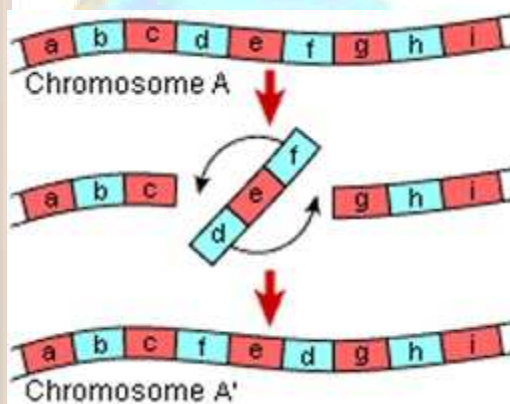
This occurs when a portion of the chromosome replicates itself adding extra length. The result is addition of a set of genes which is a duplication

This may result to over emphasizing of a trait in an organism.



3. INVERSION

This occurs when a middle piece of the chromosomes break and rotates at 180° and rejoins the chromatid. This has the effect of reversing the gene sequence.



4. TRANS LOCATION

This occurs when a portion of one chromosome breaks off and becomes attached to another chromatid of non-homologous pair. The result is transfer of genes from one pair of homologous chromosome to another.

Original Chromosomes



Translocation



5. NON-DISJUNCTION

This kind of chromosomal mutation is caused by addition or loss of one or more chromosomes. This occurs during meiosis where homologous chromosomes fail to separate. This results in some gametes having more chromosomes than others.

Example of non – disjunction

(a) DOWN'S SYNDROME

This is caused by presence of an extra chromosome number 21 individuals with this defect have a total of 47 chromosomes they have

- Resistance to infection
- Mentally retarded
- Have thick tongue
- Short body

Also children of old parents (above 40 years woman and 55 man) have increased chance of Down's syndrome.

(b) KLINEFELTER'S SYNDROME

This is caused by failure of X chromosome to separate during the process of egg formation. An individual with this condition has two X chromosome and one Y chromosome (XXY). They are – outwardly male but may also have female characteristics.

(c) TURNER'S SYNDROME

This is an individual with 45 (44 + x 0) chromosome in a cell instead of 46 (44 + xx). Individual with this condition have one X and no Y i.e (XO) they individual is sterile and abnormally short female.

6. POLYPLOIDY

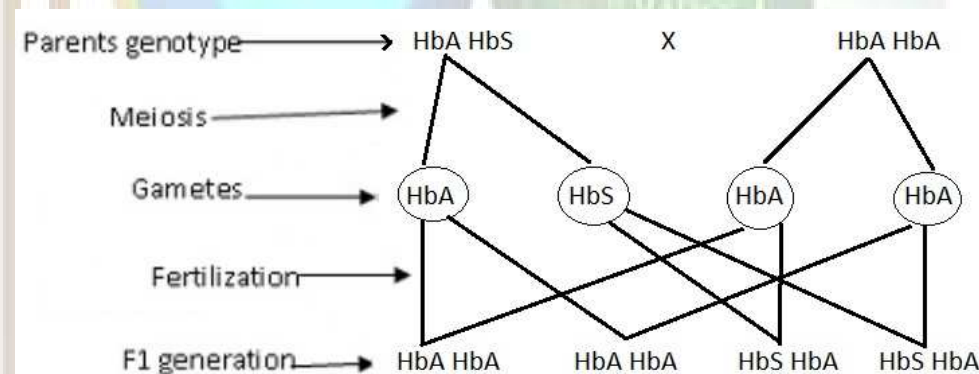
Occurs if the whole set of chromomes doubles after fertilization, where the spindle fail to be formed and the cell does not divide. It is rare in animals but common in plants

7. SICKLE CELL ANAEMIA

Sickle cell anaemia is an example of gene mutation. The normal haemoglobin is entirely replaced by an abnormal haemoglobin known as haemoglobin S

In sickle cell anaemia, the **glutamic acid** is replaced by another amino acid, the **valine** forming a haemoglobin s denoted by Hbs. Normal haemoglobin is denoted by HbA.

Haemoglobin S begins to crystallize when Oxygen concentration falls and causes red blood cell to assume the shape sickle. Half the number of red blood cell is sickle.



$\frac{1}{2}$ - perfect normal

$\frac{1}{2}$ - sickle cell trait

GENETIC COUNSELLING

Genetic information is used to advice couples who have hereditary disorders about chances of children inheriting the disorders. Genetic information could also be used in choosing marriage partners.

GENETIC ENGINEERING

This is the alteration of the structure of DNA by man.

- Genetic engineering enables man to carry out research.
 - Manufacture protein (insulin)
 - Improve animal and plant breeds
 - Correct genetic disorders
- **Genetic engineering** is the technique of changing the genotypes of an organism. It involves inserting genes from one organism into the chromosomes of another organisms. Once inserted the foreign genes work as if they were in the organism they were taken from.

APPLICATION OF GENETICS

1. MEDICINE

Genetics engineering has enabled biologists to program and make useful substance. For example the gene in man that produces insulin was inserted into escherichiacolia for producing pure insulin in large quantities.

- Human growth hormone ha also been made by using bacteria which the proper gene has been added.
- Also blood clotting factors such as fibrinogen needed by haemophiliacs are produce.
 - Vaccines from viruses are produced.

2. Biological warfare

Genetic engineering can help humans to produce biological weapons i.e. Anthrax and Vibrio cholera

3. Agriculture

- It is common for farmers to select and plant seeds from the healthiest and high yielding varies of plants with the aim of improving desirable traits as high fruits and crop production.

- Also genetics has enabled the beginning of selective breeding. Selective breeding is the crossing of animals or plants that have desirable traits to produce offspring that have a connection of the parents' desirable characteristics
- Also the knowledge of genetics developed in breeding which involves crossing relatively individuals to maintain desirable traits. The various breeds of cattle, dogs, pigeons, chicken and maize, sugarcane and goats are a result of in breeding

4.Genetic disorder

1. Pregnant women can be informed about the deformation of the fetus
2. It can help in the modification of disordered genes

Dangers of genetic engineering

1. The outcome of genetic engineering can be weird out of our imagination
2. Production of new pathogens accidentally or deliberately

CLASSIFICATION OF LIVING THINGS

KINGDOM ANIMALIA

The kingdom Animalia is large and compose of a wide variety animals, which vary greatly in structure,morphology and their body function.

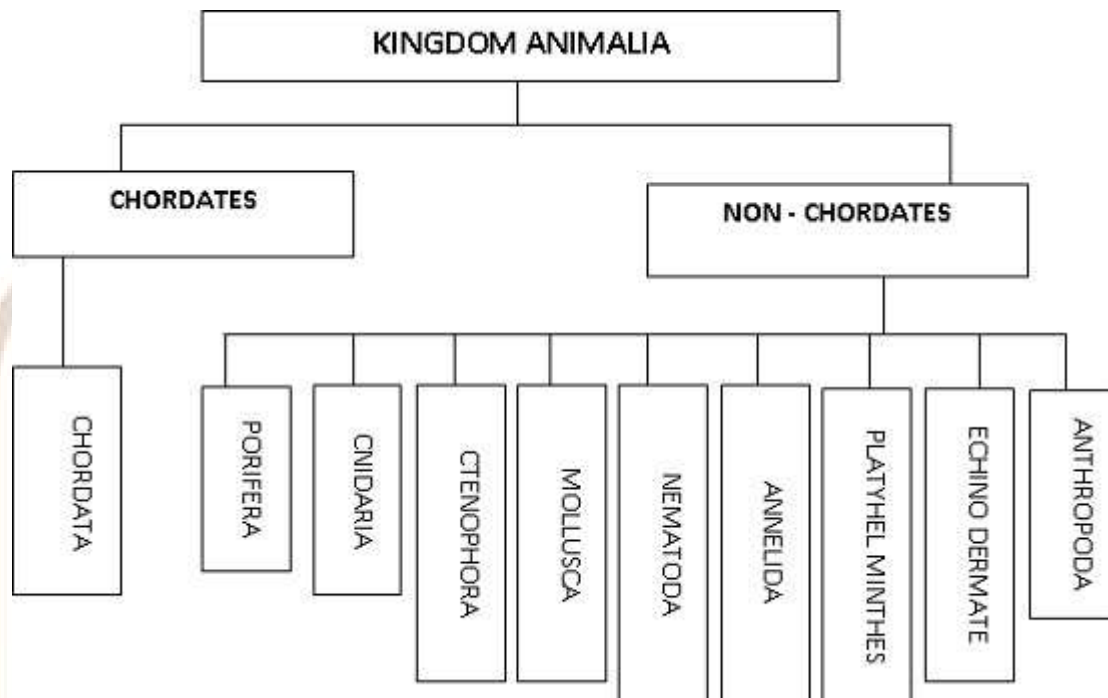
THE DISTINGUISHING CHARACTERS

- Animals are multicellular and each cell is bound by a plasma membrane.
- Animals bodies are differentiated into tissues
- Animals are heterotrophic.
- Animals are capable of locomotion.
- Animals have a nervous system

Animals can be placed into two major groups on the basis of presence or absence of a **Notochord**.

- A Notochord is a supporting rod like structure running longitudinally along the dorsal side of the animal, which may persist in life and replaced by a backbone.
 - **Chordates** are animals with a notochord
 - **Non-chordates** are animals which lack a notochord.

Chordates have only two phylum known as chordata and non-chordata comprises of many distinct **phyla**.



1. **PHYLUM PLATYHELMINTHES**

They are also called flat worms

They phylum is divided into three classes

1. Trematoda
2. Cestoda
3. Tubellaria

The distinguishing character is that their bodies are dorso vertically flattened

(a) **TREMATODA (FLUKES)**

- They are all parasitic
- Some live in the blood stream, ducts or gills or skin of fish.
- Members of this class are flat
- They have suckers at the anterior end

NB:Parasites are organisms which depend on other organisms for food and other basic need

Basic needs



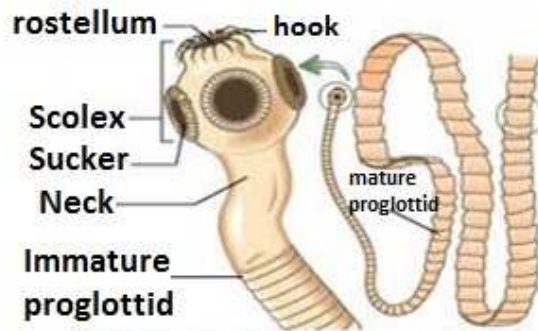
Tape worm



Liver fluke

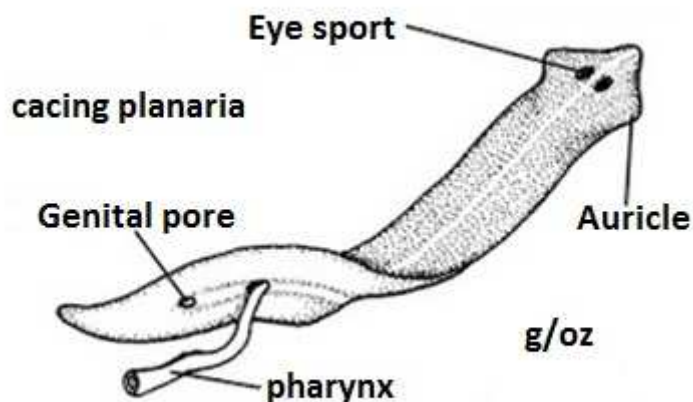
(b) CESTODA (tape worm)

- They are flat
 - Their bodies are segmented
 - They are all parasitic
 - Certain species have suckers and hooks (e.g. pork tapeworm)
- The adult tape worm lives in humans where it attaches itself to the intestinal wall with hooks and suckers it absorb the host's partly digested food through its skin.
 - The tapeworm can cause symptoms of malnutrition or anaemia, also pain due to irritation on the intestinal wall.
 - Infestation can be avoided by having all meat inspected for the presence of bladderworms and always be sure to cook thoroughly.
 - Proper sanitary condition will ensure that cattle or pigs do not ingest tapeworm egg with human faeces.



(c) TUBELLARIA

- They are flat
- They have cilia on the ventral side of the body
- Some of them are parasitic
- Some of them are free living (e.g. planaria)



2. PHYLUM NEMATODA (round worms)

Nematodes are usually found in populations of very large numbers. (usually in soil- dwellings).
Nematodes are circular in cross section and have very few cell.

- Unsegmented cylindrical body with pointed ends.
- Cuticle of protein

- No cilia or flagella
- Some are free living and some are parasitic.

Ascariasis is infection of the small intestine with the giant roundworm. *Ascaris lumbricoides* whose eggs pass out in the faeces and transmitted by eating food contaminated with these eggs. Ascariasis rarely causes symptoms and often goes untreated.

Threadworms are very small roundworms that infest the intestine often in huge numbers. The female emerges from the anus to lay eggs on the skin causing irritation itching, and these eggs are easily transferred to the transmission is by direct contact between contaminated hands and mouth or by eating contaminated food.

Filariasis including Elephantiasis is common in mosquito infested regions. Elephantiasis is caused by filarial worm.

Wuchereria bancrofti which infests the lymph vessels and skin tissues. The microscopic young worms are transmitted by mosquitoes. The worms caused inflammation of the affected parts, usually legs.

Ancylostomiasis is infestation by the Hookworms, *ancylostoma duodenal* which are small worms entering through the skin travel to the lungs then to the intestine where they attach to the wall with a ring of hooks. The eggs pass out in faeces. Hookworms cause diarrhoea, stomach pain and anaemia.

NB: Most roundworm infestations can be treated with drugs which kill the worms. They can be controlled by improved sanitation.



3. PHYLUM ANNELIDA

1. This phylum includes all “true worms”

The most common species is the earth worm; marine worms example are clam worms, sea mouse, and tubeworm; fresh water example are leech.

General and distinctive features

- Internal organs and body wall are segmented.
- A thin moist non-chitinous cuticle.
- The presence of **chaetae** (bristles)

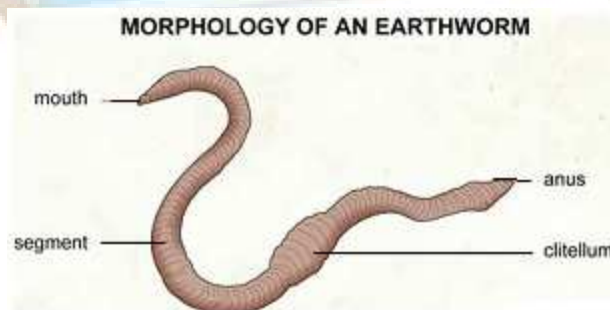
The earthworm has a long cylindrical body pointed at one end. The anterior end has a mouth and the posterior end has anus. The earth worms has no eyes and spends its life in burrows underground.

However, its anterior part is very sensitive to light which it always moves away from.

- The soft moist skin is protected by cuticle and layer of mucus.
- Each segment has 4 pairs of chaetae (excluding 1st and 2nd segment)
 - **Clitellum** is the part of the body which contains eggs

IMPORTANCE OF EARTHWORMS IN SOIL FERTILITY

- Their burrowing breaks up the soil and allows plant roots to grow more easily.
- Their burrowing aerates the soil, providing essential oxygen for respiration of plant roots.
- Their burrows help rainwater to drain through the soil more easily and prevent water logging.
- They drag leaves and other plant parts into the soil when they feed which adds humus content of the soil.



4. PHYLUM ARTHROPODA

Phylum arthropoda consists of grasshopper, spider and crab.

The distinguishing characteristics of the phylum

- Have jointed appendages
- An exoskeleton made of chitin.

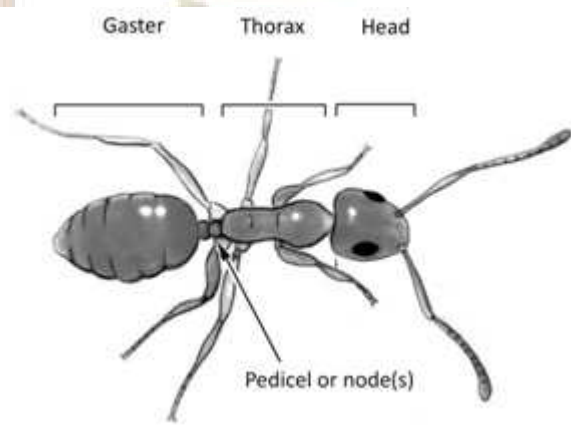
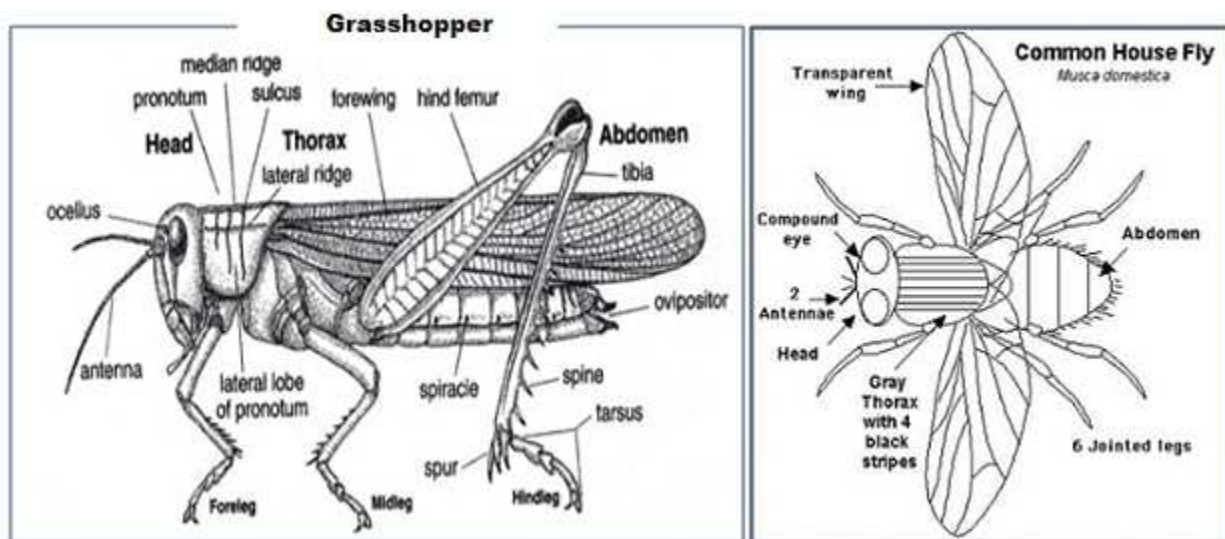
It has 5 classes which are

1. Insecta (grasshopper)
2. Crustacea (Crab)
3. Arachnida (spider)
4. Diplopoda (millipede)
5. Chilopoda (centipede)

1. CLASS INSECTA

Distinguishing characteristics of insects.

1. Body is divided into three regions; head, thorax and abdomen
2. Have one pair of antennae
3. Have three pairs of joint legs
4. Most adults forms have wings



Members of this class differ in a number of ways.

- Some have wings (grasshopper) others do not (termite workers)
- Some are large (beetle) others are small (mosquitoes)
- Some are free living in water as water scorpion, in land are cockroach, housefly, grasshopper)
- Some are parasites
- If wings are present may be one pair (housefly) or two pairs (grasshoppers). Insects with 2 pairs of wings may have a hard outer pair and soft membranous inner pair (e.g in beetles)
- Insects that feed on pollen and nectar are of economic importance as they pollinate plants
- Soil dwelling insects feed on dead plants material and are useful as they speed up the process of decay.
- Other insects are dangerous to humans, some carry diseases

e.g mosquitoes (transmits malaria, yellow fever and certain forms of filariasis) and tsetse fly (transmits sleeping sickness)

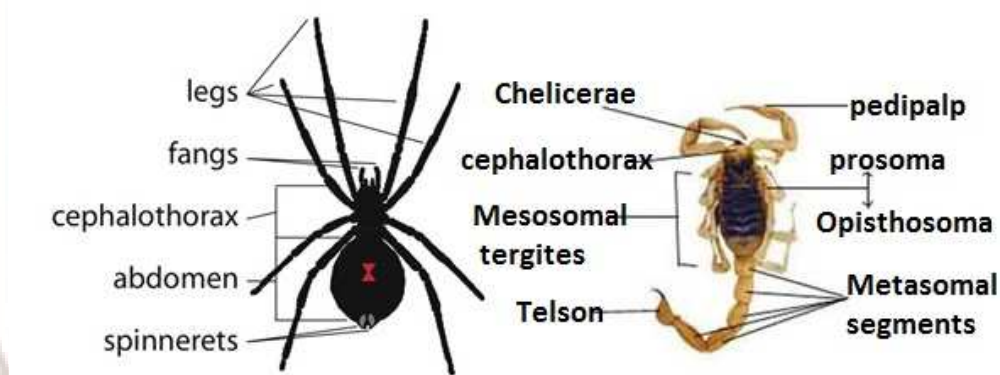
- Some effects termed as pests feed on plant tissues and stored crops.
- Termites feed on living plants and dead woods, they destroy timber and attack furniture, books, boxes and other materials made from wood. (e.g cockroach, termite, beetle)
- Housefly also transmit diseases by collecting germs from the faeces and rotting material and depositing them on uncovered food.

2. CLASS ARACHNIDA

Arachnids includes spiders, scorpions, ticks and mites

Distinguishing characteristics.

- Four pairs of jointed legs
- Head and thorax fuse to form a cephalothorax and abdomen.
- One pair of chelicera (most anterior pair of appendages)



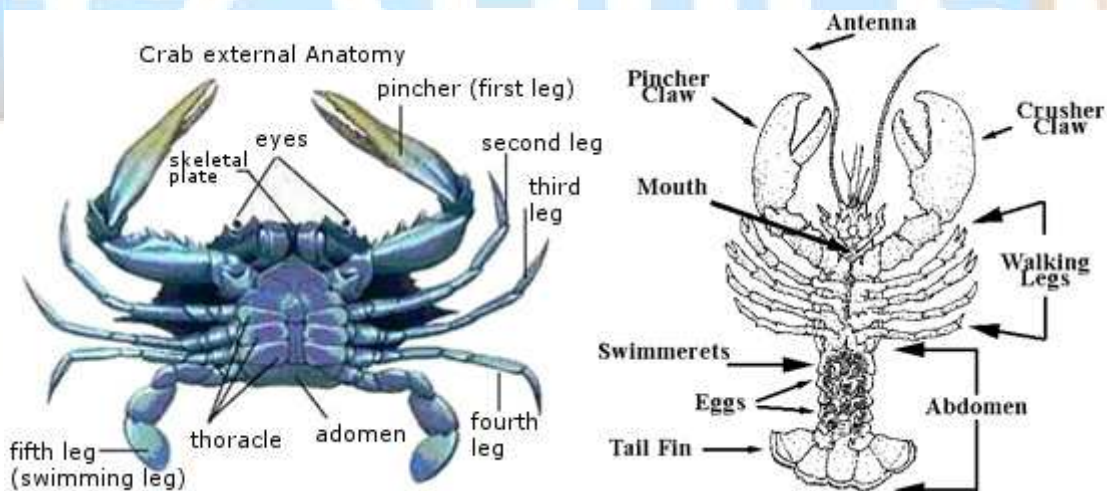
- The arachnids vary in body form and habitat.
- In some arachnids as scorpions the abdomen narrows posteriorly. Some are aquatic while others are terrestrial.

Economic importance of spiders is that they feed on pest insects. However some are poisonous.

3. CLASS CRUSTACEA

Distinguishing characteristics

1. Two pairs of antennae
 2. Bi – forked appendages
- Members of class crustacea vary in habit and body form some are marine (crab, Prawns, Lobsters) others are fresh water or in most places on land.
 - Some have a hard body covering at the anterior end.
 - Aquatic crustaceans may have telson at the posterior end which helps in swimming movement.
 - Prawns, shrimps, crabs and lobsters are important to humans as food.



CLASS CHILOPODA AND DIPLOPODA

These are two similar classes of phylum arthropoda

Distinguishing features

Have long body consisting of many segments.

4. **CHILOPODA** :It consists of centipedes

- The body of centipedes is flattened dorsoventrally.
- They have one pair of legs on each segment
- Are carnivorous feeders

5. DIPLOPODA: It consist of millipedes

- The body is rounded
- Have two pairs of legs on each segment
- Are herbivores feeders.
 - Millipedes can be dangerous / detrimental in that they feed on roots and other parts of the growing crops

NB: - Both centipedes and millipedes are soil dwelling animals



Centripede



Millipede

5. PHYLUM CHORDATA

The distinguishing characteristic

- They have a notocord in the embryonic stage. In most of chordates it is replaced by a vertebral column.
- The nerve cord is hollow and placed dorsally to the gut.
- They have gill slits at least during the embryonic stages.
- They have a tail which is behind the anus.

The presence or absence of gill, fins, mammary glands, seabacious glands, dry scaly skin, moist skin, tadpoles, wings, feathers, hard egg shells and beak is used in the classification of this group.

Classes of phylum chordata

1. Class chondrichthyes
2. Class Osteichthyes

3. Class Amphibia
4. Class Reptilia
5. Class aves
6. Class mamalia

1. CLASS CHONDRICHTHYES

This class include cartilaginous fish include sharks, skate and rays. Almost all are marine some are dorsoventrally flattened and others are spindle shaped.

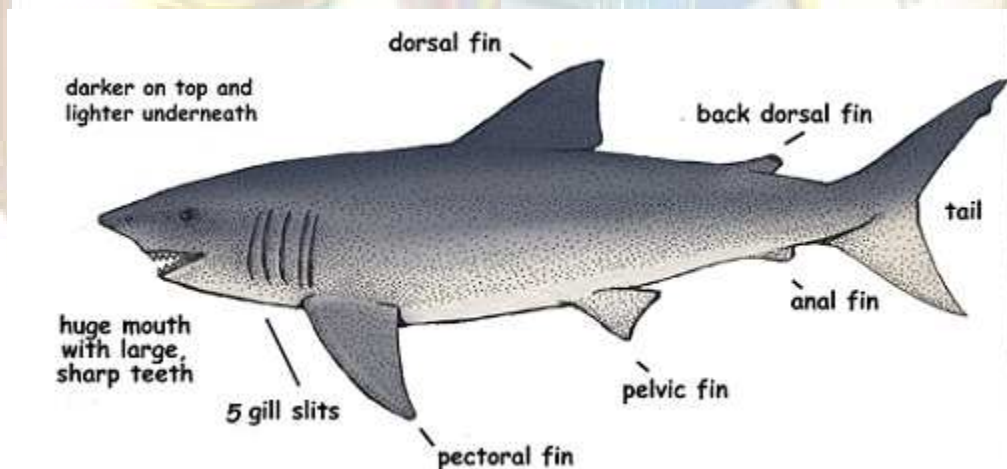
Distinguishing characteristics

1. The skeleton is made of cartilage
2. The body is covered with placoid scales
3. The caudal fin (tail) has two lobes that differ in size
4. Each pair of gills is in separate compartment
5. The gill slits are visible (there is no operculum /gill cover)
6. The mouth and two nostrils are centrally placed.
7. The body temperature varies with that of the environment i.e they are ectotherms/poikilotherms/cold blooded

Some are important source of food to humans.

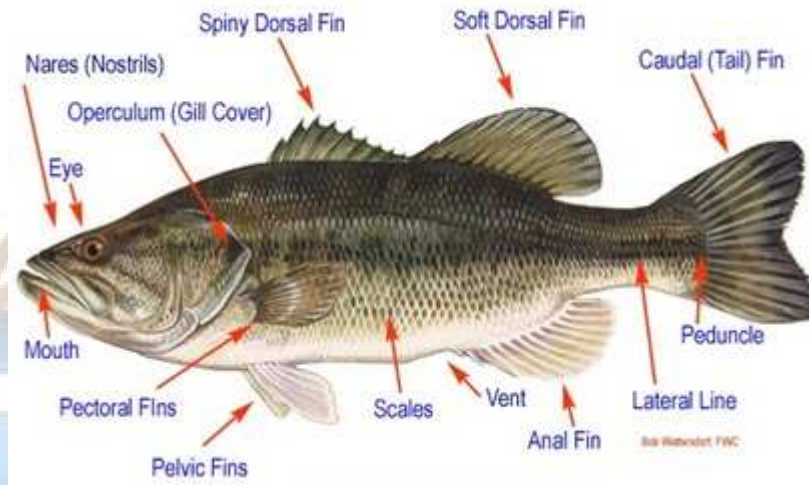
Disadvantage

1. They see us as a source of food



2. CLASS OSTEICHTHYES

1. It consist of bony fish



Distinguishing characteristics

1. Skeleton is made up of bones
2. Their Body is covered with overlapping bony scales
3. Mouth is terminally placed and nostrils found dorsal surface.
4. Gills are found in a common chamber and are covered by an operculum
5. Tail fin has lobes of some size.
6. Most have an air sac (swim blader)which aids buoyancy
7. Body temperature varies with environment. (they are ectothermic/poor kilothermic.

NB: Member of these class vary in form, size and habitat. The majority have scales while some do not. Are found both in sea water and fish water. Most have gills but a small group have lungs.

Advantage: -

1. Important source of food to humans
2. Important source of employment (fishing)
3. Fish oil are important medicinally
4. Fish meal is used as fertilizer

3. CLASS AMPHIBIA

It includes toad, frog, salamander and limbless amphibians, They have to spend part of their lives in water. Most amphibians lay eggs in water and young stages live in water. Only adults can live on land.

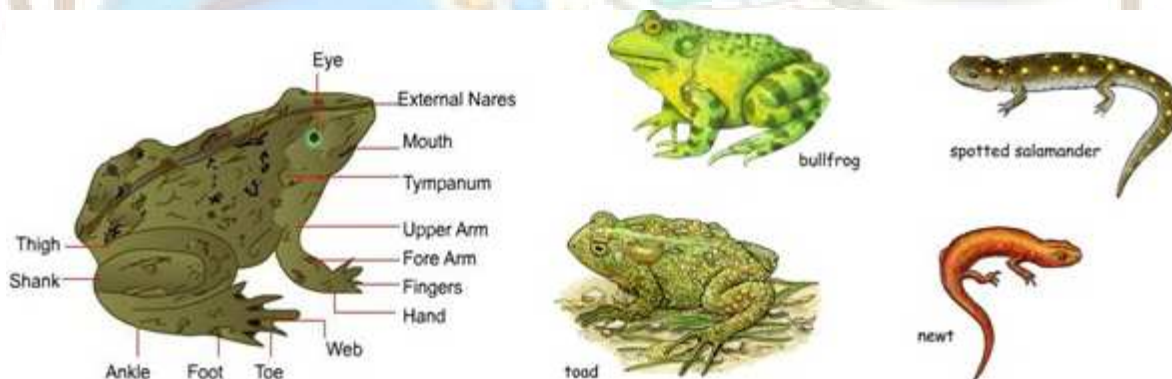
Distinguishing characteristics

1. Skin is always moist and without scales.
2. Life cycle involves larval form called **Tadpole**
3. External and internal gills are present in larval stages.
4. Have a heart with three chambers (two-atria and one ventricle).
5. Gaseous exchange is by gills in tadpoles and by lungs/ skin and mouth lining by adults.
6. Eggs are covered with a jelly like substance and laid in water.
7. Body temperature varies with that of environment (i.e. they are ectotherms/poikilothermic).

NB: -

- Amphibians vary greatly in size body form and habitat. Some are large (toads) others are small (tree frog).
- Most have limbs, few do not and look like snake or worms
- Some amphibians have webbed toes, another do not
- Amphibians are never found in salty water.

Advantage: Some feed on insects and pests which would otherwise destroy crops.



4. CLASS REPTILIA

Reptilia are thought to have evolved from Amphibians. Four main groups of reptiles are snakes, lizards, turtles and crocodiles.

Distinguishing characteristics

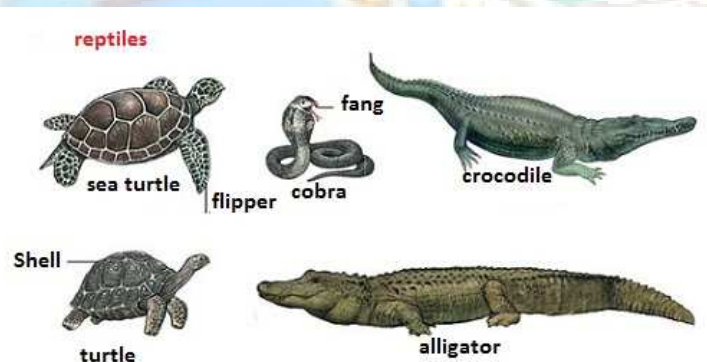
1. Have dry skin covered with horny scales
2. Have a heart divided into two atria and partially divided ventricles. But in crocodile the heart has four chambers separately.
3. Body temperature varies with that of environment (ectothermic /poikilothermic)
4. They lay eggs on land covered with soft shells

NB: -

- They vary greatly in size form and habitat.
- Some are limbless (snakes) others have limbs (Lizard and crocodile).
- Some have protective shells (tortoise and turtles).
- Some are aquatic and others are terrestrials
 - Other representatives of Reptiles are tortoise, chameleon

Disadvantages

- Some reptiles are poisonous and they attack and kill humans on occasion (snakes and crocodiles)



5. CLASS AVES

Most birds are distinguished by their ability to fly although some are flightless (e.g ostrich and penguin)

Distinguishing features/characteristics

1. Body is covered with feathers
1. The anterior of limb is modified into wings
2. The mouth is modified into a beak which varies according to feeding habits
3. They lay hard – shelled eggs
4. They maintain temperature at a constant level (homocothermic/ warm blooded)

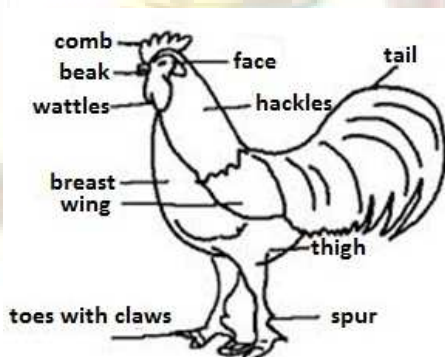
NB:-

Birds vary in size form and habitat

- Some are large (ostrich) others are small (Sunbird)
- The body is spindle- shaped and streamlined
- Most birds have hollow bones to reduce weight and aid flight
- Birds with webbed feet can swim in water (ducks)

Advantages

1. Source of food to human by eggs and meat from domestic fowl and other birds
2. Provide stuffs for cushions and pillows from feathers of fowl.



6. CLASS MAMMALIA

- It includes bat, rat, cow, mouse, man. All mammals have a highly developed brain

Distinguishing characteristics

1. Have hair or fur on all or part of their body.
2. Have mammary glands.
3. Have teeth of different types and shapes (heterodont dentition).
4. Have a diaphragm.
5. Their red blood cells have no nucleus.
6. They are viviparous (zygote develops and gets requirements internally).
7. Have sweat glands in the skin.
8. They maintain their body temperature at constant level (homeothermic/warm-blooded).

NB:

- They vary greatly in size form and habitat
- Some are very large (elephant) others are very small (mouse and rat)
- Some have wings (bats)
- Many have pinna (outer opening of the ear)
- May have either horns, hooves, claws or nails
 - The heart has four chambers
- Most live on land while others live on water

Advantages

1. Food sources (cattle, sheep, goats, rabbits)
2. Sources of materials (skin for leather, and faeces for manure)
3. Eco-tourism (wildlife park and game reserves)

Disadvantages

1. Predation of humans and livestock
2. Crop damage

ORGANIC EVOLUTION

CONCEPT OF ORGANIC EVOLUTION

Organic evolution

Is the gradual development of organisms from simple life forms to more complex life forms over the course of time. Evolution answers the question why do organisms show such great diversity/ difference. Also evolution is the process of change by which new species are formed from pre-existing species.

The main theory/ idea of evolution is that population of living things do undergo changes over generation. According to this theory some organism resemble each other hence they have a common ancestor e.g Human being and Primates, Donkeys and Zebra.

Importance of organic Evolution

1. Results to the emergence of new species from pre-existing ones (the new species are able to adapt to the changing environmental factors as climate, food)
2. Organic evolution can modify some of the body structures of the organisms to match the need of the environment
3. Organic evolution can modify immunity system to increase the survival value

ORIGIN OF LIFE

It is believed that Earth formed around 4.54 billion (4.54×10^9) years ago by accretion from the solar nebula. Volcanic outgassing probably created the primordial atmosphere, but it contained almost no oxygen and would have been toxic to humans and most modern life. Much of the Earth was molten because of extreme volcanism and frequent collisions with other bodies. One very large collision is thought to have been responsible for tilting the Earth at an angle and forming the Moon. Over time, the planet cooled and formed a solidcrust, allowing liquid water to exist on the surface

The first life forms appeared between 3.8 and 3.5 billion years ago. The earliest evidences for life on Earth are graphite found to be biogenic in 3.7 billion-year-old meta-sedimentary rocks discovered in Western Greenland and microbial matfossils found in 3.48 billion-year-old sandstone discovered in Western Australia. Photosynthetic life appeared around 2 billion years ago, enriching the atmosphere with oxygen. Life remained mostly small and microscopic until about 580 million years ago, when complex multicellular life arose. During the Cambrian period it experienced a rapid diversification into most major phyla.

THEORIES OF THE ORIGIN OF LIFE

There are four theory of origin of life which are the following

1. Special creation
2. Spontaneous generation
3. Steady state
4. Organic evolution (scientific evolution)

1. Theory of special creation

According to this theory life was non-existent before a particular time then the supreme being, super-natural father, created all living things and there was life on earth. These theories are found in holy books.

2. Theory of spontaneous generation

Scientists believed that from non-living matter, living matter developed. Example; Worms and frogs could have come from mud, dust or rotten food.

This theory was applied up to the 19th century but is no longer applied.

3. STEADY THEORY

These theories don't explain the origin of the planet, earth and all organisms. Some people found life with no source.

4. Organic evolution (scientific theory of evolution)

It states that life probably started by a catalytic effect that made free elements combine to form molecules. Elements combined by a catalytic effect, probably lightning, ultra-violet radiation or possibly gamma rays. The first four gases to form were ammonia, hydrogen, water vapour and methane.

This theory was supported by Stanley Miller who used an electric spark to synthesize amino acids from the above four mentioned gases.

These molecules further combine to form a stable system capable of releasing energy and replicating itself. These were the first living organisms resembling the present-day viruses and bacteria. More complex organs develop later.

Origin of species

It is the process by which new species were formed from pre-existing ones.

Causes of origin of species

i. Isolation of mechanisms

The deme of the organisms were not distributed evenly on the land they were isolated due to natural disasters or behavior changes these isolations were the causes of origin of new species.

ii. Reproductive isolation

This is caused by such changes that bring about barriers to successful mating between individuals of the same species

iii. Ecological isolation

These are environmental barriers that keep population or demes apart. These barriers make demes occupy different types of habitat from the original type

iv. Geographical isolation

These are physical barriers such as ocean, seas, mountains, ice valleys etc. These geographical barriers prevent the organisms from exchanging their genes

v. Behavioural isolation

This is the change in the behavior before mating period i.e Courtship or nesting

The prospective changes take place if fertilization occurs

Evidence of origin of evolution

1. Fossil records
2. Cell biology comparative embryology
3. Comparative anatomy
4. Comparative physiology
5. Comparative embryology

1. FOSSIL RECORD

Fossil are remains of the organisms that lived in ancient times. The age of a specimen can be determined by the weight of the carbon in that specimen e.g.

A fossil containing 5g of carbon showing the organism had been 5600years old. Archeological discovery showed that homonidae family which humans belong. The pongitae family to which apes like chimpanzees and the gorilla belong arose from primate stock called proconsul as per archeologist evidence the earliest homoninids appeared about four million years ago. They were

not having culture of tools making and fire making. From the same family genus homo are some development and changes to homohabilis.

Homo habilis used tools and became extinct about 1.5 million years ago.

The next species emerged were homo erectus the organism which was able to stand in an erect position homo erectus was showing communal life and work fire and tool making.

The present days species are homo sapiens or rationalizing man which was behaving high intellectual capacity ability to communicate through languages ability to show many skills

2. CELL BIOLOGY

All the cells of higher organisms show basic similarities in their structure and function i.e. all cells have DNA as carrier of genetic information. All use roughly the 20 amino acids to synthesis protein and all use the ATP as energy carrier the fact that all cells have the cell membrane, ribosome and mitochondria etc which perform similar functions indicate that all organisms had a common ancient origin.

These are other structures and chemical substances that are confined to specific groups of organisms. Organisms sharing the same chemical characteristics are considered to be more closely related this principle has been recently used to confirm phylogenetic relationship this principle is known as biochemical homology

e.g. of biochemical homology

- most plants contain chlorophyll, cellulose and starch which are absent in animal tissues
- vertebrates are the only animals that possess adrenaline and thyroxine
- only algae possess orange pigment called fucoxanthin

3. COMPARATIVE EMBRYOLOGY

This is the branch of embryology that compares and relates the embryos of different species. It helps to show how all organisms relate. Many living things are compared. Whether or not an organism has a notochord or not, it has gill arches. Many things go into comparative embryology and many things can be included

Fish Salamander Tortoise Chicken Pig Cow Rabbit Human



Comparative anatomy

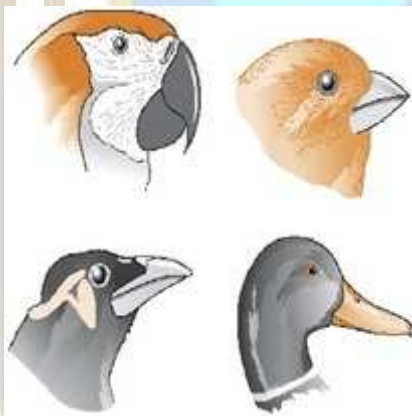
Organisms with basic structural similarities have a common related ancestral. Based on the structural similarity their functions anatomical studies are divided into :

1. Homologous structures

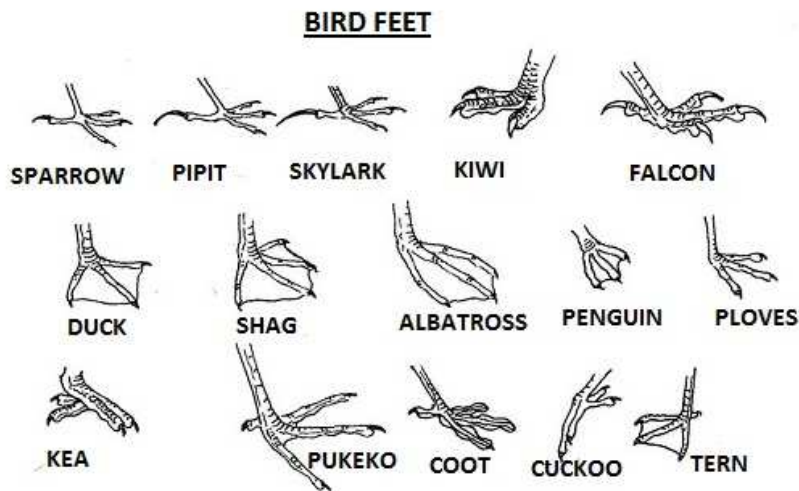
These are structures that perform different functions though they have similar ancestral origin

Examples :

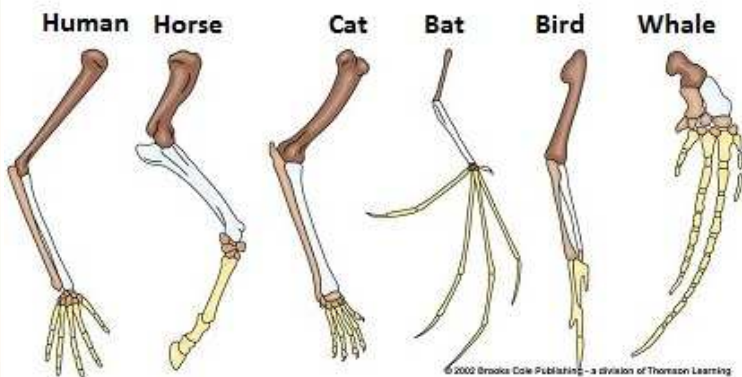
Beak structures in birds



Feet structures in birds



Limb structure in vertebrates



The type of evolution where by organisms with similar ancestral origin develop structures that form different functions is called divergent evolution.

3. Analogous structures

These are structures that perform similar functions though they have different ancestral origin

Examples: Wings in birds and insects , Eyes of the human and octopus

Convergent evolution

This is the type of evolution where by organisms with different ancestral origins develop structures which appear similar in the form and structure

Vestigial structures

These are structures which are developing from generation to the next but they serve no use. Example; appendix in humans, wings on flightless birds like the ostrich

4. Comparative physiology

Due to continental drifting organisms with a common ancestral origin became isolated and hence evolved into different species examples; monkeys with long tails found in the amazon while monkeys with short tails found in the African continent.

Mechanism of evolution

These are many theories to explain possible mechanism of evolution

1. Lamarck's theory
2. Darwin's theory
3. Neo darwin's theory
4. Punctuated equilibrium theory

1. Lamarck's theory

Lamarck led to the principle of natural use and disuse of structure. He observed that the more an individual used a part of his body the more developed that part became

If an individual failed to use a particular part that part became weak and finally disappeared Lamarck concluded that the giraffe developed a long neck due to its use while the flight less birds had their wings reduced and function less due to their dis use

Lamarck proposed that these changes of structure acquired during the life time of an individual were transmitted to their off springs which resulted into the emergency of new species

Merits in Lamarck's theory

According to Lamarck an individual is able to develop structures to suit the need of the environment it increases the organism survival in the diverse environment

Demerits in lamarck's theory

Modern genetics tells that the phenotypically acquired characteristics can not inherit therefore Lamarck cannot explain the emergency of the new species

2. Darwin of the theory

Charles Darwin proposed three theories

1. Natural selection.

Some individual posses particular variation in a population which are the key factor in determing survival and adaptation to the environment. These variation are selecting advantages given to one organism over another organism.

2. Struggle for existence.

As the population increases, causes competition between individuals for environmental resources as a result creates struggle for existence.

3. The survival for the fittest.

Organism with favourable variations will be selected by the environment and the unfavourable variations unfit characters will be eliminated.

Merits of darwin's theory

According to Darwin a number of species tend to remain constant all the time due to the regulating factors such as food, disease and predation etc.

Demerits

- Darin theory did not explain how changes occurred by chance.
- He was not able to explain how transmission of the traits occurs

3. Neo Darwin theory

These are theories that arose after Darwin theories. It said the processes of evolution can be traced to changes that take place due to mutation.

Mutation brings changes which can pass to the next generation which leads to the emergency of new species

4. Punctuated equilibrium theory

This theory was put forward by Stephen Gould and the Niles Eldredge they proposed a specie remain stable for long time [equilibrium] but often sudden and unpredictable changes spring up punctuated giving rise to new structures and new species

EFFECT OF ORGANIC EVOLUTION

1. Sickle cells anaemia

Is the hereditary disorder in which the red blood cells assume a sickle crescent shape making them less efficient in the transportation of oxygen. People with sickle cell traits are more resistant to malaria than normal people

2. Resistance to insecticides and drugs

There are some organisms that develop resistance to chemicals such as insecticides and antibiotics in continued use. Examples; DDT mosquitoes, penicillin and bacteria

Melanin pigment

There are some organisms that occur in two or more distinct forms which is known as polymorphism. Examples of polymorphism is prepared moth which occurs in white form and melamine form or dark form

The moths are normally found on the trunks of branches of the trees where they camouflage against predators.

In the population of the melanin due to the environmental pollution because of the darkened tree trunks and branches which makes them less subject to predation population white moths are decreasing

Factors that bring about evolution

Evolution on living organism are brought about by various thing such as :

1. Mutation
2. Migration
3. Environmental changes
4. Crossing over
5. Artificial selection

HIV, AIDS AND STD's

HIV

HIV stands for human immunity deficiency virus. HIV weakens the body immune system by entering into white blood cell (lymphocytes) and binds itself to chromosome and integrates into the genetic material. The virus now multiplies very fast using genetic materials of White Blood Cells. The daughter virus invades White Blood Cells destroy and kill them. As more White Blood Cells are killed the body becomes less and less fight against disease. Patient with aids are prone to opportunistic infection caused by fungi, bacteria and protozoa.

In nutshell people with AIDS die with disease their body cannot resist. These diseases are referred to as **opportunistic infection**. E.g. tuberculosis, severe diarrhea, skin cancer and pneumonia.

AIDS

AIDS stand for; *Acquire Immune Deficiency Syndrome*. For someone with AIDS T-helper fall below.

the T-helper count for health person range between 450 and 1200

CAUSES

AIDS is viral infection caused by a strain of a virus called **HIV**. HIV means *Human Immunodeficiency Virus*. HIV mainly found in body fluids such as blood, semen and vaginal secretion. Also traces of HIV found on saliva, tear and sweat

1. Primary stage (window stage) : It does not show any symptoms except for slight flu HIV test result is negative
2. A-symptomatic stage : Has no symptoms but the HIV test is positive
3. Full blown aids : Where by one gets various opportunistic infections and diseases

SEXUALLY TRANSMITTED INFECTION

These are infection, which are transmitted through sexually contact during sexually intercourse. Sexually transmitted disease are also referred to as *venereal disease*

RELATIONSHIP BETWEEN HIV, AIDS AND STD's

- HIV is sexually transmitted. Having STD's can increase risk of acquiring and transmitting HIV.
- Some STI's such as chlamydia cause open sores in the skin and become exit point into and from the blood stream of HIV.
- Studies show that infected people to be affected with another STI's are three to five times more likely to to transmit the virus through sexually contact.

SYMPTOMS OF HIV/AIDS

- Loss of body weight
- Diarrhea for longer than a month
- Shortness of breath
- White layer in the mouth and in the throat
- Swollen glands especially in the neck

TRANSMISSION OF HIV

HIV is transmitted via body fluids such as blood, breast milk, vaginal secretions, sweat, saliva, tears. The most common ways of HIV transmission are:

1. Sexual intercourse with an infected person
2. Blood transmission from a infected donor
3. Organ transplants from an infected donor
4. An infected mother to her child during pregnancy birth or breast feeding
5. Using unsterilized surgical or skin piercing instruments, such as scalpels, needles and circumcision blades that have been used on an affected person
6. Sharing toothbrushes, shaving blades or nail cutter with infected person.

NOTE: HIV is not spread by casual contact such as hugging, shaking hands, or touching unless both people have bleeding wounds

Effects:

- They causes death
- Increase a poverty
- Increase the problems of orphans and street children
- It led to stigmatization among society member

- People with HIV and AIDS get opportunistic infections and disease, for example: -
 1. Chest infections e.g. pneumonia, TB
 2. Brain infections leading to mental confusion, severe headache and fits
 3. Stomach or gut infections leading to severe diarrhea
 4. Skin cancer i.e. Kaposi sarcoma

PREVENTION AND CONTROL OF HIV/ AIDS

1. Avoid promiscuous sex partner prostitutes, commercial sex workers (avoid irresponsible sexual behavior abstain from sexual intercourse (if not marriage) be faithful to one sexual partner, use condom during sexual intercourse
2. Wear disposable gloves when touching peoples body fluid
3. Use sterilized instruments during surgery, circumcision and delivery
4. Only screened blood and organs should be used for transfusion and transplants
5. Go for HIV test in order to know your status
6. Do not share tooth brushes and shaving blades
7. People with HIV and AIDS should be given Anti—retrovirus drugs (ARV'S) which help them to show down infections.
8. Pregnant women should attend pre-natal clinic where they can be treated to prevent mother to child transmission.
9. HIV positive mother's should not breast feed their new born babies.
10. Follow the ABC rule,(Abstain, Be faithful and use Condom).

CARE AND SUPPORT FOR PEOPLE LIVING WITH HIV AND AIDS (PLWHA)

People living with HIV and AIDS can live health live for a long time if they get proper care and support we can care for them and supported them in the following ways:

- Give them well balanced meals in adequate quantities.
- Allow them to rest when they feel unwell.
- Taking them to a health center as soon as they start developing signs of illness.
- Provide them with ARV'S, allow them to work.
- Behaving in a loving way towards them and listen them.
- Counseling them to stop behavior that worsen
- Not discriminating against them or stigmatizing
- Hiding them from the public, denying them education or health services
- Chasing them away from home
- Refuse to share utensils or rooms with them
- Care and support gives People Living With HIV and AIDS (PLWHA) hope, good health piece of mind, long life strength to work and comfort.
- Discrimination led to depression, loneliness, loss performance at work and school.

IMPORTANCE OF HEALTH CARE FOR STI's, STD's AND OPPORTUNISTIC DISEASES

- Early testing and treatment will help to treat or slow down the development of the infection or disease in its early stage
- Proper treatment can save life and prevent long term effects such as infertility
- Healthcare professionals can give appropriate counseling on how to manage the infections
- Testing gives peace of mind
- Proper health care reduces the chance of infecting other people.

VOLUNTARY COUNSELING AND TESTING (VCT)

It is a process that is undertaken when a person wants to find out if they are infected with HIV. Because it is voluntary, a person who thinks they might have HIV decides on their own whether they want to have the test done. If the individual decides to go ahead with the testing they will have the opportunity to discuss the test with a trained counselor.

Most clinic use a rapid accurate scientific test that makes the results available, usually within twenty minutes after the test has been performed.

Voluntary Counseling and Testing (VCT) for HIV is an efficient internationally recognized approach for people to find out their HIV status at VCT centers. It has become one of the most effective and popular ways of diagnosing people who may have been exposed to the virus or who have been infected.

VCT is an important tool for preventing the spread of HIV—especially in communities where the epidemic is widespread. It allows for adolescents to find out their own HIV status in order to evaluate their behavior and its consequences.

VCT clinics usually have 45 minutes counseling sessions that provide information about HIV and AIDS and the testing process. VCT provides a confidential and non-judgmental environment for people who want to know their HIV status.

VCT can help to improve advocacy and reduce stigma by giving people the opportunity to talk anonymously and confidentially with counselors about their HIV status.

Voluntary counseling and test involve pre testing counseling and post testing counseling.

Pre testing counseling is done in advance before HIV test

Post testing counseling is done after HIV test if it is positive.

There are Three Main Steps in VCT:

First, there is a session of pre test counseling where questions about HIV/AIDS and the test are discussed and answered by a counselor. The counselor will help the individual determine whether testing is appropriate given the information that is shared with them about the reasons the individual wanted to be tested. Sharing information about their past sexual behavior will help the counselor determine whether testing is appropriate. After making their assessment, if the counselor deems it appropriate for the person to take the test they should

1. Describe the test and how it is performed
2. Explain AIDS and the way HIV infection is spread
3. Discuss ways to prevent the spread of HIV
4. Explain the confidentiality of the test results
5. Discuss the meaning of the possible test result
6. Ask what impact you think the results of the test will have on you
7. Discuss whom you might tell your results to
8. Discuss the importance of telling your sex and/or drug-using partner(s) if the results come back positive

Second, when the person decides to have the HIV test they must sign a consent form before the test can be administered. Informed consent is a crucial part of the VCT process and it is important that the individual is aware of their right to refuse any medical procedure, to be informed about it, and to agree to it. There is a statement which they should be asked to read beforehand stating that they have been informed about the HIV-antibody testing procedure, that they understand, and have given their consent to have the test performed.


Finally, after the test has been done the counselor gives the results to the person in the post-test counseling session (it usually takes around fifteen to twenty minutes after the test has been administered for the results to come back. If they are found to be HIV-positive (meaning that they have HIV) then they are referred to medical specialists and other counselors in order to aid them in receiving treatment and support.

WHO SHOULD SEEK VCT SERVICES

- i. Anyone who has been exposed to the risk of sexual behavior.
- ii. Anyone who is seriously considering changing his / her sexual partner.
- iii. Anyone who is diagnosed with sexually transmitted infections.
- iv. Anyone who has had/had more than one sexual partner.
- v. People who are sharing sharp instruments.
- vi. Commercial sex workers.
- vii. Refugees and migrant workers.

viii. Anyone who wishes to find out his /her sexual partner.

SIGNIFICANCE OR IMPORTANCE OF VCT

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- i. It is a way to find out about HIV and AIDS status so that a person can plan for the future.
 - ii. It is an effective way of preventing HIV and AIDS because it promotes sexual behavior change and helps people to make wise decisions.
 - iii. It is a means of HIV and AIDS treatment and care.
 - iv. It helps people to get useful and right information about HIV and AIDS.
 - v. It provides psychological support for people living with HIV and AIDS thus helping them to lead a normal life.
 - vi. It helps the government in planning for care and treatment by knowing the number of infected people.
 - vii. Testing negative is a strong motivation for one to reduce sexual behavior.
 - viii. Testing positive gives one an opportunity to find out how he / she can live longer and a more productive life.
 - ix. It gives confidence to the people that are planning marriage or pregnancy.
 - x. It helps to prevent mother to child transmission.

Some barriers to VCT for young people

- i. Some of the barriers to VCT for young people include limited availability, legal issues and accessibility of VCT services.
- ii. Waiting times and costs.
- iii. Pressure by health staff to notify partners.
- iv. Worries about confidentiality and fear that the results of HIV tests would be shared with partner(s) and/or parent(s) without their consent.
- v. Fear of being stigmatized and labeled by their friends, families and communities.

vi. Inadequate prevention, care and support from health care providers (i.e. councilors, doctors, nurses etc.) to effectively meet the needs of youth.

PROCEDURE AND TECHNIQUES OF VCT

- i. Counseling and testing must be truly voluntary.
 - ii. The counselor should cross check code numbers on all forms against the client codes.
 - iii. The results should be provided to a person in person to ensure that the correct person receives the results this also helps to maintain confidentiality.
 - iv. The counselor should ensure the person has enough understanding of the results.
 - v. The result should be provided in the manner that it is easily understood by the client if the result is positive the counselor should be gentle and provide emotional support so as to help the client cope with the situation.
 - vi. When the client is negative the counselor should provide information on how to remain negative
 - vii. It is better to provide pre testing counseling and guiding.
 - viii. The counselor should be aware in the manner he /she calls clients from the waiting area to avoid verbal or non verbal behavior that might disclose the status of the client and he can be mentally distressed.
 - ix. Unless it is very necessary result should not be provided in written form.
 - x. The results should not be given if the client is not ready to accept them.
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