**THIRD TERM E-LEARNING NOTE**

**SUBJECT: BIOLOGY CLASS: SS 2**

## SCHEME OF WORK

**WEEK TOPIC**

1. Excretion in Lower Organisms
2. Excretory System in Vertebrates and Plants
3. Male and Female Reproductive Structures
4. Sexual Reproduction
5. Reproduction in Plants
6. Pollination
7. Ecological Succession
8. Overcrowding and Food Shortage
9. Balance in Nature
10. Family Planning

**REFERENCES**

* + Modern Biology for Senior Secondary Schools by S.T. Ramalingam
  + Essential Biology by M.C Michael
  + New School Biology by H. Stone and Cozen
  + SSCE Past Questions and Answers
  + New System Biology by Lam and Kwan
  + College Biology by IdodoUmeh
  + UTME and Cambridge Past Questions and Answers
  + Biology Practical Textbook

**WEEK ONE**

**EXCRETION AND EXCRETORY SYSTEM**

**CONTENT**

* Excretion
* Types of Excretory structures and Taste
* Excretory Structures in some Organisms

**EXCRETION**

Excretion is the process by which metabolic waste products are removed from the body of all living things. Excretion is different from egestion which is the removal of solid waste (undigested food substances i.e.faeces) through the anus. Excretion is necessary for the following reasons:

* To avoid or prevent any harm that would be caused by any excretory product.
* Some excretory products are poisonous to the body and should be removed.
* To maintain water balance in the body (homeostasis).
* To avoid interference of waste products with normal metabolic activities in the body.

**EXCRETORY STRUCTURES AND WASTE IN ORGANISMS**

|  |  |  |
| --- | --- | --- |
| **Organism** | **Excretory Structure** | **Excretory Waste Product** |
| Protozoa | Contractile vacuole | C02, ammonia and water |
| Flatworm | Flame cells | C02, ammonia and water |
| Earthworm | Nephridia | C02, ammonia and water |
| Crustacean | Green glands | C02, ammonia and water |
| Insect | Malpighian tubules | C02, ammonia and uric acid |
| Fish | Kidney | C02, ammonia and water |
| Amphibian(toad) | Kidney | H20 and salt |
| Reptiles | Kidney | H20 and salt |
| Birds | Kidney and lungs | C02 and water vapour |
| Mammals | Kidney, lungs, skin and liver | C02, water, urea |
| Flowering plants | Stomata, lenticels and leaves | H20, C02, 02. tannins, gum, alkaloids, oil and latex |

**EVALUATION**

1. List five excretory structures adapted to aquatic habitat
2. Mention four excretory waste in plants

**TYPES OF EXCRETORY SYSTEMS**

**CONTRACTILE VACUOLE IN PROTOZOA**

Contractile vacuole is a simple structure found in the cell of fresh water protozoa. Water constantly enters the cell of a protozoan through the selectively permeable membrane because the cell is hypertonic to its environment. As water enters the cell, a contractile vacuole is formed which collects the water and expands, when it reaches the maximum size, it contracts and discharges the water through a temporary break in the cell membrane at interval. Excretion of carbon dioxide and ammonia is by diffusion through the cell membrane

**FLAME CELL IN FLATWORMS**

The excretory system consists of two longitudinal canals with branched tubules which end in flame cells. The flame cell has a large hollow called the cell lumen with bunch of flagella hung on it. Waste product from the surrounding cells enters the flame cells. The flagella help to propel the fluid into the tubules. The fluid passes into the exterior through a narrow tube called duct.

**NEPHRIDIUM IN EARTHWORM**

A pair of nephridia is found on each segment of the earthworm except the three and the last. Each nephridium consists of a ciliated funnel, nephrostome which leads into a long coiled tube (narrow and middle ciliated tubes, wide non-ciliated tubes and muscular tube). The tube opens to the exterior as nephriodiophore (excretory pore). Waste product mainly urea is absorbed from blood capillaries surrounding the nephridia. The fluid containing the waste through the long tube of the nephridia, salt and other useful substances are reabsorbed through the wall of the tube. The unabsorbed substances and water gather in the muscular tube and discharge to the exterior through the excretory pore.

**EVALUATION**

1. How are excretory products removed in amoeba and earthworm?
2. Describe the excretory structure in flatworm.

**MALPIGHIAN TUBULE IN INSECT**

Malpighian tubules are found between the midgut (small intestine) and the hindgut (large intestine). One end opens into the gut while the other end closed freely floats in the haemocoel. Nitrogenous waste and water in the haemocoel are absorbed at the distal close end into the tubule. The waste is converted into uric acid as it passes along the malpighian tubule towards the gut. A lot of water is also reabsorbed so that by the time the uric acid reaches the proximal end, it is changed to solid crystals. More water is reabsorbed in the rectum therefore concentrated urine leaves the body as almost dried solid.

**GENERAL EVALUATION**

1. Define excretion.
2. Explain the necessity for an excretory system in animals.
3. Describe the mechanism of excretion in insects.
4. List five excretory product in plants.
5. Differentiate between excretion and egestion.

**READNG ASSIGNMENT**

College Biology, chapter 9, pages 186-204

**WEEKEND ASSIGNMENT**

**SECTION A**

1. The organelle which eliminates water from the body of protozoa is A. plasma membrane B. contractile vacuole C. cell wall D. nucleus
2. In insects, the structure that performs the same function as the kidney in man is the A. nephridium B. flame cell C. malpighian tubule D. trachea
3. The excretory structure in earthworm is the A. malpighian tubule B. nephridium C. kidney D. flame cell
4. Flame cells are the A. excretory systems of worms B. excretory and respiratory systems of flatworms C. excretory systems of flatworms D. secretory systems of flatworms
5. Which of these is a waste product of an insect? A. alkaloids B. uric acid C. sweat D. mucilage

**SECTION B**

1. State the similarities and differences between excretory organs of a mammal and earthworm
2. State three factors that leads to the opening and closing of stomata

**WEEK TWO**

**EXCRETORY SYSTEM IN MAMMALS AND PLANTS**

**CONTENT**

* Excretory system in mammals
* Structure and functions of the kidney
* Structure of the urinary tubule
* Process of urine formation
* Excretion in plants

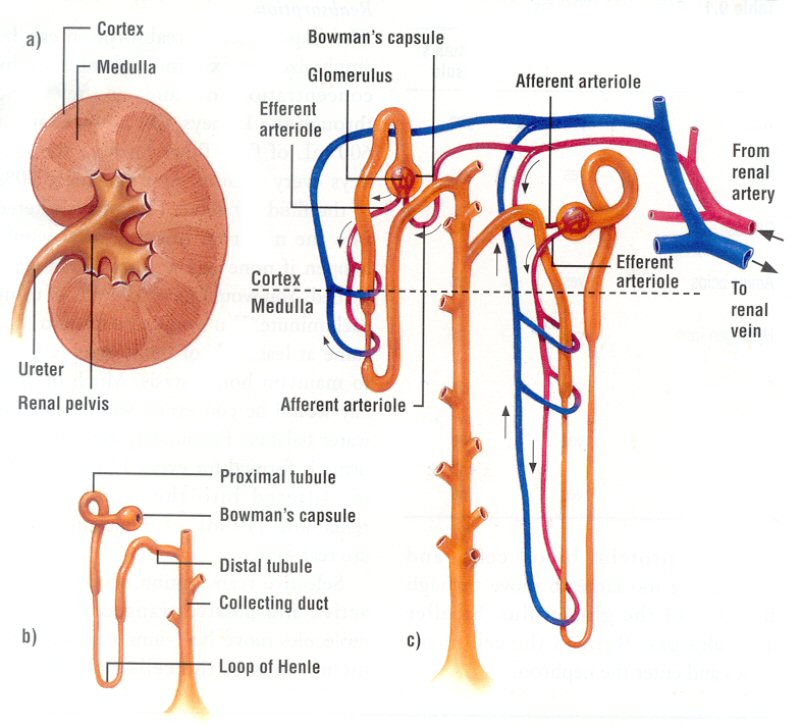
**EXCRETORY SYSTEM IN MAMMALS**

Mammalian lungs excrete water vapour, and C02, the liver excretes bile pigment called bilirubin, the skin excretes water, salt and urea through the sweat, and the kidney excretes water, mineral salt and urea. The excretory system of mammals consists of a pair of kidney, ureter, bladder, renal artery and renal vein.

**STRUCTURE OF THE KIDNEY**

The mammalian kidney is a bean-shaped, reddish brown organ located in the posterior end of the abdomen. The right kidney is slightly lower in the body than the left. Cutting a kidney longitudinally, two distinct regions are observed; an outer cortex and an inner medulla. Several narrow tubules called urinary tubules (nephrons) pass through the two regions stated above. The tubules open at the tips of triangular- shaped masses of tissues called pyramids. The pyramids open into a funnel-shaped cavity called the pelvis. The kidney has many tiny capillaries which are branches of the renal artery and the renal vein. The pelvis continues as ureter, a long narrow tube connecting the kidney to the urinary bladder.

**Diagram of the Kidney**



**FUNCTIONS OF THE KIDNEY**

The three major functions carried out by the kidney are as follows

**Osmoregulation:** This is the process by which an animal regulates the balance between water and salt in their body fluid. When the concentration of the blood is higher than that of the cell content through the kidney extract or remove these substances from the blood so as to maintain normal osmotic balance in the body and vice-versa.

**Maintenance of Acid-Base Balance:** The kidney excretes excess acids or bases when either of them is more concentrated in the body. If the body's concentration of base is higher than that of acid, more salt will be excreted with the urine as a result, acid-base balance is maintained in the body.**Excretion**: The kidney removes metabolic waste product from the body in form of urine. Urine formation is made possible by the numerous urinary tubules which are the functional units of the kidney.

**EVALUATION**

1. Describe briefly the mammalian excretory system.
2. What are the functions of the kidney?

**STRUCTURE OF THE URINARY TUBULE (NEPHRON)**

The nephron consists of a cup-shaped Bowman's capsule which opens; into short coiled proximal convoluted tubules. The tubule continues as a U-shaped loop, the Henle's loop in the medulla, the loop re-enters the cortex as the distal convoluted tubule and widens as it enters the pelvis. The nephron is associated with several networks of capillaries. The renal artery branched in the Bowman's capsule formed a knot of capillaries called the glomerulus which re-joins to form a blood vessel leading out of the capsule and branches into a capillary network around the urinary tubule before joining the renal vein.

**FORMATION OF URINE**

**ULTRA-FILTRATION:** Blood is brought to the kidney by the renal artery, which enters the glomeruli (capillaries) in the Bowman's capsule. Water, mineral salt, sugar and other solute are filtered from blood into the capsule.

**SELECTIVE RE-ABSORPTION:** The glomerular filtrate flows down the tubules at the proximal convoluted tubular loop and the loop of Henle's where some watery sugar, amino acid and salt useful to the body are reabsorbed into the blood capillary by active transport. This process of reabsorption of useful materials back into the blood is called selective reabsorption.

**HORMONAL SECRETION:** As the fluid flows through distal convoluted tubules, more water is reabsorbed by the action of anti-diuretic hormones (ADH) and urine is finally formed. The urinary tubules empty their content into the pelvis and from the pelvis urine trickles through the ureter into the urinary bladder, which when full contracts and discharge urine out of the body through the urethra.

**EVALUATION**

1. Describe the urinary tubule
2. Describe the process of urine formation

**EXCRETION IN PLANTS**

Plants have no special excretory organs and excretory wastes are minimal. Elimination of waste takes place through the stomata and lenticels. Main waste products of plants arewater which is eliminated through transpiration and guttation and carbon dioxide from respiration at night when photosynthesis is not taking place. Other waste products in plants are alkaloids (quinine, nicotine, cocaine, morphine) products are converted into harmless substances, stored in some parts of the plants as useful commercial products.

**GENERAL EVALUATION**

1. Mention five excretory structures in mammal.
2. Describe the structure of excretion.
3. Describe the function of the kidney.
4. Describe the structure of the urinary tubule.
5. List four kidney diseases, stating their effects and remedy.
6. How is urine formed in mammals?

**READING ASSIGNMENT**

College Biology Chapter 9, page 186-204

**WEEKEND ASSIGNMENT**

**SECTION A**

1. Excess water in plants is excreted as water vapour and droplets respectively through A. transpiration and guttation B. respiration and guttation C. photosynthesis and guttation D. guttation and condensation
2. Which of the following is not an excretory organ? A. kidney B. skin C. leaf D. large intestine
3. Which of the following waste products in plants is excreted through the stomata and lenticels? A. carbon dioxide B. alkaloids C. tannins D. anthocyanins
4. Which of the following is responsible for the removal of excess water in human? A. small intestine B. kidney C. spleen D. bladder
5. The urinary tubule of the kidney function through A. ultra filtration and selective reabsorption B. osmosis and diffusion C. active transport and osmosis D. active transport and cytoplasmic strand

**SECTION B**

1. Differentiate between excretion in plants and animals.
2. Mention five structural parts of the excretory system in mammals and their functions.

**WEEK THREE AND FOUR**

**MALE AND FEMALE REPRODUCTIVE STRUCTURES**

**CONTENT**

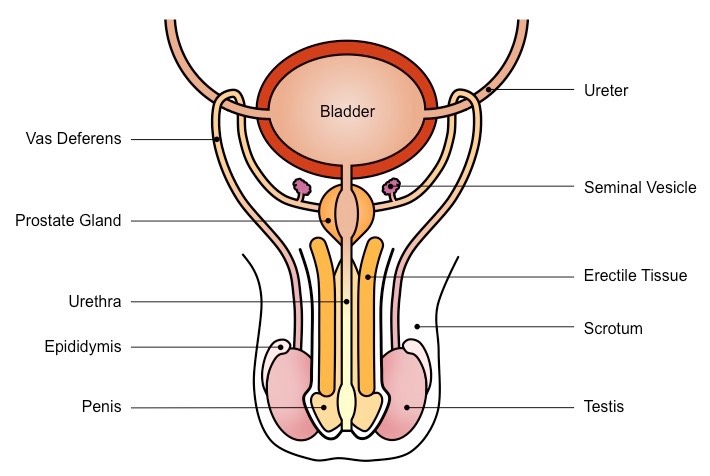
* Structures and Functions of the Reproductive System (Male and Female)
* Structure of the Gametes (Sperm and Ovum)
* Differences Between Male and Female Reproductive Organs

**REPRODUCTIVE SYSTEM**

Most multicellular animals and plants undergo a complex form of sexual reproduction in which especially differentiated male and female reproductive cells (gametes) unite to form a single cell, known as a zygote, which later undergoes successive divisions to form a new organism. The process takes place with the help of the system known as the reproductive system. This system can be divided into

* male reproductive system and
* female reproductive system.

**STRUCURES AND FUNCIONS OF MALE REPODUCION SYSTEM IN MAMMALS**

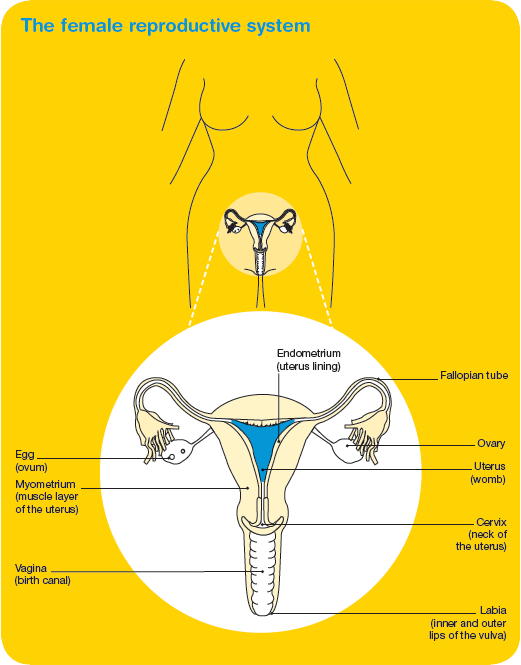
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| **STRUCTURE** | **DESCRIPTION** | **FUNCTIONS** |
| Testis | Oval shaped, found in scrotal sacs in pairs outside the body to enjoy cooler temperature. | * production of sperms * production of male sex hormones (testosterone) * development of secondary sexual character in male   . |
| Seminiferous tubules | Found within the testis, composed of a mass of sperm producing tubes. | Site of sperm production |
| Epididymis | Found outside the testis as a long coiled tube. | Collect and stores sperm temporary till maturity. |
| Vas deferens  (sperm duct) | A narrow tube which leads from epididymis to the seminal vesicles. | Conduction of sperm from epididymis to seminal vesicle. |
| Seminal vesicle | A small sac at the back of vas deferens. | * Stores sperm till ejaculation. * Secretes part of the seminal fluid.   NOTE; Seminal fluid contains fructose which provides energy for the sperms. |
| Prostrate gland | Connected to the urethra through many tubules | Secretion of seminal fluid. |
| Cowper’s gland | Located very close to the prostrate gland. | Secretes a part of the seminal fluid which raises the acidic ph of the female reproductive medium which otherwise can kill the sperm. |
| Urethra | A narrow tube which passes through the penis. | Aids the passage of sperm into the vagina of the female animal and also passage of urine out of the body hence it is called urinogenital opening. |
| Penis | Contains tissues which makes it turgid (erect when filled) with blood | Helps to introduce sperm into the vagina of the female animal and also passage of urine. |

**EVALUATION**

1. Outline five structural parts of the male reproductive system and their functions
2. Why is urethra aurinogenitalopenining?

**STRUCTURES AND FUNCTIONS OF THE FEMALE REPRODUCTIVE SYSTEM**

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|  |  |  |  |
| --- | --- | --- | --- |
|  | **STRUCTURE** | **DESCRIPTION** | **FUNCTION(S)** |
| 1 | Ovaries | Found on each side of the vertebra column (two in every woman) | - Produce eggs (ova)  - produces female sex hormone (oestrogen and progesterone)  - Development of secondary sexual characters in female. |
| 2 | Oviduct  (fallopian tube) | A long narrow tube funnel opening which receives eggs released by the ovary and it is a linkage between ovary and uterus. | -Fertilization takes place in the oviduct  - Allows the passage of egg from ovary to the uterus |
| 3. | Uterus | A muscular organ which is a cavity for development of the zygote into a baby. | - Site of embryo development from implantation till birth |
| 4. | Vagina | A muscular tube leading from the uterus to the outside of the body. | - It receives sperms from penis during intercourse  -Allows the passage of foetus during birth |
| 5 | Cervix | A ring of muscles with tiny opening that closes the lower end of the uterus where it joins the vagina. | -Controls the opening and closing of the vagina especially during birth. |
| 6 | Vulva | Refers to all external parts of the female reproductive organ | - Allows the passage of the penis into the vagina during intercourse.  - permits passage of foetus during birth. |
| 7 | Clitoris | A small sensitive organ which correspond to the male penis. It is erectile and becomes stiff when stimulated due to blood inflow | * Helps to stimulate female during sexual intercourse(experience orgasm) |

**EVALUATION**

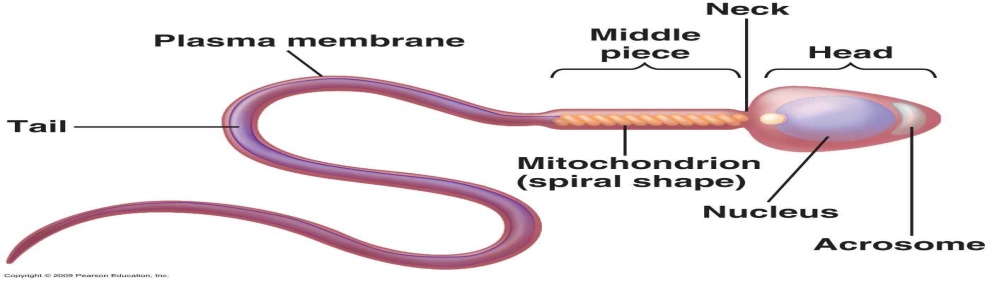
1. State five structural differences between male reproductive system and female reproductive system.
2. Describe the organs in the female reproductive system.

**STRUCTURE OF MAMMALIAN GAMETES**

**GAMETE**

Gamete is a mature sexual reproductive cell having a single set of unpaired chromosome. It can be male or female gamete. They are formed in the gonads (testis on ovaries) through a process called gametogenesis.

**MALE GAMETE**



**A SPERM**

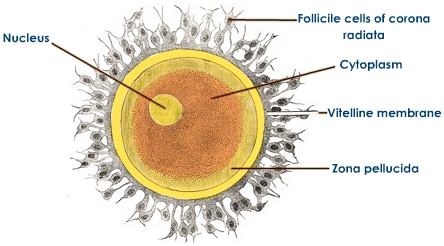
This is called sperm (or spermatozoa) and produced in the male gonads (testis) by a process called **spermatogenesis.** It is microscopic and unicellular in nature. Usually smaller and more elongated than the egg; about 0.05 mm (0.005 cm) long.

**Spermatozoon** consists of the following parts:

1. **Acrosome**: It can be found at the upper part of the head, containing lytic enzymes used to dissolve egg membrane to enhance penetration during fertilization.
2. **Middle piece**: It contains mitochondria for the generation of energy used by the sperm for swimming towards the egg.
3. **Flagellum**: The long whip-like tail for propelling the sperm cell
4. **Nucleus**: It can be found in the head of the sperm cell containing genetic materials (DNA-deoxyribonucleic acid) which fuses with the nucleus of the ovum at

fertilization.

**FEMALE GAMETE**



**THE OVUM**

This is called egg (ovum) and is produced in the female gonad (ovary) by a process called oogenesis. This is larger than sperm, about 0.1mm in diameter.

Each ovum is made up of the following

* Cytoplasm
* A central Nucleus: It contains the chromosomes which carry the genes.
* Granules and yolk droplets: A source of nourishment for the embryo at the early stage of development.
* Plasma membrane: It surrounds the cytoplasm.
* Outer vitelline membrane and jelly coat of glycoprotein.

**Note**: The nuclei of the sperm and ovum contains chromosome which carries the gene that are responsible for transmission of characters from parents to offspring.

**GENERAL EVALUATION**

1. What is reproduction?
2. Draw a well labeled diagram of the male reproductive organ in mammals.
3. List five structural parts of the female reproductive organ in mammals and state their functions.
4. State five distinct differences between the male and female reproductive organs in mammals
5. Differentiate between the male and the female gametes in mammals.

**READNG ASSIGNMENT**

College Biology, chapter 16, pages 292-324

**WEEKEND ASSIGNMENT**

**SECTION A**

1. The following are female sex hormone except A. oestrogen B. progesterone C. testosterone D. oxytocin
2. The site of production of sperm is A. epididymis B. seminiferous tubules C. seminal vesicle D. penis
3. Fertilization takes piece in the A. uterus B. vagina C. oviduct D. vulva
4. \_\_\_\_ parts of the male gamete dissolve the egg membrane to enhance penetration A. nucleus B. acrosome C. flagellum D. vitelline membrane
5. The process by which the male and the female gamete are formed in the gonads is referred to as \_\_\_\_ and ­­­­­­­­­\_\_\_\_\_

**SECTION B**

1. Draw a well labeled diagram of the sperm cell and state the functions of the labeled parts.
2. Differentiate between sexual and asexual reproduction

**WEEK FIVE**

**REPRODUCTIVE SYSTEM IN PLANTS**

**CONTENT**

* Structures and Functions of the Reproductive Organs in Plants
* Arrangement of Reproductive Organs in Plants
* Types of Flowers
* Kinds of Placentations

**STRUCTURES AND FUNCTIONS OF THE REPRODUCTIVE ORGANS IN PLANTS**

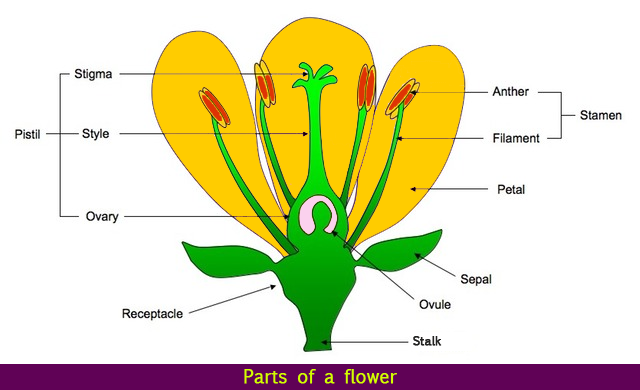
The flower is the reproductive structure of a flowering plant. It has both male and female sex organs hence it can carry out sexual reproduction. After fertilization has taken place in flowers, seeds are produced.

A flower has two major parts:

* The floral part (whorls)
* The flower stalk (pedicel).

The floral part of the flower is formed by

* calyx (sepals)
* corolla (petals)
* androecium (stamens)
* gynoecium (carpels)



**PARTS OF A TYPICAL FLOWER**

**THE CALYX**

The **calyx** consists of sepals which are usually small and green. They protect the flower present in the bud. Sepals are usually up to 3-5 in numbers and they may be separated (polysepalous) or joined to form a cup (gamosepalous). Epicalyx may be present e.g in hibiscus flower.

**THE COROLLA**

The **corolla** consists of petals inside the sepals. Petals are the attractive part of the flower and could be up to 4-10 and may be separated (polypetalous) or joined to form a tube (gamopetalous). They are generally coloured and scented to attract pollinators (e.g insects)

**THE ANDROECIUM**

The a**ndroecium** is the male reproductive organs of a flower. It is a group of stamens which consist of two parts –the filament and anthers. Stamens could be up to 3 or more (free or joined together).The anther is a 2-4 lobed structure producing the pollen grains (fine yellowish particles) which in turn produce the male gamete in flowers. At maturity, the anther lobes open to release the pollen grains.

**THE GYNOECIUM**

Th**e gynoecium** is the female reproductive organ of a flower. It is the inner most floral part of the flower. Gynoecium consists of carpels which may be one or many. Carpels may be separate **(monocarpous)**e.g flamboyant or may be fused (**polycarpous**) e.g. hibiscus. A Pistil or carpel consists of three parts, they areovary, style and stigma.

The ovary contains ovule which produces the female gamete. After fertilization, the ovary develops into fruit while the ovule develops into seed.

**TYPES OF OVARY**

1. Superior Ovary- when it is above other floral parts and such flower is called hypogynous flower e.g. hibiscus
2. Inferior Ovary- when it is below other floral parts such flower is referred to as epigynous flower e.g. sunflower.
3. Half inferior Ovary- when the ovary is at the same level with other floral parts, such is called perigynous ovary e.g. rose flower.

**EVALUATION**

1. Describe the male reproductive parts of a flowering plant.
2. Explain the different types of ovary.

**TYPES OF FLOWER**

Generally, flowers defer in the following

* number of floral parts
* colour of petals
* size and shape
* symmetry
* Flowers can be radially symmetrical/regular (actinomorphic) or irregular (zygomorphic).
* A complete or perfect flower, when all the four floral parts are present, or imperfect or incomplete flower if one or more of the floral parts are absent.
* Position of the ovary (hypogynous, epigynous or perigynous flowers).
* If flowers occur singly (solitary flower) or in group (inflorescence).
* If flowers are born in axils of leaves (axillary) or at the end of the stem or branches (terminal flowers).

**EVALUATION**

1. Classify flowers based on a) number of floral parts b) position of the ovary
2. List the factors to consider when classifying flowers.

**SEXES IN PLANTS**

Most flowers are bisexual i.e. they have both stamens and carpels while a few are unisexual (either male or female). Therefore, a plant can be **monoecious** (when both male and female flower occur on the same plant e. g. maize or **dioecious** (when male and female flower are found on different plant e. g. pawpaw.

**PLACENTATION**

This is defined as the arrangement of the ovules within the ovary of a flower. The ovules are attached to the ovary by fleshy structures called placenta through short stalks called funicles.

**TYPES OF PLACENTATION;**

1. **Marginal placentation**: Ovule are arranged at the margin of the ovaries e.g. beans, flamboyant flowers
2. **Parietal placentation:**  Ovules are arranged to the side of the ovary or within a single chamber or cavity e.g. pawpaw.
3. **Free central placentation:** Ovules are born on a knob projecting from the base of the ovary e. g. water lily.
4. **Axile placentation**: Carpels meet at the centre to form the placenta for attachment of ovules e.g. tomatoes
5. **Basal placentation:** Ovules are attached to the base of ovule e. g. sunflower.

**GENERAL EVALUATION**

1. With a well labeled diagram describe the structural make up of a flower.
2. With an example each state and explain the types of ovary.
3. List the four floral parts of a flower and their functions.
4. Classify flower based on sexes.
5. What is placentation?
6. Describe five types of placentation and give one example in each case.

**READNG ASSIGNMENT**

College Biology, chapter 16, pages 305-324

**WEEKEND ASSIGNMENT**

**SECTION A**

1. The reproduction structural part of the flower include the following except A. corolla B. androecium C. gynoecium D. stigma
2. A flower having both male and female flowers on the same plant is referred to as A. monoecious flower B. dioecious flower C. hypogynous flower D. axillary flower.
3. An example of flower possessing half inferior ovary is A. hibiscus B. sun flower C. rose flower D. flamboyant
4. The arrangement of ovules in the ovaries is referred to as A. pollination B. placentation C. fertilization D. solitary
5. An example of axile placentation is found in A. sunflower B. lily C. pawpaw D. tomato

**SECTION B**

1. With the aid of diagrams, distinguish between a monocarpous ovary and a syncarpous ovary.
2. Describe five types of placentation and give one example in each case.

**WEEK SIX**

**POLLINATION**

**CONTENT**

* Definition
* Pollination in plants
* Features of self and cross pollinated flowers
* Agents of pollination

**DEFINITION**

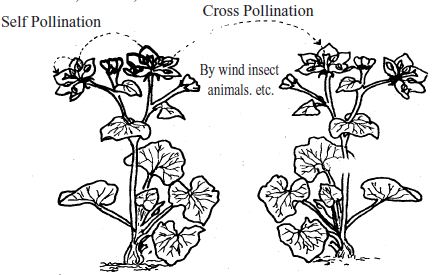
This is the transfer of mature pollen grains from the anther of one flower to the mature stigma of the same or another flower of the same plant or another plant of closely related species. Pollination usually precedes fertilization. There are two types of pollination namely; self pollination and cross pollination

**SELF POLLINATION**

This is the transfer of mature pollen grain from the anther of a flower to the stigma of the same flower or to that of another flower of the same plant e.g. tomato and pear. Therefore, self pollination involves only one parent plant i.e. bisexual flowers or monoecious plants

**CROSS POLLINATION**

This is the transfer of mature pollen grains from the anther of a flower to the stigma of a flower on another plant of the same or closely related species e.g. hibiscus, pawpaw. Therefore cross pollination involve two parent plants i.e. unisexual flowers or dioecious plants. Cross pollination depends on external agents like wind, insect etc

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**ADVANTAGES OF SELF POLLINATION**

1. It ensures effective pollination in bisexual flowers
2. It avoids wastage of pollen grains

**DISADVANTAGES OF SELF POLLINATION**

1. Production of weak offspring due to continuous self pollination
2. The offspring are less adaptive to the environment.

**ADVANTAGES OF CROSS POLLINATION**

1. Production of healthier offspring.
2. Production of viable seeds
3. The offspring are more adapted to the environment
4. Formation of new varieties with good characteristics

**DISADVANTAGES OF CROSS POLLINATION**

1. It depends on external agents e.g. wind and insect
2. It leads to wastage of pollen grain especially in wind pollination.

**EVALUATION**

1. What is pollination?
2. Differentiate between self and cross pollination

**FEATURES OF SELF POLLINATED FLOWERS**

Features favouringself pollination include

1. **Homogamy**: This is the ripening of anther and stigma of bisexual flower at the same time
2. **Cleistogamy:** This is when ripe pollen grains are deposited on the stigma which then becomes ripened at the same time.

**FEATURES OF CROSS POLLINATED FLOWERS**

1. **Dioecious flowers:** When male and female flowers occur on separate plant e.g. pawpaw
2. **Dichogamy:** When male and female parts mature at different times. Dichogamy can be
3. protandry : when anther matures or ripens before the stigma e.g. sunflowe, okro and cotton
4. protogyny when stigma matures before anther e.g. palms and figs.
5. Possession of brightly coloured petals to attract insect e.g. hibiscus.
6. Possession of sweet smell for attracting insects e.g. rose flower.
7. Unisexual flowers
8. Self incompatibility
9. Position of anthers and stigmas

**EVALUATION**

1. What are the features of cross-pollinated flowers?
2. Define the terms (a)homogamy (b)cleistogamy (c)dichogamy.

**AGENTS OF POLLINATION**

Agents of pollination (pollinators) are the organisms which help in the transfer of pollen grains from the anther to the stigma of flowers. This pollinator include: insects, birds, snails, bats and man and also physical factors like wind and water.

The two major agents of pollination are:

* insects
* wind

Flowers pollinated by them are marked with certain features that will be stated below

**CHARACTERISTICS OF INSECT POLLINATED FLOWERS (ENTOMOPHILOUS)**

1. Large conspicuous petals and sepals
2. Bright colouration
3. Possession of scent
4. Presence of nectars.
5. Presence of rough, sticky and relatively few pollen grains
6. Flat, sticky stigma to receive pollen grains.

Entomophilous flowers include hibiscus, crotolaria, pride of barbadous, etc.

**CHARACTERISTICS OF WIND POLLINATED FLOWER (ANAEMOPHILOUS FLOWER)**

* + 1. Small inconspicuous petals and sepals
    2. Dull coloured flowers
    3. Absence of scent
    4. Absence of nectars
    5. Large quantity of pollen grains
    6. Pollen grains are small, lightened sticky
    7. Elongated sticky stigma with large surface area.

Examples include cereals like maize, guinea corn and rice

**GENERAL EVALUATION**

1. What is pollination
2. Explain what you understand by self and cross pollination.
3. What are the features of self and cross pollination?
4. State five characteristics of entomophilous and anaemophilous flowers.
5. What are the agents of pollination?

**READING ASSIGNMENT**

College Biology, chapter 16, page 333 – 348

**WEEKEND ASSIGNMENT**

**SECTION A**

1. Which of these is not condition for cross pollination A. protandry B. protogyny C. homogamy D. self incompatibility
2. The following are entomophilous flowers except A. hibiscus B. crotolaria C. maize flower D. pride of Barbados
3. Courtship behaviours in animals include the following except A. display B. migration C. pairing D. adaptation
4. Which of these is not a type of courtship display in animals A. croaking in toad B. colour change in chameleon C. bright colour feather in peacock D. singing in human being
5. The following are advantages of cross pollination except A. wastage of pollen grains B. production of viable seeds C. leads to varieties of offspring D. offspring are more adapted to the environment

**SECTION B**

1. Differentiate between entomophilous and anaemophilous flower
2. Outline four features that favours cross pollination

**WEEK SEVEN**

**ECOLOGICAL SUCCESSION**

**CONTENT**

* Introduction
* Types of Succession
* Differences Between Successions
* Characteristics of Succession
* Outcome of Succession

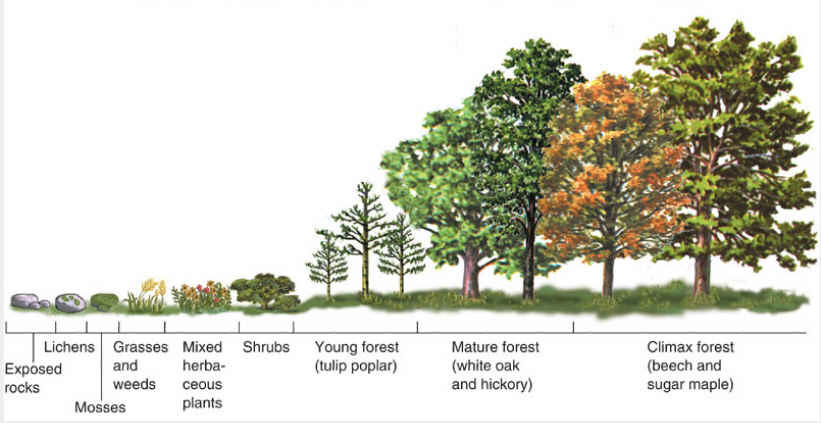
**ECOLOGICAL SUCCESSION**

The orderly change in the inhabitants of an area over time is called succession. It can also be defined as the step by step orderly and gradual replacement of communities of organisms that leads to a climax community.

An illustration of succession is that of a pond. Rain carries sediment from surrounding land into the pond, filling it and making it shallower. Algae that live in the pond die and eventually fall to the bottom, adding organic materials to the sediment.

Some plants such as pond weeds grow at the bottom. These plants make up the pioneer community. The pioneer plants are the first to inhabit the changing environment. The roots of these underwater plants hold much silt, quickly building up the bottom cover of the pond. As they die, their organic matter accumulates at the bottom. The water along the edges becomes so shallow that water lilies and other floating plants replace the pioneer plants.

The final stage of succession in a particular area is called climax community. The species that constitute the climax community differs from biome to biome. A climax community is also a stable community because its appearance and species composition are stable. To become climax, the community would have gone through a sequence of species.

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**TYPES OF SUCCESSION**

Basically, there are two types of succession; these are

* Primary succession
* Secondary succession

**PRIMARY SUCCESSION**

This is a type of succession that begins from bare ground, bare rock or bare body of water.

Primary succession on land may be studied on a building site where a heap of sub-soil, stones or cement block is left over after construction. In an aquatic habitat, primary succession may be observed in a new artificial pond.

The first in any succession are called primary colonizers and are usually autotrophic plants. These have simple requirements for life and can withstand exposures. By the second year of the primary succession in addition to more algae and lichens, mosses may begin to grow. As they grow, they wear out some soil and some of them die and decay, creating more soil for their successor.

By the third year, small herbaceous plants may be present. These in turn help to change the habitat by overshadowing the smaller plants, causing them to die out and dropping their leaves, and thus making the soil suitable for other organisms. As years pass by, more species come into the habitat, while some face out. Succession of species continues till the climax is reached. Then, bigger life forms like shrubs and trees are found growing.

**SECONDARY SUCCESSION**

Secondary succession is a succession that occurs when an area has not been totally stripped of soil and vegetation. It occurs more rapidly than primary succession because soil has already been formed. It also occurs when a farmer abandon old field. Secondary succession begins from an existing community which has been interfered with by man and other factors. Fire, drought and floods can cause secondary succession.

**EVALUATION**

1. Define pioneer community.
2. How is a stable community reached?

**DIFFERENCES BETWEEN PRIMARY AND SECONDARY SUCCESSION**

|  |  |  |
| --- | --- | --- |
|  | **PRIMARY SUCCESSION** | **SECONDARY SUCCESSION** |
| 1 | Starts on a bare surface | Starts on already colonized surface |
| 2 | It is slower or takes longer time to reach a climax community | It is faster or takes a shorter time to reach a climax community |
| 3 | Starts with lower organisms | Starts with fairly complex organisms |

**CHARACTERISTICS OF SUCCESSION**

* Plants form pioneer organisms being the producers
* The number of organisms is usually increased from year to year until a climax is reached.
* Diversity of organisms species increase from year to year.
* Succession is orderly and progressive starting with microscopic green plants and ending with big trees.
* Each generation of species alters the habitat by making more soil, and when they die the soil becomes more fertile.
* There is competition among organisms in that the various species present compete for the available resources such water, CO2, O­­2, light and space. The plants that are more able to compete displace other.
* Changes in species composition as the fittest survive and the unfit fade out.

**OUTCOME OF SUCCESSION**

* Changes in the physical environment due to structural changes of the species and the activities in the community.
* Simple organisms which start the succession are usually replaced by more complex ones in an evolutionary trend
* Equilibrium point is attained through colonization of abandoned farmland by a wide variety of organisms
* The final outcome of succession is the climax or stable community.

**GENERAL EVALUATION**

* 1. What is ecological succession?
  2. Write short note on primary succession
  3. Differentiate between primary and secondary succession.
  4. Define stable community.
  5. State the outcome of succession.

**READNG ASSIGNMENT**

College Biology, chapter 23, pages 537-540

**WEEKEND ASSIGNMENT**

**SECTION A**

1. The change which occurs during ecological succession is A. sudden B. rapid C. gradual D. no change
2. The pioneer community include any of the following except A. spirogyra B. water weeds C. trees D. lichen
3. All these except one serves as the basis of primary succession A. already colonized habitat B. bare ground C. bare body of water D. bare rock
4. The following except one are false about secondary succession A. starts on a bare surface B. It is slow C. starts with fairly complex organism D. takes longer time to reach climax community
5. One of these is a pioneer organism. A. Lichen B. liverwort C. Conifer D. Grass

**SECTION B**

1. State five characteristics of ecological succession.
2. (a) State the two types of ecological succession
3. Differentiate between the two successions.

**WEEK EIGHT**

**OVERCROWDING AND FOOD SHORTAGE**

**CONTENT**

* Overcrowding
* Factors Causing Overcrowding
* Effects of Overcrowding
* Adaptation to Overcrowding
* Food Shortage

**OVERCROWDING**

This is a situation in which a population increases beyond a point called the carrying capacity where the resources (e.g. food and space) are not enough to support all the individuals in thepopulation. Therefore, overcrowding reduces the food and space available for individual

species in the population.

**FACTORS CAUSING OVERCROWDING**

1. Natality: An increase in the rate at which a particular species gives birth in a restricted area results in overcrowding.
2. Increase in food supply
3. Decrease in mortality: Overcrowding results when the rate of death of organisms in a habitat is lower than the rate of birth.
4. Immigration: Inflow of individuals into a habitat increases the population which later causes overcrowding.
5. Lack of dispersal of fruits or seeds of plants.
6. Social habits of animals like termites, ants and bees lead to their multiplication in the colony.
7. Inadequate space

**EFFECTS OF OVERCROWDING**

These include:

1. Shortage of food since the available food in the habitat in the habitat is rapidly eaten up due to overcrowding.
2. Shortage of space due to increasing population of species.
3. Competition occurs as the organisms struggle for scarce resources e.g. food, space. The stronger ones get the resources while the weaker ones are deprived i.e. survival of the fittest.
4. Anti-social behaviours like fighting or cannibalism can result from the stress of overcrowding.
5. Easy spread of diseases e.g. tuberculosis in human (air-borne).
6. Preying or feeding on each other when food is in short supply.
7. Death of organisms as weaker organisms in overcrowding area easily dies off due to lack of food and space.

**ADAPTATION TO AVOID OVERCROWDING**

In order to survive overcrowding, plants and animals have developed the following adaptive features:

1. **TERRITORIAL BEHAVIOUR**

Animals like mammals, lizards, birds etc establish territories which they are possessive of. They fight for and defend the territories against any intruders. A successful claim of the territory ensures sufficient food, space mating partners and parental care for the organisms.

1. **SWARMING**

This is exhibited by some social animals such as termite and bees when some of them move out from an old colony to a new one. Hence, overcrowding is avoided.

1. **EMIGRATION**

This is the outward movement of animals out of their locality to anther place of settlement. This prevent overcrowding.

1. **DISPERSAL OF SEEDS AND FRUITS**

This could be by water, wind, animals, insects and explosive mechanism. The seeds and fruits are carried far away from the parent plants. Hence, overcrowding is prevented.

1. **FORMATION OF CANOPIES**

This is an attribute of forest trees. This helps the plants to trap enough sunlight and also prevent the shorter plants below from getting the light. The lower plants

eventually die off and overcrowding is avoided.

1. **PRODUCTION OF CHEMICALS**

Roots of some plants produce chemicals which prevent the growth of other plants close to them. Therefore, overcrowding is avoided.

**FOOD SHORTAGE**

In a well established habitat, population sizes of various species are adjusted to the quantity of food that is available in the habitat. Factors that can decrease the food supply to the habitat thereby causing food shortage are as follows;

* Natural disaster like flood, drought
* Diseases of plants and animals
* Pests such as locust, grasshoppers, weevils
* Lack of or inadequate storage facilities
* Bush burning which destroys soil organisms reduces soil fertility and exposed the soil to erosion.

All these result in poor yield and eventual food shortage

**EFFECT OF FOOD SHORTAGE ON POPULATION SIZE**

1. Competition: - Scarcity of food leads to struggling among organisms for any available food. This results in the survival of the fittest. This can result in fighting and cannibalism (animals feeding on themselves e.g. man)
2. Emigration: - Animals also move from an area of food shortage to where sufficient food is available.
3. Decrease in the rate of reproduction: - Many human beings and marriage due to lack of or inadequate food supply may engage in family planning to reduce the number of children to be catered for.

**GENERAL EVALUATION**

1. What is food shortage?
2. Outline four factors that cause food shortage.
3. State three causes of food shortage.
4. State two outcomes of succession.
5. Discuss five adaptive features of organisms used to survive overcrowding.

**READNG ASSIGNMENT**

College Biology, chapter 23, pages 541-544

**WEEKEND ASSIGNMENT**

**SECTION A**

1. The following except one results from food shortage A. Competition B. Reduced mortality rate C. Emigration D. Increased mortality rate.
2. Food shortage makes the population size A. increase B. decrease C. stabilize D. fluctuate
3. Food storage results in A. stability of price B. Natural disaster C. high natality rate D. overpopulation
4. These are methods of storing and preserving food except A. Silos B. barns C. refrigeration D. Marketing.
5. These are forms of adaptation to avoid overcrowding except A. Pairing B.Territoriality C. Swarming D. Canopy

**SECTION B**

1. (a) What is overcrowding?

(b) State five effects of overcrowding.

2. State five ways of improving crop yield.

**WEEK NINE & TEN**

**BALANCE IN NATURE AND FAMILY PANNING**

**CONTENT**

* Dynamic Equilibrium in Nature
* Factors Affecting Population
* Abiotic Factors Affecting Population
* Biotic factors affecting Population
* Family planning and birth control

**DYNAMIC EQUILBRIUM IN NATURE**

When population-influenced factors (abiotic and biotic) are favourable, growth is promoted but when they are unfavourable growth is retarded. A factor which limits the population growth is called a **LIMITING FACTOR**. The sum of all the limiting factors is known as **ENVIRONMENTAL RESISTANCE**

The net effect of the abiotic and biotic factors is at a point, the population size of living organisms tends towards a dynamic equilibrium known as **BALANCE IN NATURE.** When the population increases, the environmental resistance increases too. For instance, food decreases in a population and this results into competition which later leads to the death of the weaker organisms, thereby keeping the population relatively constant

**FACTORS AFFECTING POPULATION OF ORGANISMS**

**Population** is the total number of organisms of the same species living together in a given area at a particular time. In an ecosystem, the community is made up of many populations of different species of organisms. When various population or biotic community of an established ecosystem is generally stable, such a community is said to be balanced.

The various factors controlling the population of organisms in a particular habitat are generally referred to as **ENVIRONMENTAL RESISTANCE**. These factors can be grouped into two;

* Abiotic factors
* Biotic factors

**ABIOTIC FACTORS AFFECTING A POPULATION OF ORGANISMS**

These include heat, water, space, light and nutrients.

1. **HEAT**: Organisms do run away from hot environment because heat can cause stress or death.
2. **WATER:** The availability of water determines the survival rate of organisms in any population. Therefore water availability increases the population while lack of it causes a decrease in population.
3. **SPACE:**  This is important for normal growth and development. Lack of space results in overcrowding and competition among the organisms.
4. **LIGHT:** This is of utmost importance in plant community. Without light producers may not be able to manufacture food needed by all organisms in the habitat. Low light intensity also results in weak plants which adversely reduce the quantity of food.
5. **NUTRIENTS:** To manufacture their food, plants require nutrients in the soil. Lack of these nutrients leads to deficiency symptoms noticed in plants e.g. stunted growth. This eventually results in poor yield of crops.

**EVALUATION**

1. What is limiting factor?
2. How is balance reached in nature?

**BIOTIC FACTORS AFFECTING A POPULATION OF ORGANISMS**

These are activities of organisms affecting other organisms and they include food, competition, natality, mortality, dispersal, parasite, predators and pathogen.

1. **FOOD**: This is the basic material required for survival of the organisms, for their growth and development and reproduction.
2. **COMPETITION**: This arises among organisms due to lack of space, food and other resources in the environment. Competition aggravate into fighting and cannibalism among animals.
3. **NATALITY:** This is the rate of birth. High birth rate increases population and results in overcrowding.
4. **MORTALITY:** This is the rate of death. Low death rate increases population, but high death rate reduces it. With low death rate there will be food shortage and overcrowding.
5. **DISPERSAL**: Among plants, seeds and fruits dispersal through water, wind, animals and insects reduces the chances of overcrowding. This in turn prevents overpopulation.
6. **PARASITE:** These are organisms that feed on or in another organism (the host). Their action can cause damage or death of the host, thus reducing the population.
7. **PREDATORS**: These are organisms which feed on weaker ones (the prey). If predation is high, it reduces the population of the prey.
8. **PATHOGEN**: These are disease causing organisms e.g. bacteria, viruses, fungi, protozoa. Their actions affect the health of other organisms. The population of the host organisms is thus reduced when the pathogenic attack is high.

**EVALUATION**

1. List the abiotic factors affecting the population of organisms.
2. What is the difference between limiting factors and environmental resistance.

**FAMILY PLANNING AND BIRTH CONTROL**

In nature, biological equilibrium is attained by predator-prey relationship. However, this is achieved in human beings by family planning and birth control. **Family planning is a device by which couples determine the number of children they want and when they want them.**

Birth control refers to the method used to prevent a woman from becoming pregnant for as long as she wishes.

Without family planning, the population of a nation can rise indiscriminately and may not be able to match the available food and other resources. Famine and death can eventually result.

Family planning is all about prevention of pregnancy and not termination of life. Carefully planned family planning prevents unwanted pregnancies. The birth control or family planning devices include the following;

* Use of condom
* Sterilization
* Spermicides
* Intra-uterine device (IVD)
* Contraceptive pills or injection
* Rhythm method
* Withdrawal method

**GENERAL EVALUATION**

1. What do you understand by environmental resistance
2. List the abiotic factors affecting the population of organisms.
3. State five of the biotic factors affecting the population of organisms.
4. Differentiate between family planning and birth control.
5. State five devices that can be used in family planning

**READNG ASSIGNMENT**

College Biology, chapter 23, pages 542-544

**WEEKEND ASSIGNMENT**

**SECTION A**

1. Population means …………. A. number of organisms in an habitat B. total number of organisms of the same species C. total number of organisms of different species D. total number of organisms
2. The biotic factors affecting population include the following except A. parasite B. predator C. water D. mortality
3. These are abiotic factors affecting population except A. space B. natality C. light D. nutrient
4. The least effective method of birth control is the use of A. pills B. condom C. spermicide D. withdrawal method
5. The activities of an organism which affect the survival of another organism in an habitat is referred to as ………… factor A. biotic B. abiotic C. edaphic D. climatic

**SECTION B**

1. a) What is population?

b) State six biotic factors affecting population of organisms

2. What is dynamic equilibrium?