FIRST TERM E-LEARNING NOTE

SUBJECT: BIOLOGY **CLASS: SS 3**

SCHEME OF WORK

WEEK TOPIC

1. Regulation of internal environment, structures and function of the kidney, diseases, effects and remedy.
2. Liver: – Structure, functions and diseases, Skin: – Structure, functions, diseases and care.
3. Hormones: - Location, secretion, function, effects of over-secretion and under-secretion.
4. Nervous co-ordination: - CNS component, structure and functions of the brain and spinal cord
5. The peripheral nervous system and the neurone.
6. Reflex and voluntary actions, conditional reflex.
7. Sensory organs: - Skin as a sense organ, organ of sight (The eye).
8. Organ of hearing, smell and taste.
9. Development of new organisms (Courtship behavior in animals, Stages in development of toad, insects)
10. Development of new organisms (Seeds, fruits in plants, Germination of seeds)

REFERENCES

- College Biology by Idodo Umeh
- Modern Biology for Senior Secondary Schools by S.T. Ramlingam
- Essential Biology by M.C Michael
- New Biology by H. Stone and Cozen
- SSCE, past questions and answers
- UME and CAMBRIDGE past questions and answers
- Biology practical text

WEEK ONE
REGULATION OF INTERNAL ENVIRONMENT

CONTENT

- Homeostasis, mechanism and structures of homeostasis
- Structures of the Kidney
- Functions of the Kidney
- Kidney diseases, effects and remedy

HOMEOSTASIS

Homeostasis is the process by which a fairly constant internal environment is maintained in an organism. The internal environment of an organism is made up of the body fluid such as blood, lymph and tissue fluid. For efficient functions of body cells and healthy growth, a living organism must be able to adjust to any change in the physical and chemical conditions of its body fluids. These conditions include temperature, PH, osmotic pressure, concentrations of dissolved substances and mineral ions.

MECHANISM OF HOMEOSTASIS

Homeostatic processes are control mechanisms which are used to detect and adjust to changes in the internal environment of the organism. These mechanisms usually include:

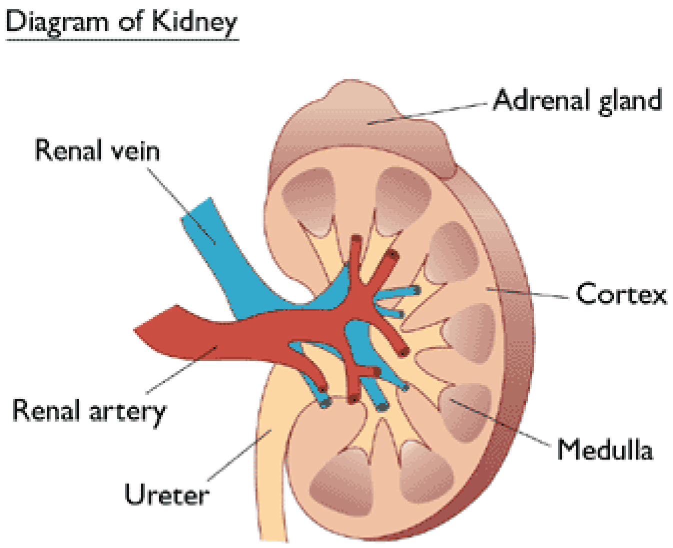
a. Sensory detectors which recognize a change in a given condition and stimulate the relevant body parts.
b. Effectors organs or glands which react and restore the normal state.

STRUCTURES FOR HOMEOSTASIS

Osmoregulation (homeostasis) in unicellular organism is ensured by the use of contractile vacuole. The main organs involved in homeostasis in multicellular organisms include; kidney, liver, skin, ductless glands (hormones) and the brain which has the overall control of the homeostatic process in the body.

EVALUATION
1. What is homeostasis? List four factors of homeostasis.
2. List four structures of homeostasis in multicellular animals

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.

FUNCTIONS OF THE KIDNEY

The kidney serves as the chief osmoregulator and excretory organ in the body of mammals, performing the following functions:

a. It removes toxic wastes and harmful substances.
b. It produces heat during cold.
c. It excretes nitrogenous wastes like urea.
d. It regulates water level in the body
e. It assists to regulate pH of the body.
f. It maintains salt or ion-balance in the body.

The first three are excretory functions while the last three are osmoregulatory functions of kidney

KIDNEY AS AN OSMOREGULATOR

Kidney is an osmoregulator by maintaining the water, salt and pH balance of the blood and this occurs in the distal tubules and collecting ducts of urinary tubules.

- WATER BALANCE

When the body is dehydrated (little water in the body) which results from drinking small quantity of water or losing water through sweat on a hot day, the osmotic pressure of the blood increased. The osmoreceptors in the hypothalamus detect the changes and stimulates the pituitary gland to secrete more antidiuretic hormone (ADH) which makes the walls of the urinary tubules more permeable so that more water is reabsorbed into the blood; therefore less water is lost from the body as concentrated urine.

When the body is hydrated (too much water in the body) which results from drinking large quantity of water or on cold days when we sweat less, the osmotic pressure of the blood is lowered and less ADH is secreted and the wall of the kidney becomes less permeable and more water is lost from the body as dilute urine.

- CONTROL OF BLOOD SODIUM IONS AND PH LEVEL

When the concentration of sodium ion in the blood is higher than normal, the excess is excreted. If it is lower, then more sodium ions are reabsorbed. This process is regulated by inhibiting or stimulating the secretion of the hormone aldosterone.
The normal pH of the blood is 7.4. When the pH becomes acidic, the hydrogen ions are excreted and when it becomes alkaline, the hydrogen carbonate ions are excreted.

EVALUATION
1. Outline five functions of the mammalian kidney
2. Describe how a kidney act as an osmoregulator

KIDNEY (RENAL) DISEASES, EFFECTS AND REMEDY
RENAL DISEASES
1. Nephritis: - This is the inflammation of the blood vessels (glomeruli) in Bowman's capsule of nephron caused by bacteria (streplococci). The blood vessels become porous and useful materials from the blood are leaked into the glomerular filtrate. Inflamed blood vessels can also be blocked as a result of accumulation of dead cells which can lead to kidney failure.
2. Diuresis: This is a condition in which large quantities of dilute urine are produced because the cells of the kidney tubules are not reabsorbing water from the glomerular filtrate. Diuresis is common in patients suffering from diabetics insipidus.
3. Kidney stones: These are stony masses of minerals and organic matter formed in the urinary tubules. Low water intake with high salt intake predisposes someone to this disease by causing crystallization of mineral salts which disturb the free flow of urine.
4. Dropsy (oedema):- This is a disease condition in which the cells of Bowman's capsule are unable to absorb water from the blood in the urinary tubules. This causes water retention in the blood or tissue and resulting swelling of some body parts

EFFECTS OF KIDNEY DISEASES
a. Presence of proteins and blood cells in urine (nephritis).
b. Swollen face and ankles resulting in constant weakness and sluggishness (oedema).
c. Excessive urination with resulting weight loss (diuresis).
d. Abdominal pain due to obstruction to passage of urine. Also, high blood pressure and bloody urine may result (kidney stone).
e. General body pains and fever (any of the renal disease)
f. High blood pressure, dizziness and fatique

REMEDY
a. Use of drugs e. g. antibiotics (nephritis), diuretics (oedema)
b. Kidney transplant (diuresis, nephritis)
c. Dialysis: use of dialysis machine (artificial kidney) to filter waste out of the patient's blood (nephritis).
d. Reduction in water intake (oedema)
e. Taking excess water, and avoiding excessive intake of food containing calcium (kidney stone)
f. Surgical operation called nephrectomy (kidney stones)

EVALUATION
1. List four kidney diseases and explain two
2. List four effects of kidney diseases and four remedy of kidney diseases

GENERAL EVALUATION
1. What is homeostasis? State three physio-chemical conditions of the internal environment of an organism.
2. Discuss briefly the mechanism of homeostasis.
3. Kidney is both excretory and osmoregulatory in its function." Explain

READING ASSIGNMENT
College Biology, chapter 9, page 186 - 198

WEEKEND ASSIGNMENT

1. The maintenance of a constant internal environment is referred to as (a) plasmolysis (b) diuresis (c) homeostasis. (d) glycolysis
2. All the organs below are homeostatic in function except (a) liver (b) kidney (c) food vacuole (d) skin
3. Which of the following is not a kidney disease? (a) oedema (b) hepatisis (c) nephritis (d) kidney stones
4. Which of the following is not one of the effects of kidney diseases (a) absence of blood cells in urine (b) oedema (c) high blood pressure (d) excessive urination.
5. One of the following is not a function of kidney. (a) Removal of poisons (b) maintaining salt balance (c) excretion (d) it regulates water level.

THEORY

1. Why do people urinate more on a cold day?
2. Explain briefly 'Dialysis

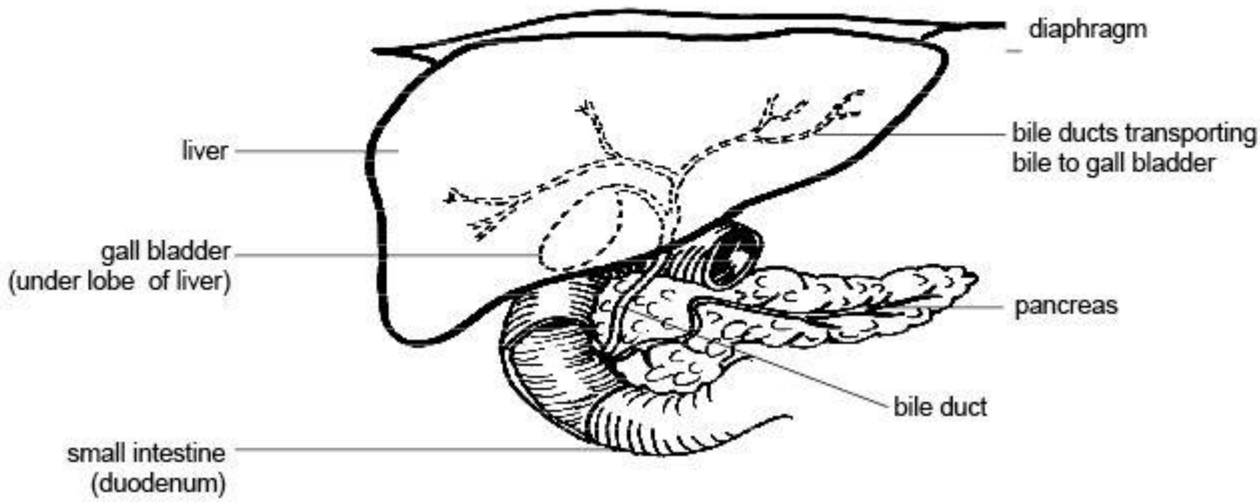
WEEK TWO

LIVER AND SKIN: STRUCTURE, FUNCTIONS, DISEASES AND CARE

CONTENT

- Structure and functions of the liver
- Diseases, effects and remedy of liver diseases
- Structure of the skin
- Functions, diseases and care of the skin
- Temperature regulation
- Control of body temperature

STRUCTURE OF THE LIVER



The liver is the largest organ in the body of a mammal with a weight of about 1.25kg. It is reddish brown, soft with two lobes and it is located below the diaphragm on the right side of the abdomen. It partly overlaps the stomach and has bile duct connecting it to the duodenum. The duct is attached to the gall bladder.

FUNCTIONS OF THE LIVER

1. Regulation of blood glucose level by converting excess glucose to glycogen under the control of the hormone insulin. With low glucose level, glycogen is converted to glucose under the influence of hormone, glucagon. Both insulin and glucagon are produced by the pancreas.
2. Regulation of blood protein. The body cells cannot store excess amino acids in the body. The liver therefore deaminates excess amino acids by breaking them down into amino group (converted to urea for excretion) and carboxyl group (converted to carbohydrates which are stored as glycogen)
3. Manufacture of essential blood proteins like fibrinogen, prothrombin, globulus etc which are involved in blood clotting.
4. Regulation of lipids by converting them to glucose.

5. Production of bile for emulsification of fats. The bile is stored in the gall bladder. (bile is 98% water and 2% bile salts, bilirubin, inorganic salts and cholesterol)
6. Storage of vitamins and minerals like iron, zinc, copper and potassium.
7. Storage of blood (up to 1,500 cm^3 of blood) and regulation of blood volume and pressure in general circulation.
8. Formation of red blood cells (RBC) in foetus and breakdown of RBC in adults.
9. Inactivation of hormones
10. Detoxification of poisonous and toxic materials like drugs, food preservatives and pollutants in air and water
11. Production of heat as a by-product of its numerous metabolic activities.

EVALUATION

1. Describe the structure of a liver
2. State six functions of the liver

DISEASES OF THE LIVER

These include diabetes, viral hepatitis, gall stones, cancer of the liver, and cirrhosis of the liver. Jaundice is a disease that may be due to the liver disease or some other causes.

1. **Diabetes:** This is caused by inability of the liver cells to convert excess glucose in the blood to glycogen due to the failure of the pancreas to produce the hormone insulin
2. **Viral Hepatitis:** This is inflammation and destruction of the liver cells by viruses.
3. **Gall Stones**: These are stony masses formed in the gall bladder or bile duct. These are mostly precipitation of cholesterol. The gall stones obstruct the flow of bile, subjecting the gall bladder to infections.
4. **Cancer of the liver:** This is uncontrollable outgrowth of liver cells which prevents liver from carrying out its normal functions.
5. **Cirrhosis of the liver:** This is a disease condition in which the damaged liver cells become replaced by useless fibrous tissues, making the liver firm and irregular. This can be caused by excessive drinking of alcohol and hepatitis.
6. **Jaundice**: caused by increase in the blood bilirubin level due to excessive breakdown of red blood cells observed in sickle cells or chronic malaria patients and obstruction of bile duct by gall stones or diseases of the liver. The symptom of jaundice is yellowing of skin or eye white.

GENERAL EFFECTS OF LIVER DISEASES

a. Weakness b. Jaundice c. Slight fever d. Oedema e. High blood pressure

REMEDY

The liver cells have the natural capacity of regenerating (dividing and producing new cells). The liver can therefore heal itself with the aid of the following procedures:

a. A long period of bed rest
b. Low fat controlled diet
c. Avoiding drinking alcohols.
d. Removing the cause of the disease e.g. gall stones.
e. Liver transplant can be done in progressive liver cirrhosis and cancer of the liver. A lobe of the liver can be donated while the remaining one soon regenerates.

EVALUATION

1. List five liver diseases and state four remedy of the liver diseases

STRUCTURE OF THE SKIN

The skin is the largest organ of the body which covers its entire surface. It is composed of an outer epidermis, an inner layer of dermis and a layer of subcutaneous fat under the skin (below the dermis). An average skin is between 1-2 mm thick.

Epidermis

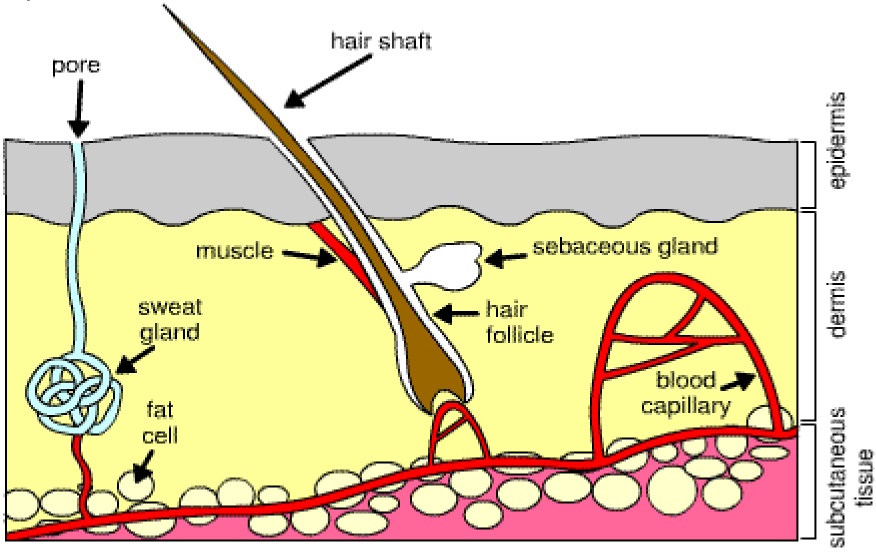
It is the outer upper part of the skin which consists of three layers, namely;

a. Cornified layer b. Granular layer c. Malpighian layer

CORNIFIED (HORNY) LAYER

This is the outermost layer of the epidermis which consists of fats, dead cells and keratin. Keratin makes the layer tough, flexible and water-proof; it prevents microbial entrance as well as reduces water loss from the body. The cornified layer is constantly wearing away and replaced from the granular layer below.

GRANULAR LAYER
It consists of living cells produced by the malpighian layer. These cells are continuously converted to cornified layer cells and keratin is deposited inside them and they lose their nuclei and become flattened in shape.



MALPIGHIAN LAYER
This is constantly dividing to produce new epidermis. Sweat glands, sebaceous glands and hair follicles are also produced from the epidermis. It contains the pigment melanin, which gives colour to the skin. It also has keratin, a protein which is responsible for the toughness and flexibility of the skin.

Dermis
It is composed mainly of connective tissues. These include;

a. **Blood capillaries** which supply food and oxygen and remove waste.
b. **Hair follicles.** The malpighian cells at the base of the skin keep dividing to produces long cylindrical hairs. When the hair is touched, the nerve endings in the follicle respond.
c. **Erector muscle** attached to each hair follicle. Its contraction and relaxation makes the hair to stand upright and flattens respectively when regulating the body temperature.
d. **Sebaceous gland** which secretes sebum which repels water and also prevents microbes from multiplying.
e. **Sweat gland** which continues as sweat duct and opens outside as the sweat pore. It absorbs water and salts from the surrounding capillaries which when release outside evaporate and cools the body.
f. **Sensory nerve endings** (skin, being a sense organ)
g. **Subcutaneous fat (adipose tissue)** which act as a long term food store and an insulating layer preventing heat loss from the body.

EVALUATION
List five structural parts of the skin and their functions

FUNCTIONS OF THE SKIN

1. Protection: The skin protects the body against dehydration, invading microbes, mechanical damages and poisonous chemicals.
2. Sensitivity: It controls receptors sensitive to heat, cold, touch and pressure in response to stimuli.
3. Temperature regulation: through vasodilation and vasoconstriction
4. Excretion: It removes excess water and nitrogenous waste (urea) from the body
5. Production of vitamin D using ultra-violent rays of the sun
6. Storage: store fats in the adipose tissues which forms an insulating layer

DISEASES

The diseases of the skin may be caused by viruses, bacteria, protozoa or fungi. These include chicken pox, measles, pimples, skin rashes, eczema, boil etc.

CARE OF THE SKIN

a. Taking bath regularly.
b. Eating balanced diet especially with vitamin A and B.
c. Use of deodorants and anti-perspirants which may control excessive sweating and unpleasant odour.
d. Regular exercise.
e. Wearing clean clothes.
f. Exposure to fresh air and UV rays (vitamin D)

EVALUATION

1. Outline five functions of the skin
2. List five skin diseases and five ways of caring for the skin

TEMPERATURE REGULATION

Mammals like human maintain a constant body temperature. This allows them to live in any type of weather, "arctic" or "tropic". Heat gained or loss from the body caused a rise or fall from the normal body temperature which is approximately 37^oC.
Hypothalamus monitors, receives information and stimulates processes for balance. When there is

Rise in body temperature which may be caused by hot weather, vigorous exercise, high fever or exposure to solar radiation. An increase in body temperature stimulates temperature receptors in the hypothalamus to send nerve impulses to the skin. These impulses stimulate processes that get rid of excess body heat. These processes include

- **Vasodilation**: - The expansion (dilation) of blood capillaries beneath the skin epidermis and relaxation of capillaries in deep layer of the skin. This allows more blood flow near the surface and heat is lost through the epidermis into the air by convection and radiation, thus reducing the temperature.
- **Sweating**: - Sweat glands are stimulated by nerve impulses to secrete large amount of sweat which evaporates and cools the body. Other mammals lose heat by (panting) i. e. evaporation of water through the mouth, nose and tongue.
- **Decreasing metabolic rate**: This minimizes heat production within the body.
- **Lowering of hairs: -** Erector muscles relax keeping the hair flat on the skin surface.

Fall in body temperature due to cold weather the following processes occur:

- **Vasoconstrictions:** The narrowing or contraction of the blood capillaries beneath the skin surface and expansion of those ones in deep layers. Less blood flows near the surface of the skin. Therefore, less heat is lost by convection and radiation, thus making the person looks pale and blue.
- **Shivering:** rhythmic contractions of skeletal muscles to produce heat.
- **Increasing metabolic rate:** The thyroid gland is stimulated by the hypothalamus to produce hormone thyroxine which increases the metabolic rate, hence more heat is produced especially by the liver
- **Raising of hairs:** Erector muscles contract to raise the hairs to trap air which is a bad conductor of heat.

EVALUATION

Describe four ways through which the skin can control a rise in body temperature.

GENERAL EVALUATION

1. What is (a) Deamination (b) Detoxification
2. Describe jaundice, stating three causes of it.
3. List five dermal structures and state their functions
4. Define (a) vasodilation (b) vasoconstriction
5. Describe the role of the liver in digestion and osmoregulation
6. Describe the homeostasis functions of the skin

READING ASSIGNMENT

WEEKEND ASSIGNMENT

1. The pigment in the malpighian layer responsible for skin colouration is known as (a) melanin (b) haemoglobin (c) haemoyanin (d) keratin
2. Which of the following specialized structures are stimulated by touch, pressure, pains heat and cold? (a) Receptor (b) synapse (c) cell bodies (d) muscle
3. The increase in width of the blood vessels in the mammalian skin at high temperature is known as (a) vasodilation (b) sweating (c) vasoconstriction (d) vasculation
4. Which of the following stimuli is not provided through the skin of mammals? (a) light (b) pressure (c) pain (d) touch
5. Which of the following parts of mammalian skin is directly involved in excretion? (a) Sebaceous gland (b) sweat gland (c) horny layer (d) blood capillaries

THEORY

Explain how skin acts as: (a) an organ of temperature regulation (b) an excretory organ.

WEEK THREE
HORMONAL CO-ORDINATION

CONTENT

- Hormones and endocrine glands
- Pituitary hormone
- Thyroid hormone
- Parathyroid hormone
- Pancreatic hormone
- Adrenal hormone
- Reproductive hormones
- Plant hormones
- Application of hormones to agriculture

HORMONES AND ENDOCRINE GLANDS

Hormones are chemical substances produced or secreted by endocrine glands (ductless glands) in response to various stimuli. Hormones are secreted into the bloodstream and circulated to exert their effect on their target organs. This effect could be to speed up or slow down biological reactions.

A few hormones like thyroxine and other growth hormones exert their effects on all body cells. A hormone can therefore be defined as a chemical messenger that is produced in one part of an organism and brings about a specific effect in a target organ some distance away. Hormones (usually needed in small amount) are active in homeostasis, growth and development. After their actions, hormones are inactivated in the liver and excreted in urine.

EVALUATION

1. What is hormone?
2. State four characteristics of hormones

ANIMAL HORMONES

There are basically five groups of animal hormones which are secreted by different glands

PITUITARY HORMONE

The pituitary gland can be found below the hypothalamus. It consists of anterior and posterior parts. Both parts of the pituitary gland release hormones. The anterior pituitary gland secretes growth hormones and several tropic hormones that regulate the activities of other endocrine glands through homeostatic mechanism. Hence, the pituitary is called "master gland". These hormones include

a. Gonadotropins i. e. follicle stimulating hormone (which cause the ovary to produce mature eggs and the testis to produce sperms) and lutenizing hormone (which causes ovulation in female and production of testosterone in by the testis)
b. Adrenocorticotropic hormone which stimulates the adrenal cortex to secrete corticosteroids
c. Thyroid stimulating hormones

d. Prolactin which stimulates the secretion of milk by the mammary gland
e. Somatotropin which stimulates the growth of long bones and increases metabolic rate in the cells. Growth hormones are produced during childhood and adolescence.

Over secretion of growth hormones in children causes gigantism while under secretion causes dwarfism.

The posterior pituitary gland produces

a. Anti-diuretic hormone (ADH)
b. Oxytocin which stimulates the contraction of the uterine wall and dilation of the cervix during parturition and milk letdown from the nipples.

EVALUATION

1. List four hormones secreted by the pituitary gland and their functions.
2. Describe how the pituitary act as the master gland

THYROID HORMONES

The thyroid gland is located in the region close to the larynx (the neck region). It produces three main hormones, the most important of which is thyroxine (others are triiodothyronine and calcitonin). Thyroxine

a. regulates the growth and development of all body cells.
b. increases the rate at which glucose is oxidized in the body cells and increases heat production as well.

Under secretion of thyroxine causes **cretinism** that is observed in physically underdeveloped and mentally retarded children, sluggishness and **goiter** in adults. Over secretion of thyroxine causes hyper activeness and restlessness.

PARATHYROID HORMONE

Parathyroid glands are attached to the thyroid gland and are observed as four tiny glands. The hormone, called parathormone raises blood calcium level by:

a. Releasing calcium from bone
b. Increasing calcium absorption in the gut.
c. Reducing calcium excretion by the kidney.

Calcitonin (a thyroid hormone) lowers the blood calcium level.

Over secretion of parathormone causes the bones to become fragile, soft and prone to fracture while under secretion causes muscle spasms.

EVALUATION

1. What is the effect of under secretion and over secretion of thyroxine?
2. List two parathyroid hormones and their functions.

PANCREATIC HORMONES

The pancreas is a digestive as well as an endocrine gland. Hence, it has both exocrine and endocrine functions. Most cells in the pancreas produce digestive enzymes. Among these cells are hormone – producing cells called <u>Islets of Langerhans</u> which produce two hormones, **insulin and glucagon.**

Insulin lowers the blood glucose level by stimulating the liver cells to convert excess glucose to glycogen for storage in the liver and muscles

Deficiency of insulin causes diabetes mellitus i. e. excretion of glucose in urine, less appetite and great thirst. Over secretion of insulin causes fall in blood sugar level and incessant hunger.

Glucagon raises the blood glucose level by stimulating the liver to convert stored glycogen to glucose.

ADRENAL HORMONES

The adrenal glands are located above the kidney and they produce two distinct groups of hormones. The adrenal cortex produces **corticoids** while adrenal medulla produces **adrenaline and noradrenaline** (the emergency hormones). Corticoids include; glucocorticoids (which raise blood glucose level during stress e.g. cortisol) and mineralocorticoids which regulate the levels of sodium and potassium ions in body fluids e.g. aldosterone increases sodium ions absorption.

Adrenalin as an emergency hormone prepares the body for immediate action in time of fright, danger and anger by

a. increasing muscular tone

b. increasing heart beat rate and respiration
c. aiding pupils dilation
d. increases the rate of conversion of glycogen to glucose by the liver

Under secretion of adrenalin results in slow response to emergency, low blood pressure and heart beat while over secretion results in over anxiety and excitement.

EVALUATION
1. Describe how adrenaline act as an emergency hormone
2. What are the functions of pancreatic hormones?

REPRODUCTIVE HORMONES

Certain cells in the reproductive organs produce hormones. The testes produce testosterone, the male sex hormone and the ovaries produce oestrogen and progesterone (female sex hormones). Sex hormone production begins at puberty (a period in late childhood, between 10 and 14 year of age), then the production of sex hormone is greatly increased, causing the body to grow rapidly and change into a sexually mature form.

The production of sex hormones is stimulated by gonadrotropic hormones secreted by the pituitary gland

Male sex hormone, testosterone stimulates:
a. the growth and maturation of the penis, testes and accessory sex structures.
b. the development of male sex characteristics such as muscular body, growth of hair in the pubic region, armpit, chest and the face and deepening of the voice.

Female sex hormone **oestrogen** which performs the following functions.
a. brings about the development of secondary sexual characteristics such as the enlargement of the breasts, growth of hair in the pubic region and armpit, widening of hip and fats distribution.
b. regulates the reproductive or menstrual cycle.

Progesterone
a. inhibits egg production (ovulation) during pregnancy
b. prepares and maintain the lining of the uterus
c. aids implantation and development of the embryo in the uterus

Over-secretion of reproductive hormones causes excessive development of sexual organs and abnormal urge for sex while under-secretion results in poor development of secondary sexual characters, sexual organs and low urge for sex.

EVALUATION
1. List three reproductive hormones and their functions
2. Describe how female sex hormones controls the reproductive cycle

PLANT HORMONES

Co-ordination in plants is simpler than in animals. It is ensured by chemicals known as plant hormones. These are similar to animal hormones in that they are:

a. only needed in small amount to bring about their effects.
b. produced in one part of the body and transported to another part where they exert their effects.

Animal hormones are produced in specific glands and bring about response in specific target organs. In plants, hormones are not produced in tissues specialized for their production. Their effects are also more general varying with concentration and types of organs. Plant hormones stimulate or inhibit growth in the target tissues in response to external stimuli such as light, temperature, gravity and touch. These substances are known as plants growth hormones, but they affect other activities such as fruits formation, roots development and leaf fall. Combination of plant hormones brings about responses that are different from what each hormone will produce alone. This type of interaction is also common in animals. The responses of plant hormones are usually much slower than most of animals. This is because responses in plants are mainly brought about by growth.

TYPES OF PLANTS HORMONE

One of the most important groups of plants hormones are **auxins**. Other groups include gibberellins, cytokinins, abscisic acid and ethene (ethylene).

AUXINS

The most important naturally occurring auxin is indoleacetic acid (IAA). It is produced at the apices of a shoot and it is transported in one direction away from the tip. It moves across short distance by diffusion and longer distance through the phloem. Auxin influences cell division, elongation and differentiation. It

a. influence the growth of stem towards light (positive phototropism) and root away from it (negative phototropism). Similarly, it causes the growth of roots towards the force of gravity (geotropism).
b. stimulates the development of lateral and adventitious roots for increased water and mineral absorption.
c. causes apical dominance by inhibiting the growth of lateral buds
d. promotes the development of fruits.
e. breaks dormancy in seeds ensuring early germination
f. delay leaf fall

GIBBERELLINS

These plant hormones are found in root and stem apices. They promote growth by stimulating both cell elongation and cell division. They also stimulate growth in dwarf varieties. Other effects of gibberellins include

a. Inducing dormant seeds to germinate
b. Causing dormant auxiliary buds to grow
c. Increasing fruit size.

CYTOKININS
Cytokinins are produced in roots. They are also growth promoting hormones like auxins and gibberellins. Together with auxins, they stimulate cell division so that stems and roots grow normally. Unlike auxins, they stimulate the lateral buds to grow into branches. They delay ageing in plants.

ABSCISIC ACID
This hormone is produced in mature green leaves, fruits and root caps. It is a growth inhibitor whose effects generally oppose both auxins and gibberellins. It:

a. suppresses the growth of bud.
b. induces dormancy
c. brings about ageing in leaves.
d. controls the opening and closing of stomata.

The effects of abscisic acid enable the plants to withstand severe environmental condition.

ETHENE
This is a simple hydrocarbon which is produced in leaves, stems and young fruits. It retards lateral bud development and hastens the ripening of fruits.

EVALUATION

1. List four plants hormones and their functions
2. Describe how auxins act as growth hormone in plant

APPLICATION OF HORMONES TO AGRICULTURE
Natural plant hormones and synthetic ones are used in horticulture and agriculture. The uses are:

a. Artificial vegetative propagation: Auxins are used in rooting powders which are applied at the end of cutting to induce root formation. Synthetic auxins are used to knit together parts of plants after grafting by inducing wound tissue formation.
b. Weed control: The synthetic auxin is used as a selective weed killer (herbicide) e. g. 2, 4 – D
c. Harvesting: Auxins are used to ensure a longer stay of fruits on the plants.
d. Parthenocarpy: Auxin and gibberellins causes flowers to develop into fruits without fertilization
e. Preservation: Cytokinins used in storing vegetables prevent yellowing. Growth inhibitors (abscisic acid) are used to prevent onions and potatoes in stores from sprouting.

EVALUATION
Outline five applications of plant hormones to agriculture.

GENERAL EVALUATION

1. What are hormones?
2. What are ductless glands
3. Outline five general functions of hormones
4. Discuss the exocrine and endocrine functions of the pancreas
5. Describe how the female sex hormones controls the reproductive cycle
6. In two ways, show how plant and animal hormones are similar.
7. State four differences between hormonal coordination in plants and animals
8. How relevant are plant hormones to agriculture

READING ASSIGNMENT
College Biology, chapter 13, page 244 - 250

WEEKEND ASSIGNMENT

1. Which of the following statement is correct? Hormones are (a) secreted into the blood through ducts (b) secreted directly into the blood stream (c) inactive chemical substances in the blood stream (d) not important
2. The pituitary is called "master glands" because (a) it is located in the brain (b) its secretions are more numerous than any other glands. (c) it secretion controls other glands (d) it is used in mastering learning.
3. The condition known as cretinism is caused by the deficiency of (a) thyroxine (b) adrenaline (c) vitamin A (d) oxytocin.

4. Auxins are produced in the (a) apical region of roots and shoot (b) edges of leaves (c) epidermis of roots (d) epidermis of shoots.
5. All these are plant hormones except (a) thyroxine (b) auxins (c) abscisic acid (d) ethylene

THEORY

1. State six effects of adrenaline as an emergency hormones on body organs
2. In a tabular form state the gland, location, functions, effects of undersecretion and over secretion of (a) thyroxine (b) insulin (c) somatotropin

WEEK FOUR
NERVOUS CO-ORDINATION

CONTENT

- The nervous system
- The central nervous system.
- The brain (components, descriptions and functions)
- Structure and functions of the spinal cord

THE NERVOUS SYSTEM

The nervous and hormonal systems co-ordinate various biological activities in the body of multicellular animals, the basic structural unit of nervous system is the nerve cell called **neurone**. It consists of a dense, cell body and protoplasmic processes called **nerve** fibres. A bundle of long nerve fibre is called a **nerve.** The main mechanism of information transfer is electric impulses known as **nerve impulses** along the nerve fibres.
All the nervous systems in complex animals have the following:

a. The central processing region (the brain)
b. The nerves bringing impulses from receptors to the brain.
c. Nerves carrying information from the brain to the effectors.

Sensory receptors detect stimuli from the external and internal environment and so act as information collectors. They are often found in the sense organs. Effectors include muscles and glands that go into action on receiving nerve impulses from the brain. Such actions include muscular contraction, enzymes production, hormone secretion etc.
The nervous system is divided into the central and the peripheral nervous systems

CENTRAL NERVOUS SYSTEM (CNS)

The CNS consists of the spinal cord and the brain which are enclosed protectively within the vertebral column and the skull respectively. The CNS, in coordinating biological activities, receives a constant input of impulses which keep it informed of changes in the animal's internal and external environment.
Impulses to the CNS from receptors are transmitted along sensory nerves and are therefore known as sensory impulses. Those impulses from the CNS to the effectors are known as motor impulses since they are transmitted along motor nerves.

THE BRAIN

An average- sized brain for an adult weight is 1.2 - 1.4kg. the brain consists of thousands of neurones enclosed in the skull and covered by three layered membranes i. e. meninges (outer dura, middle arachnoid and inner pia matter). The ventricles between layers of the meninges are filled with cerebrospinal fluid. The brain consumes about 25 percent of the body's oxygen supply. The brain has three regions, the forebrain, middle brain and hindbrain.

FOREBRAIN

This is the most predominant part of the brain, connected with intelligence and speech. It comprises of three major parts; cerebrum, thalamus and hypothalamus.

Cerebrum

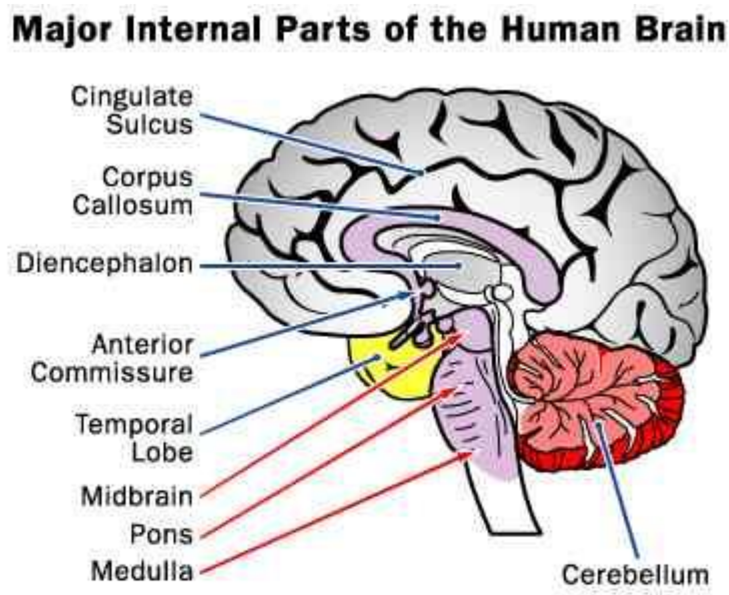
This occurs in two halves, connected together through fibres called corpus callosum. The halves are called the cerebral hemispheres. Each hemisphere is made up of four indistinct lobes which are frontal, parietal, temporal and occipital. The most active region of the cerebrum is the outer layer called cerebral cortex which is made up of grey matter. The cortex is highly convoluted for increased surface area. The more convoluted the cortex, the more the cerebral capacity. The cerebrum carries out its functions with each area specializing in a particular activity. Cerebrum

a. control all voluntary actions.
b. it receives sensory information, processes it and sends the response through the motor neurones to the effectors.
c. it is the seat of consciousness, memory, learning, intelligence, reasoning and judgement

Thalamus
This is oval in shape and acts as a relaying center. Thalami
a. receives sensory information from lower parts of the brain and the spinal cord, integrate it and pass it to relevant regions of the cerebral cortex.
b. it helps to experience sensation.

Hypothalamus
This is the region below the thalamus. It
a. controls the pituitary gland
b. it acts mainly in the body **homeostasis** i. e. controls body temperature, water balance and blood pressure
c. it also controls emotion e.g. anger, fright, joy etc.
d. it controls appetite and speech

EVALUATION
1. Outline the component of the nervous system
2. State two functions of the cerebrum



MIDBRAIN
The mid brain connects the forebrain and the hind brain. it consists of optic lobes and the pineal body.
a. controls reflexes connected with sight and hearing
b. it is a link between the fore and the hind brain.

HINDBRAIN
The hindbrain consists of three parts; cerebellum, pons varolii and medulla oblongata.

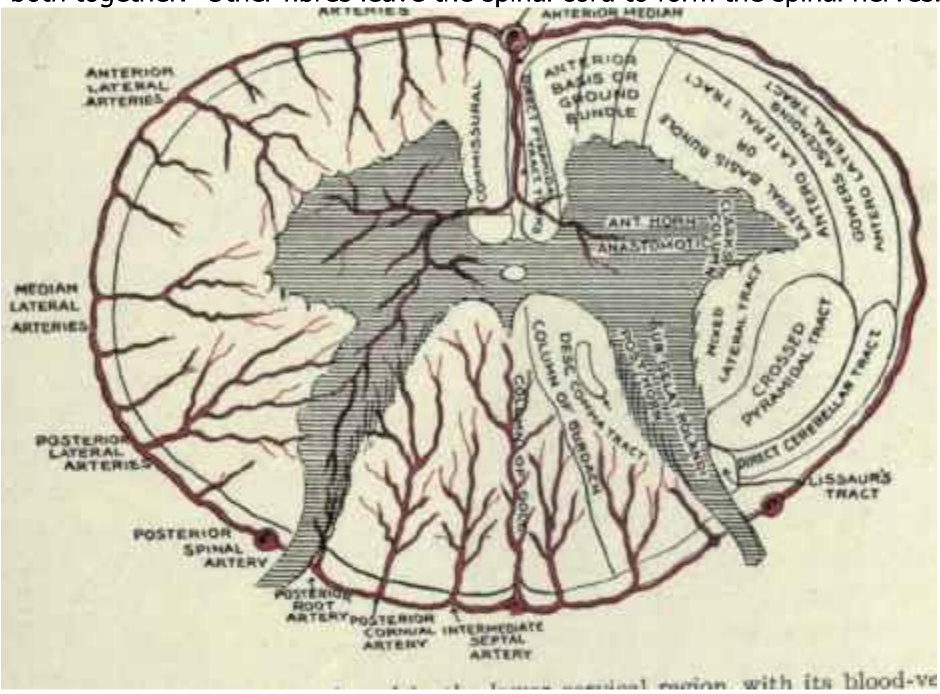
Cerebellum
It has three parts; a central part connected to two lateral parts through the pons varolii. The two lateral parts are called cerebellar hemispheres. The cerebellum
a. controls the body posture
b. coordinates muscular movement to maintain the body balance.

Medulla oblongata
This is the posterior end of the brain which continues into the spinal cord. Unlike the cerebellum and cerebrum, the medulla oblongata has an inner grey matter and at outer white matter. It
a. controls all involuntary actions e. g. yawning, blinking of the eye

b. controls involuntary movement of the body especially those involved in respiration, heart beat and digestion.
c. Regulate the blood pressure by controlling dilation and constriction of blood vessels.

EVALUATION
State two functions each of a. cerebrum b. hypothalamus c. cerebellum

THE SPINAL CORD (STRUCTURE AND FUNCTIONS)
The spinal cord consists of thousands of neurones which run down the length of the neural canal at the back of vertebrates. The spinal cord is enveloped within three layered membrane called meninges. A narrow canal, the spinal canal runs down the centre of the cord. The canal is filled with a fluid called **cerebrospinal fluid**.
The transverse section of the spinal cord shows a greyish region called the **grey matter** surrounded by a lighter region called the **white matter.** The grey matter is composed, practically of all the cell bodies of the neurones in the spinal cord. Since the cell bodies are dense, and granular, they give this region it typical greyish appearance. The white matter consists of the nerve fibres of these cell bodies. Some of these fibres run along the spinal cord to the brain connecting both together. Other fibres leave the spinal cord to form the spinal nerves.



The spinal cord functions in:
1. coordianting simple reflex actions such as knee jerk and automatic reflexes such as sweating.
2. It sends impulses to the to the brain and responses from the brain to the effectors

EVALUATION
Describe the structure and functions of the spinal cord.

GENERAL EVALUATION
1. Differentiate between forebrain and hind brain
2. What are meninges
3. State three functions of cerebrospinal fluid
4. Describe the brain
5. Differentiate between dorsal root and ventral root

READING ASSIGNMENT
College Biology, chapter 10, page 207 - 211

WEEKEND ASSIGNMENT
1. The fore brain is made up of the following except (a) cerebellum (b) thalamus (c) hypothalamus (d) cerebrum
2. The part of the brain that controls the body homeostatic is the (a) thalamus (b) medulla oblongata (c) hypothalamus (d) cerebrum

3. The human brain consumes ____ of the body oxygen supply (a) 10% (b) 25% (c)50% (d) 75%
4. The shock absorber fluid filling up the spinal canal and the brain ventricle is (a) intercellular fluid (b) cerebrospinal fluid (c) vertebraterial fluid (d) amniotic fluid
5. The band of fibres connecting the two halves of the cerebrum together is called (a) median fissure (b) pons varolii (c) corpus callosum (d) thalamus

THEORY

1. Explain briefly the dorsal root ganglion
2. Differentiate between cerebrum and medulla oblongata

WEEK FIVE
THE PERIPHERAL NERVOUS SYSTEM

CONTENT

- Peripheral nervous system
- Somatic and autonomic nervous systems
- The neurones (Structure and function)
- Classification of neurones
- Transmission of nerve impulses

THE PERIPHERAL NERVOUS SYSTEM

These include the sensory system (receptor and nerves leading from all parts of the body to the CNS) and the motor system (nerves running from the CNS to the effectors). The PNS consists of twelve **cranial nerves** (connecting the brain to the head and neck region) and thirty one **spinal nerves** (connecting the spinal cord to the thorax, abdomen and limbs).
The motor system is subdivided into somatic and autonomic nervous system.

EVALUATION
Differentiate between the cranial and spinal nerves

SOMATIC AND AUTONOMIC NERVOUS SYSTEMS

The SNS consists of motor (efferent) neurones that connect the CNS to each skeletal muscle. It serves the parts of the body which take part in responses to external stimuli and all voluntary actions.

The ANS consists of motor (efferent) neurones that connect the CNS to glands, smooth muscles and cardiac muscles. It regulates all the body's involuntary activities such as heart beat, respiratory movement e. t. c. The ANS is subdivided into sympathetic and parasympathetic nervous system which works in opposition to one another.

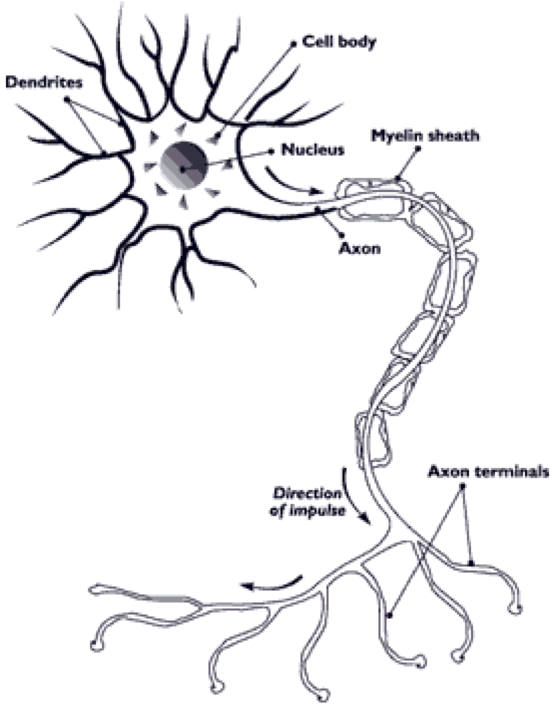
a. **Sympathetic nervous system** is made up of nerves which connect internal organs to the thoracic and lumber areas of the spinal cord. The effect of this nervous system dominates in times of emergency and exertion; it regulates homeostatic mechanisms such as vasodilation, vasoconstriction and secretion by sweat gland etc.
b. **Parasympathetic nervous system** is made up of nerves which connect internal organs to several cranial nerves and spinal nerves of the sacral region. The effect of this nervous system dominates during normal relaxed periods.

EVALUATION

1. Differentiate between somatic and autonomic nervous system
2. Differentiate between sympathetic and parasympathetic nervous system

THE NEURONES (STRUCTURE AND FUNCTION)

Neurones (nerve cells) are the basic structural and funtional unit of the nervous system and are responsible for transmission of impulses within the body.



Each neurone is composed of some basic parts namely:

a. a cell body (soma)
b. One or more short extensions or processes called DENDRONS each of which branches to form many DENDRITES.   .
c. a long process called axons which branch at the free end and terminate at the synaptic knobs.

The **cell body** may be oval, polygonal or star shaped with a large nucleus and dense granulated cytoplasm which give it its greyish colour. It relays impulses it receives from the dendrons to the axon.

The **dendrons** carry nerve impulses that their **dendrites** received to the cell body. The dendrites are the main receptive regions of the neurones and may be stimulated by sensory receptors and other neurones carrying impulses.

The **axons** carry electric impulses away from the cell bodies to the proper destination usually some distance away. The axon of a motor neurone going to a skeletal muscle may be several metres long. It may also divide into several branches so that impulses from one neurone go to several places. Sometimes, a fatty sheath known as **myelin sheath** surrounds the axon. The myelin is interrupted at intervals by constrictions known as **nodes of ranvier**. Myelin sheath acts as an electrical insulator. It also increases the speed at which impulses travel along the axon.

EVALUATION

Describe the structure and function of the neurone

CLASSIFICATIONS OF NEURONES

In vertebrates, it is common to group neurones according to their functions, these are:

a. Sensory (afferent) neurones which transmit impulses from the receptors to the CNS.
b. Motor (efferent) neurones which transmit impulses away from the CNS to the effectors (mus cles and glands).
c. Relay (association or intermediate) neurones which connect the pathways of sensory and motor impulses. They are found mainly in the central nervous system.

EVALUATION

Classify neurones based on functions

TRANSMISSION OF NERVE IMPULSES

Transmission of impulses along a neurone is by electrical (through a nerve fibre) and chemical (across a synapse) means. Three phases involved include

a. RESTING STATE: - A state when a neurone is not transmitting an impulse. In this state, the nerve fibre is electrically polarized with excess sodium ions (Na^+) outside the cell and excess potassium (K^+) inside the cell. Therefore the cell becomes positively charged outside and negatively charged inside.

b. ACTION STATE: - When the dendrites of a neurone receive impulses, the neurone becomes depolarized and the cell membrane suddenly permits the inflow of sodium ions and outflow of potassium ions. The cell body then transmits the impulse to its axon.
c. TRANSMISSION BETWEEN NEURONES: - Transmission here is by chemical means. When an impulse reaches the synapse, it stimulates the secretion of a chemical substance called acetylcholine which transmits the impulse to another neurone or muscle fibres.

EVALUATION
Discuss briefly the transmission of impulse by a neurone

GENERAL EVALUATION

1. Outline the nervous system graphically.
2. State five functions each of sympathetic and parasympathetic nervous system.
3. Differentiate between somatic and autonomic nervous system.
4. What is a neurone
5. Differentiate between afferent and efferent neurones

READING ASSIGNMENT
College Biology, chapter 10, page 211 - 217

WEEKEND ASSIGNMENT

1. The muscle and the gland together are referred to as ______ a) receptor b) effector c) neurone d) sensory cell
2. A neurone that transmits messages from the sense organ to the central nervous system is a) sensory neurone b) motor neurone c) relay neurone d) effector
3. Which of the following is not a structural part of a typical neurone a) axon b) dendron c) cell body d) dendrite
4. Which of the following neurons has no myelin sheath a) afferent b) efferent c) relay d) motor
5. A point where one neurone connects with another is called a a) dendron b) myelin sheath c) synapse d) ganglion

THEORY

1. Give five examples of the antagonistic actions of sympathetic and parasympathetic nervous system.
2. State the functions of five structural parts of a typical neurone

WEEK SIX
REFLEX, VOLUNTARY ACTIONS AND CONDITIONAL REFLEXES

CONTENT

- Reflex and voluntary actions
- The reflex arc
- Differences between reflex and voluntary actions
- Conditioned reflexes
- Differences between hormonal and nervous coordination

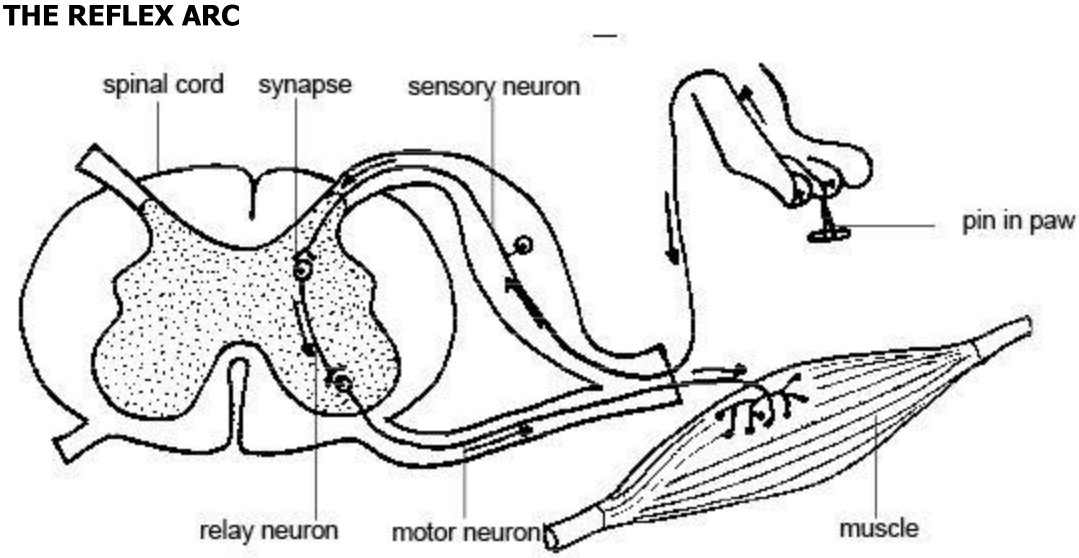
REFLEX AND VOLUNTARY ACTIONS

Actions are responses to stimuli. These actions are grouped into two: involuntary (reflex) and voluntary actions.

REFLEX ACTIONS

Reflex actions are automatic responses to stimuli which do not involve the conscious or higher centre of the brain. These actions are mainly protective, guarding us from dangerous stimuli and helping us to maintain posture and balance. Reflex actions include jerking of the legs, blinking of the eyes etc.

THE REFLEX ARC



The reflex arc involves the following:

a. the sensory receptors that receive the stimulus.
b. the sensory neurones along which the sensory impulse travels
c. the relay or intermediate neurone through which the sensory impulse is passed on.
d. the motor (efferent) neurones along which the response is transmitted.
e. the effectors (muscles and glands) which the motor impulses trigger to bring about an appropriate response.

Reflex actions can be:

1. Spinal reflex involving the spinal cord e.g knee jerk
2. Cranial reflex involving the brain e.g closing of pupil in the presence of bright light.

EVALUATION

1. Describe the pathway of a simple reflex arc.
2. What are reflex actions? Give five examples

VOLUNTARY ACTIONS

These are actions initiated and controlled by the conscious part of the brain, which involve thoughts before performance. They involve:

a. the conscious parts of the cerebrum
b. most of the reflex arc components
c. ascending and descending fibres in the spinal cord.

Examples of voluntary actions are playing football, solving mathematical problems, walking, driving etc.

DIFFERENCES BETWEEN REFLEX AND VOLUNTARY ACTIONS

REFLEX ACTION	VOLUNTARY ACTION
1. Actions does not involve higher centre of the brain (unconscious)	Actions involves higher centre of the brain (conscious)
2. Involves smaller number of neurones.	Involves numerous neurones.
3. Response is rapid	Response is slow
4. Response is stereotyped	Response varies with circumstances.
5, It is inborn	It can be learnt

CONDITIONED REFLEXES

A reflex action may be instinctive (does not have to be learned) e. g. sucking behaviour of newly born baby or conditioned reflex (learned responses or behaviour that can be performed without thinking about it) e. g. walking, riding a bicycle, writing e. t. c. A famous Russian biologist, Ivan Pavlon demonstrates what is meant by conditioned reflex using a puppy and associating its food time with the sound of a bell.

ROLES OF CONDITIONED REFLEX ON BEHAVIOUR

a. It helps us to acquire new skills by learning such habits.
b. It helps to modify many simple reflex actions because of conditions associated with them.
c. It helps us to behave in highly complicated manner (movements become faster and automatic.

EVALUATION

1. Differentiate between conditioned and instinctive reflex actions
2. What are voluntary actions? Give five examples

DIFFERENCES BETWEEN HORMONAL AND NERVOUS COORDINATION

NERVOUS COORDINATION	HORMONAL COORDINATION
1. Messages are transmitted as electrical impulses.	Messages are transmitted as chemical impulses.
2. Transmission is via nerve fibres.	Transmission is via blood stream.
3. Transmission is very fast	Transmission is slow.
4. Response is fast, shot-lived and precise.	Response is slow, long-lasting and widespread.
5. It is mainly controlled by the brain and the spinal cord.	It is controlled by the pituitary gland.
6. Effectors (muscles and glands) receive the message.	Target organs receive the message.

GENERAL EVALUATION

1. What do you understand by a) voluntary action b) reflex action
2. Give five examples each of a) voluntary actions b) reflex actions
3. Differentiate between voluntary and reflex actions
4. Give five examples conditioned reflexes
5. What are the roles of conditional reflexes on behaviour

READING ASSIGNMENT

College Biology, chapter 10, page 217 - 221

WEEKEND ASSIGNMENT

1. Automatic responses to stimuli which do not involve higher centre of the brain are referred to as ---------- actions a) voluntary b) reflex c) muscular d) nervous
2. Behavioural patterns acquired only through learning are referred to as a) reflex action b) conditioned reflex c) voluntary action d) learning
3. Which of these is not a conditioned reflex a) walking b) typing c) driving d) sneezing
4. Transmission in hormonal coordination is through a) blood stream b) nerve fibre c) lymph d) neurone
5. Which arrangement shows the correct pathway of impulse transmission
   a. Axon ----- cell body ----- dendrites ----- synaptic knob
   b. Dendrites ----- synaptic knob ----- cell body ----- axon

c. Dendrites ----- cell body ---- axon ---- synaptic knob
d. Cell body ---- dendrites ----- synaptic knob ---- axon

THEORY
1. Describe what happens when you accidentally picked up a hot object
2. Differentiate between instinctive and conditioned reflexes.

WEEK SEVEN
SENSE ORGANS

CONTENT
- Sensory receptors
- Skin as a sense organ
- The organ of sight**,** Structure of the eye
- Functions of the eye (Image formation and accommodation)
- Defects of the eye and their correction

SENSORY RECEPTORS

All living organisms respond to changes in their environment (stimuli). These changes can be mechanical, electromagnetic, chemical or thermal. Though most cells in the bodies of organisms are sensitive to stimuli, certain cells specialize in detecting a particular type of stimulus, these are called **sense cells or sensory receptors** which are quite many in human bodies, monitoring the internal environment.

Sensory receptors sensitive to mechanical changes are called mechanoreceptors likewise thermoreceptors, chemoreceptors and photoreceptors are sensitive to heat, chemical and light respectively.

The sensory receptors change the **detected stimulus into electrical impulses** which when received by the brain are translated into pictures, sounds, smell, taste sensations. Structures containing sensory receptors are referred to as sense organs

A **sense organ** is defined as a group of specialized cells or tissues or which are able to receive, perceive or detect stimulus and transmit the information to the central nervous system. There are five types of sense organs in mammals; these include

a. Skin detecting touch, pain, pressure and heat or cold.
b. Eye detecting light (sense of sight)
c. Ear detecting sound (sense of hearing and balancing)
d. Nose detecting smell
e. Tongue detecting taste

EVALUATION
1. What are sensory receptors
2. What are sense organs? List major sense organs and their functions

SKIN AS A SENSE ORGAN

In the mammalian skin, there are many sensory receptors for detecting several stimuli like touch, pressure, pain, cold and heat unlike other sense organs which detect one type of stimulus each.

Generally, sensory receptors are not evenly distributed through out the skin. Each type is more concentrated in certain body region.

Sensory nerves ending sensitive to pressure (called pacinia corpuscles) are found deepest in the skin. Hence they need stronger stimulation. Those sensitive to touch (meissner's corpuscles) are largely distributed closest to the skin surface (in the epidermis) especially in hairless regions like tongue, fingers, lips, forehead etc. hence they need a gentle stimulation. In between pressure and touch receptors are those detecting cold, heat and pain.

EVALUATION

List five sensory receptors in the skin and their functions

THE ORGAN OF SIGHT (EYE)

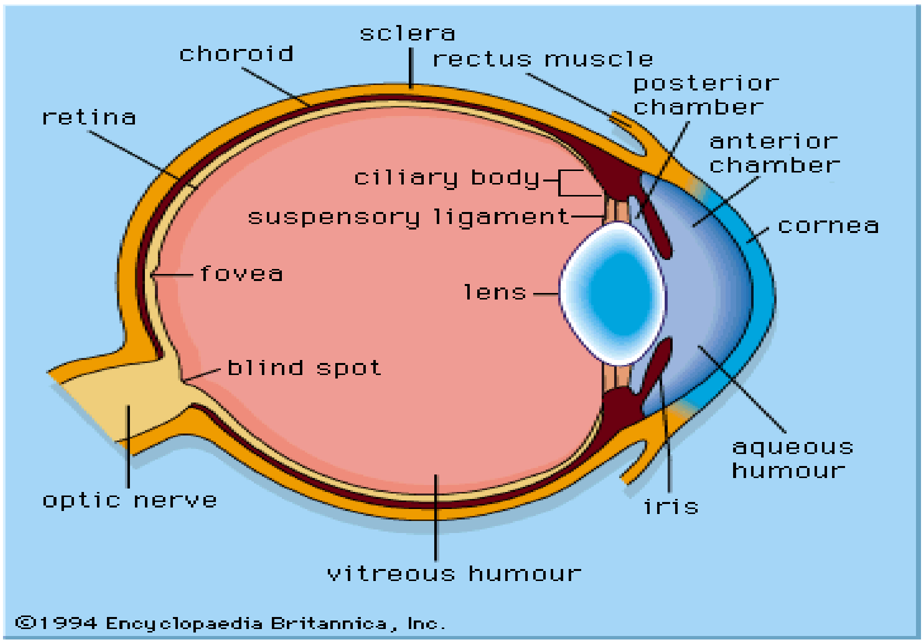
The eye is the organ of sight, spherical in shape and protected by occular or optical structures like eye sockets, eyelids, eyelashes, tear or lacrimal glands and conjunctiva.

a. The eye sockets house the eyes.
b. Eye lids (upper and lower) protect the eye from foreign particles or mechanical injury.
c. Tear or lacrimal glands, at the meeting point of the eyelids secretes a salty fluid called tear which washes dust and destroys bacteria using its chemical substance called lysozyme.
d. Eye lashes are rows of hairs on the eyelid which protect the eye ball from dust, excessive light and shield the eye against sweat and water.
e. Conjunctiva is a thin transparent membrane lining the inside of the eyelids and protectively covers the cornea. The conjunctiva gets inflamed during infection (conjunctivitis).

STRUCTURE OF THE EYE

The wall of the eye ball consists of three layers namely (from outside inwards): sclera, choroid and retina

a. THE SCLERA: - the outermost white layer which gives shape to the eye and protects the inner part of the eye. The sclerotic layer bulges out in front of the eye to form the transparent cornea. The cornea admits light into the eye, brings the light to focus on the retina and protects the eye externally.
b. THE CHOROID LAYER**: -** This is highly vascularized and pigmented (black). This layer provides food and oxygen to the cells in the eye. The black pigment helps to absorb light rays and prevents light reflection. It consists of the ciliary muscles, iris, pupils, suspensory ligaments and the lens.
   - IRIS**: -** a band of muscle fibres that contracts and relaxes to alter the size of the pupils thereby controlling the amount of light passing through the eye.
   - PUPIL: **-** This is the opening between the upper and lower Iris and it controls the amount of light which enters the eye. Bright light makes the pupil small while dim light makes it big.
   - CILIARY MUSCLE**: -** It consists of circular and radial muscles which contracts and relaxes to alter the focal length of the lens to focus near and distant objects.
   - SUSPENSORY LIGAMENTS: - Hold the lens in place
   - LENS: - This is a transparent biconvex elastic structure held in position by suspensory ligament. It helps to refract light rays entering the eye. It also makes fine adjustment to focus the image of an object on the retina.
c. THE RETINA**: -** This is the part of the eye sensitive to light. It is also vascularized, pigmented and elastic. Light rays come to focus on the retina. Images formed on the retina are always real, inverted, and smaller than the real object. Two types of sensory cells (photo receptors) found in retina are cones and rods.
   - **Cones** are cells in the retina, which are sensitive to coloured visions and high light intensities. They contain a photochemical substance called iodopsin which is not easily bleached by high light intensities.
   - **Rods** are more than the cones. They are sensitive to colourless vision and low light intensities. A purple pigment – protein complex made from vitamin A called rhodopsin is found on the surface of rods. Rhodopsin is easily bleached when light falls on it.



- YELLOW SPOT (Fovea centralis): - This is the most sensitive part of the retina from where the fullest visual information is sent to the brain. It is the point where image is focused.
- BLIND SPOT: - This is the point where the cells are not sensitive to light i.e no cones or rods here. The optic nerve goes out of the eye to the brain from the blind spot.
- OPTIC NERVES: This nerve transmits sensory impulses to and from the brain.
- AQUEOUS HUMOUR: - This is the transparent watery liquid which fills the space between the cornea and the lens. It is made up of solutions of protein, sugar, salt and water. This liquid refracts light rays onto the retina and helps to maintain the spherical shape of the eye.
- VITREOUS HUMOUR: - This is wider, transparent, jelly-like liquid which fills the space between the lens and the retina. It is also a mixture of protein, sugar, salt and water. It carries out the same function as the aqueous humour.

EVALUATION
1. List five ocular structures and their functions
2. State the functions of the following parts of the eye a) iris b) retina c) lens d) ciliary muscles

FUNCTIONS OF THE EYE
The eye performs two major roles; Image formation and accommodation.
1. Image Formation:-
Light rays from any object pass enter the eye through cornea, pass through the aqueous humour, lens and vitreous humour to the retina. These structures are all transparent and contribute to the refraction (bending) of the light rays thus enabling the rays to converge on the retina. The image of the object (real, inverted and smaller) is then formed on the retina. The stimulus of light reflected from the object is received by the rods or cones depending on the light intensity and are converted to electrical impulse. The impulse is transmitted through the optic nerve to the optic lobe of the brain which correctly interpretes the image. To form a sharp image of the object, all the light rays refracted meet at a particular point on the retina called yellow spot.
2. Accommodation:-
This is the ability of the eye to focus near and distant objects on the retina i.e. the ability to see clearly through the adjustment of the focal length of the lens.
TO SEE NEAR OBJECTS
1. The ciliary muscles contracts, making the suspensory ligaments relax their attention on the lens.
2. The lens then becomes more convex in shape thus reducing the focal length of the lens to focus the image on the retina.

TO SEE DISTANT OBJECTS
1. The ciliary muscles relax, making the suspensory ligaments contract and pulling on the lens.
2. The lens becomes flattened (elongated) increasing its focal length to focus the image on the retina.

EYE DEFECTS AND CORRECTIONS

An eye is defected when an image cannot be properly formed on the retina. The defects include;

a. **Short sightedness (myopia):** - This is a defect in which a person sees nearby object clearly but distant ones appear blurred because the eye ball is longer than normal (from back to front). Therefore, light rays from distant object are brought to focus in front of the retina. *CORRECTION:* - Using spectacles or glasses with suitable concave or diverging lens which diverge the light rays from a distant object before entering the eye so that the eye can bring the rays to a focus right on the retina.

b. **Long Sightedness (hypermetropia**) :- This is the defect in which a person sees far object clearly but near ones appear blurred because the eye ball is shorter than normal,. Therefore light rays from near object are brought to a focus behind the retina. *CORRECTION:* - Using spectacles or glasses with suitable convex or converging lens which converge the light rays from the near object before entering the eye so that the eye can bring the rays to a focus right on the retina.

c. **Presbyopia: -** This is an eye defect resulting when the lens and the ciliary muscle lose their elasticity with advancing age. Therefore, light rays from nearby object are not bent inward sufficiently and so are brought to a focus behind the retina. *CORRECTION:-* By the use of converging lens.

d. **Astigmatism: -** This is caused by uneven cornea surface and can be corrected by using lens with compensating uneven surface.

e. **Cataract:-** This occurs mainly in old people in which eye lens becomes cloudy and can be corrected with a plastic lens or spectacles with suitable lens.

f. **Night Blindness:-** This is due to deficiency of vitamin A

g. **Conjunctivitis:-** Inflammation of the conjunctiva caused by the bacteria or irritants in the wind.

EVALUATION

1. Describe two major eye defects and their functions
2. Describe the mechanism of image formation by the eye

GENERAL EVALUATION

1. What is a sense organ
2. What is a receptor
3. List four sensory receptors found in the skin and their functions
4. Compare and contrast the mammalian eye and the camera.
5. What are the advantages of having two eyes
6. Describe the visual condition 'colour blindness'

READING ASSIGNMENT

College Biology, chapter 11, page 222 - 229

WEEKEND ASSIGNMENT

1. Specialized cells for detecting stimuli are referred to as ______ which change the detected stimuli into _____________
2. Which of the following is false (a) sensory receptors are evenly distributed in the skin (b) the nose is human olfactory organ (c) both small and taste sensations are closely related. (d) choroid layer of the eye is highly vascularized.
3. The image of an object is formed on the ____ of the eye at a point called ____
4. All these are true about seeing a distant object with the eye except (a) the ciliary muscles relax (b) the suspensory ligaments relax (c) the lens becomes elongated (d) the suspensory ligament contract.
5. Converging lens is used to correct the following eye defects except (a)myopia (b) hypermetropia (c)presbyopia (d) long sightedness

THEORY

1. Explain why a person in a dark room feel dazzled for some seconds when suddenly exposed to bright light.
2. Differentiate between yellow and blind spots of the eye

WEEK EIGHT
ORGAN OF HEARING, SMELL AND TASTE

CONTENT

- The organ of hearing (Structure of the ear and their functions)
- Mechanism of hearing
- Mechanism of balancing
- Organ of smell (structure and function of nose)
- Organ of taste (structure and functions of the tongue

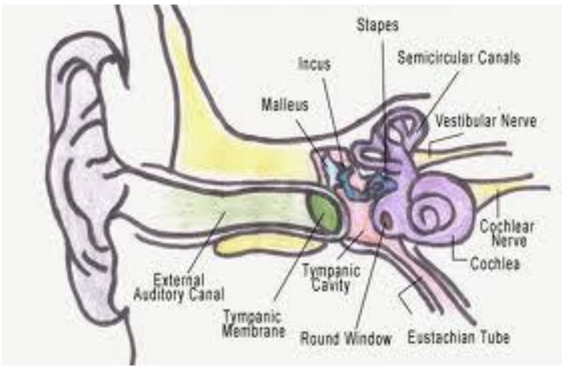
THE ORGAN OF HEARING

Mammals have two ears on each side of the head. The greater part of it is enclosed in the skull for protection. The ear is for hearing as well as for maintaining balance.

STRUCTURE OF THE EAR AND THEIR FUNCTIONS

The mammalian ear is divided into 3 parts.

1. The outer ear.
2. The middle ear.
3. The inner ear.



The outer ear

This is made up of the following from outside the organism:

a. **The Pinna: -** This is flexible being made up of soft cartilage covered with skin. The pinna collects sounds, detects their direction and directs them into the canal called external auditory meatus (ear tube).
b. **External Auditory Meatus:** - This consists of fine hairs and glands which produce wax. Therefore it prevents germs, insects and dusts from entering and affecting the ear. It allows the passage of sound waves from the pinna to the ear drum.
c. **The Tympanic Membrane (Ear Drum):-** This is a thin membrane which vibrates when sound waves get to it. It separates the external ear from the middle ear. Therefore, it transmits sound waves from the outer ear to the middle ear.

The middle ear

This is a small air-filled_chamber in the skull, which is made up of three tiny soft bones (ear ossicles) and Eustachian tube.

a. **Ear Ossicles: -** These include malleus (hammer), incus (anvil), and stapes (stirrup). The ossicles form a bridge linking the outer and inner ear through a membrane covered opening called round window. The ossicles transmit vibrations across the tympanic membrane to the oval window and the pressure in the window is magnified.
b. **Eustachian Tube:** - This is a narrow tube in the middle ear connecting it to the pharynx. This usually opens when yawning, it allows air to enter or leave the middle ear so that the air pressure on both side of the eardrum is equal.

The inner ear

This is made up of a bony complex passage way called bony labyrinth, which is filled with a fluid called perilymph. Inside the bony labyrinth are membranous sacs and tubes called membranous labyrinth filled with the fluid, endolymph.

The bony and membranous labyrinth forms the two auditory structures which include the cochlea and the semicircular canals. These two structures are connected to the utriculus and sacculus respectively.

a. **The Cochlea**: - a snail shell-like structure of hearing is concerned with hearing. It contains sensory hair cells (mechanoreceptors) which synapse with sensory neurones that form the cochlear nerves; they both form the organ of corti.

b. **Semi-circular canal:** - the three canals lie at right angle to one another, they have swollen ends called ampullae which contain sensory hair cells and otoliths (ear stones). These structures are concerned with balance and maintaining the posture of the body.

EVALUATION

1. Mention five structural parts of mammalian ear and their functions
2. Mention two sensory cells found in the ear

FUNCTIONS OF THE EAR

The two major functions of the ear is hearing and balancing.

Mechanism of hearing

The pinna detects and collects sound waves in the air and concentrates them and passes them on through the external auditory meatus. The wave causes the tympanic membrane to vibrate and the vibrations are passed on to the ear ossicles which amplify them. The oval windows magnify the vibrations, passing them into the inner ear (cochlea) where the perilymph and endolymph vibrate. The vibrations of the endolymph stimulate the organ of corti in the cochlea to convert the sound vibration to electrical impulse. The impulses then stimulate the auditory nerves of the acoustic branch to the brain for interpretation.

Mechanism of balancing

Head movement in any direction causes the fluid in the semicircular canals and the otoliths in the ampullae to move. Impulses are set up and transmitted through the vestibular branch of the auditory nerves to the brain for interpretation. The brain relays impulses to the body muscles for balancing the position of the body.

DISEASES OF THE EAR

The major disease of the ear is deafness. It can be temporary or permanent. It can be caused by damage to the tympanic membrane, eustachian tube or sensory cells in the cochlea. Also, wax blocking the ear canal, infection of the ear or sudden very loud or constant noise causes deafness.

Care of the ear

1. Regular use of cotton wool
2. Avoid the use of sharp object in cleaning the ear.
3. Avoid loud noise
4. Avoid being blown on the ear side that can damage the ear drum.
5. Consulting medical doctors in case of any ear problem.

EVALUATION

1. Describe the mechanism of hearing and balancing.
2. Outline five ways of caring for the ear.

ORGAN OF SMELL (NOSE)

The human olfactory organ is the nose. The epithelia lining of the nasal cavity is rich in sensory nerve ending. Compared to lower class animals like dog, man has a poor sense of smell. We detect smell quickly but for a short time.

MECHANISM OF SMELLING

Nose functions well when wet. The smell receptors are stimulated by chemicals. Particles of volatile chemical substances in the air dissolve in the mucus layer over the cell receptors in the nostrils. The stimulation of the receptors gives rise to nerve impulses which travel through the olfactory nerve to the olfactory lobe of the brain. The brain then interprets the kind of smell.

ORGAN OF TASTE (TONGUE)

The sensory cells for taste are called taste buds located on the tiny swellings on the exposed surface on the tongue. They are connected by four sensory nerves to the brain which interprets what is tasted. The tongue therefore is sensitive to four primary tastes:

a. Sweet taste: detected by chemoreceptors at the tip of the tongue.
b. b.Salty taste: detected by chemoreceptors by the side (frontal).
c. Sour taste: detected by chemoreceptors at the side of the tongue (towards the back).

d. Bitter taste – detected by chemoreceptors at the back.

MECHANISM OF TASTING

Chemicals from any substance put in the mouth dissolves in the saliva on the tongue, this stimulates the sensory nerve endings in taste buds which then pass the impulses to the brain for interpretation as sweet, bitter, sour or salty

NOTE: - Both smell and tastes are closely related sensations, hence we smell what we taste. When we eat and drink, the taste receptors are stimulated, at the same time flavour producing chemical from the food dissolves in the moist air in the mouth and flow into the nasal cavity to stimulate the smell receptors. The smell sensation is more severe than taste sensation.

EVALUATION

1. Draw the structure of the tongue to show the major sensitive areas
2. Describe the olfactory functions of the nose

GENERAL EVALUATION

1. State the advantages of having two ears
2. Discuss briefly two types of deafness
3. Draw a well labeled diagram of the tongue to show the areas that are sensitive to primary tastes
4. Describe the mechanism of smelling
5. State four functions of the organ of smell

READING ASSIGNMENT

College Biology, chapter 11 page 229 - 234

WEEKEND ASSIGNMENT

1. The following are parts of the inner ear except a) ampulla b) semi-circular canal c) cochlea d) ear ossicles
2. -------- helps to equalize air pressure on either side of the ear drum. a) sacculus b) Eustachian tube c) ampulla d) endolymph
3. The following are concerned with hearing except a) organ of corti b) semi circular canals c) cochlea d) acoustic nerve
4. Which part of the ear is responsible for the maintenance of balance a) cochlea b) perilymph c) semi-circular canal d) stapes
5. The inner ear is filled with -------- and --------- fluid

THEORY

1. Explain why a person that has been spinning feel dizzy for sometime after stopping.
2. State five causes of deafness

WEEK NINE

DEVELOPMENT OF NEW ORGANISMS

CONTENT

- Courtship behavior in animals
- Stages in development of toad
- Metamorphosis in insects
- Life histories of housefly and cockroach

COURTSHIP BEHAVIOURS IN ANIMALS

Courtship is a reproductive communication between males and females of a species that ends in sexual union. Courtship behaviours in animals include

1. PAIRING: - A form of courtship in which a compatible male and female separate themselves from other in a group to form a mating pair. Pairing occurs in human, toad, fish, winged termites etc.
2. DISPLAY: - A process involving fixed pattern movements or attractive exhibitions and responses between a male and a female which ends in mating. Examples of display include croaking in toads, dancing, singing in human, production of odour by females, stunning tail feathers of a peacock etc.
3. TERRITORIALITY: - A form of behavior in which a member of a specie marks out a fixed area and defend it against intruders of the same species. Usually males establish territories prior to mating. Territories are established by most vertebrates except amphibians.
4. SEASONAL MIGRATION: - Seasonal movement of animals from one place to another in connection with breeding, feeding and escaping unfavourable climatic conditions. Termites, birds, fish etc exhibit seasonal migration.

STAGES IN DEVELOPMENT OF TOAD

In toad, an amphibian and a vertebrate, **Courtship** takes place during rainy season when male toads make loud croaking noise to attract females which are swollen with eggs. The male later climbs the female back, holding her firmly with the thick parts on its thumbs. As the female lays her eggs, the male release its sperms on them (external fertilization). The developmental stages after fertilization include

1. **The egg stage**: - the eggs laid are enclosed in strings of jelly which perform the following roles: (i) Protecting the egg from mechanical damage (ii) Ensuring easy access to oxygen for survival (iii) Preventing microbial attack (iv) Preventing the egg from drying up
2. **The zygote (fertilized egg) stage:** After fertilization the zygote formed undergo mitotic cell division for the embryo to emerge. The embryo gets its food from egg yolk and dissolved oxygen through the jelly.
3. **The young tadpole stage:** – The young tadpole emerges from the jelly after 1-2 days. The tadpole attaches itself to a water weed by a sticky substance secreted by its v-shaped cement gland (from under its head) The tadpole feeds on egg yolk (no mouth yet) and gets its dissolved oxygen through the skin .Developing eyes, ears and nostrils are seen with marked portion for mouth.
4. **The external gill stage:** – The young tad pole has a head, body and tail. Three external gills are found on either side of the head. It develops horny jaws which are used to feed on water weeds. The intestine is long and coiled with the cement gland still present.
5. **Internal gill stage**: - 6-10 after hatching, the external gills disintegrate while the internal gills develop .A gill cover called operculum grows over the gills. The tadpole now breathes like a fish. Its tail elongates and muscles develop.
6. **The limb stage**: – The hind limbs grow first and develop. The fore limbs then start to grow out. The left fore limb appears first through the opercular opening followed by the right forelimb. The internal gills gradually disintegrate while the lungs start developing. The mouth develops and replaces the horny jaws. Intestine shortens and the tad pole starts eating small animals in the water. The eyes become big and prominent.
7. **Young toad stage**: - The tadpole reabsorbs the tail and then changes into small toad. It comes out of the water to the land where it grows into a full adult toad.

Metamorphosis in toad (from egg to the adult toad) takes about 40-45 days under the control of the hormone thyroxine produced by the thyroid gland (found between the head and the trunk).

EVALUATION

1. List the stages in metamorphosis of toad.
2. Differentiate between external and internal gill stages of toad metamorphosis.

METAMORPHOSIS IN INSECTS

Metamorphosis is the gradual changes that occur during the development of an animal from the zygote (fertilized egg) to the adult stage. There are two types of metamorphosis in insects which include

1. complete metamorphosis
2. incomplete metamorphosis

Complete metamorphosis

This is the series of gradual changes which takes place in insects from fertilized eggs to larva then to pupa and finally to the adult stage:

Egg -------- larva ------- pupa ------- adult

No resemblance between pupa and adult stage .Insect undergoing complete metamorphosis include housefly, mosquito, butterfly, bees, wasps and beetles.

Incomplete metamorphosis

In this type of metamorphosis, the egg hatches into a nymph which generally resembles the adult except that it is smaller, wingless and sexually immature.

Egg ------- nymph ------- adult

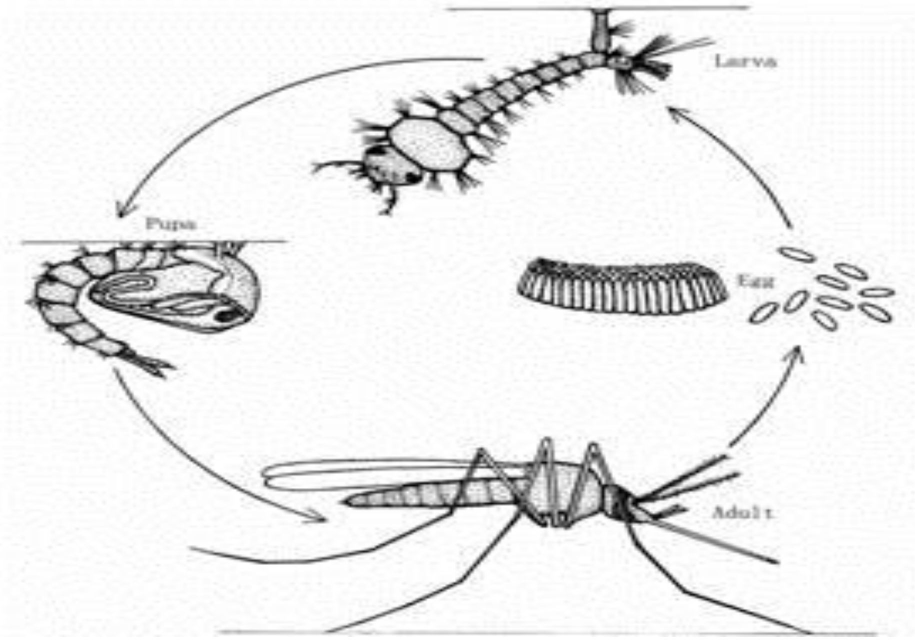
EVALUATION

1. What is metamorphosis
2. Name the stages involved in complete and incomplete metamorphosis

LIFE HISTORY OF HOUSEFLY

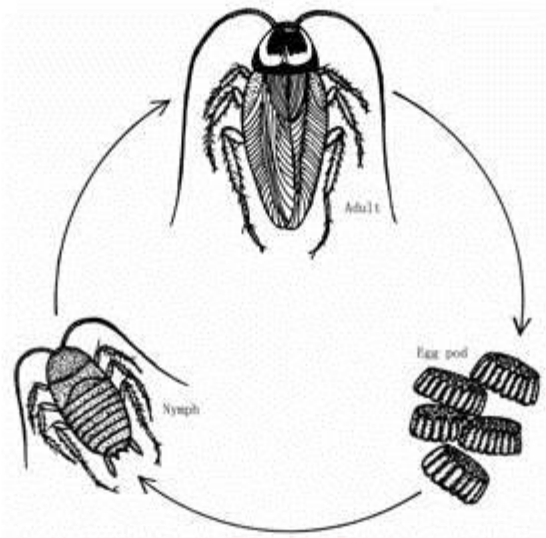
Housefly undergoes complete metamorphosis. Its life history involves: -

a. Egg stage: - 2 – 7 batches of eggs (100 – 150 eggs in a batch) are laid by the female housefly in a moist dirty environment. The eggs hatch into white larvae in about 8 – 24 hours.
b. Larva stage: - The larva called maggot has a segmented body. The head bears a pair of hook for tearing food and drawing the larva along. On the ventral surface of the segmented body lie spiny pads for movement. It has two pairs of spiracles for breathing. The larva moults several times and lasts for about 5 – 14 days after which it moves to a dry place to begin the pupal stage.
c. Pupal stage: - The maggot shortens; its skin becomes hard and brown forming the pupal case (puparium). It does not feed or move. Internal re-organisation takes place at this stage. In about 3 – 10 days, the young adult hatches out of the puparium.
d. Adult stage: - The adult housefly called imago emerges from the puparium using a sac-like organ (ptilinum) to break it open. It moves to the surface of the dirt and flies away when the wings are dry.



LIFE HISTORY OF COCKROACH

Cockroach undergoes incomplete metamorphosis. Its life history involves: -



a. Egg stage: - A female cockroach lays about 10 – 16 eggs in a horny egg case (ootheca) which she carries in her abdominal pouch for some time and later deposit it in a safe dark. After 30 – 100 days, the eggs hatch into nymphs which are wingless, small and whitish in colour.
b. Nymph stage: - The nymphs feed, grow, become brown, moult about 13 times to become adults.
c. Adult stage: - In the process of moulting, the wings first appear as wing pad and later into full grown wings. A cockroach requires 11 – 20 months to develop from eggs to imago.

EVALUATION
Describe briefly metamorphosis in a) cockroach b) housefly

GENERAL EVALUATION
1. Define metamorphosis
2. Describe the stages involved in the development of toad.
3. Define complete and incomplete metamorphosis in insects. Give two examples in each case.
4. Differentiate between complete and incomplete metamorphosis.
5. Describe the life cycle of a named insect that undergoes complete metamorphosis.

READING ASSIGNMENT
College Biology, Chapter 16, page 354 – 360, 370 - 373

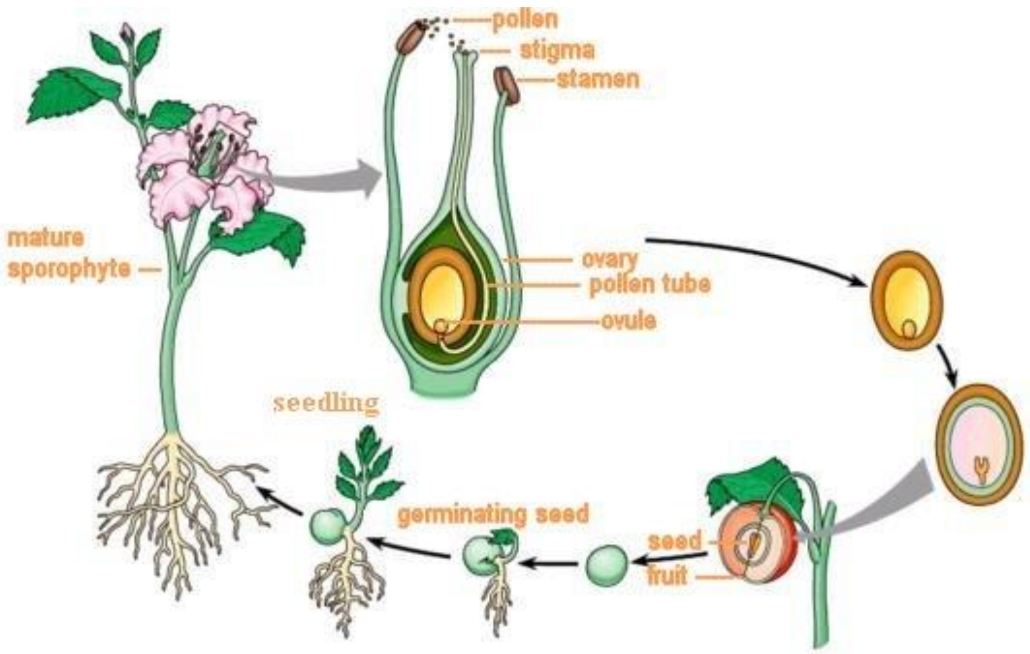
WEEKEND ASSIGNMENT
1. The following insects undergo incomplete metamorphosis except (a) grasshopper (b) cockroaches (c) butterfly (d) termite
2. The young tad pole feeds on -------- (a) small animals (b) water weed (c) egg yolk (d) fish
3. Which of these is not a function of the string of jelly covering on eggs laid by toad (a) nourish the embryo (b) protect eggs from microbial attack (c) protect eggs from mechanical damage(d) protect eggs from drying up
4. Larvae of mosquito is called (a) caterpillar (b) grub (c) wriggler (d) imago
5. A common process that occurs in metamorphosis of insects is (a) moulting (b) feeding (c) fertilization (d) dormancy

THEORY
1. Differentiate between metamorphosis in butterfly and termites
2. Differentiate between the external and internal gill stage of toad's development

WEEK TEN
DEVELOPMENT OF ZYGOTE IN FLOWERING PLANTS, GERMINATION OF SEEDS, ADAPTIVE FEATURES IN A DEVELOPING ANIMAL

CONTENT
- Fertilization and development of zygote in plants
- Formation of seeds and fruits
- Germination of seeds and condition necessary for germination
- Adaptive features in a developing animal
- Definition of oviparity, viviparity and ovoviviparity

DEVELOPMENT OF ZYGOTE IN PLANTS
Pollination is followed by fertilization and the development of zygote in flowering plants during which the flower changes into a fruit enclosing the seeds. The male and female sex cells that form zygote at fertilization are the pollen grain and the ovule. The following are the processes involved



a. After pollination - the pollen grain absorbs a sugary liquid on the stigma swells, and germinates.
b. The outer coat of the pollen grain splits and the pollen tube grows out and down inside the style.
c. The nucleus of the pollen grain divides into two – a large tube nucleus and a smaller generative nucleus .The male nucleus is the male gamete.
d. One of the male nuclei – after their release into the embryo sac, fuses with the ovule to form a zygote which develops into the embryo this is called first fertilization.
e. Second fertilization takes place when the second male nucleus fuses with the secondary nucleus to form endosperm nucleus which produces the endosperm (food store house of the embryo).

FORMATION OF SEEDS AND FRUIT (DEVELOPMENT OF EMBRYO)
The zygote divides by mitosis to form many cells which differentiate and become organized into an embryo. The embryo is made up of the following parts:

a. the plumule (embryonic shoot) b. the radicle (embryonic root)
c. one or two cotyledon (seed leaves) d. endosperm (they could be absent)

As the embryo develops, the ovary and the ovules undergo changes and develop into fruit and seed or seeds respectively.

SEED
A seed is defined as the ripen fertilized and developed ovule .The structure of the seed have the following parts

a. seed coat –This is the outer membrane of the seed
b. hilum – is the point of attachment of the seed to the seed stock
c. Micropyle - The tiny hole through which air and water get into the embryo of the seed. Embryo is the inner most part of the seed.

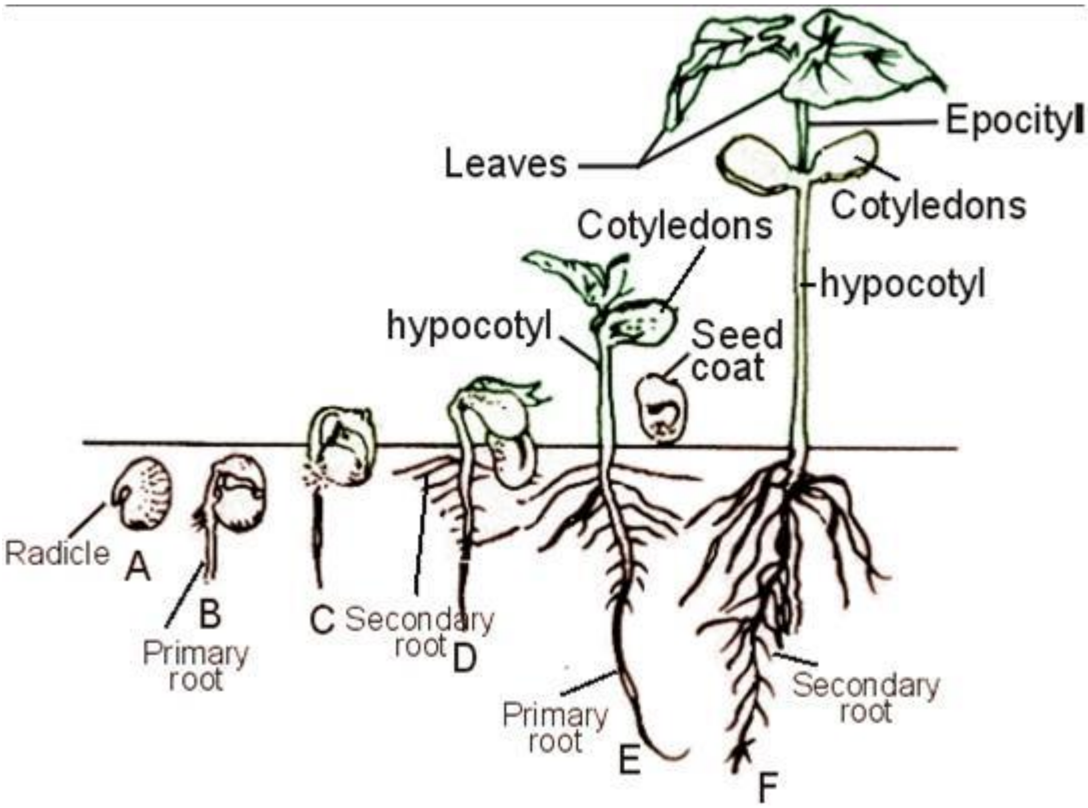
A seed with one seedling is called monocotyledon e.g. cereals such as maize, millet, rice, sorghum, wheat etc. Those with two seed leaves are called dicotyledonous plant e.g. mango, beans.

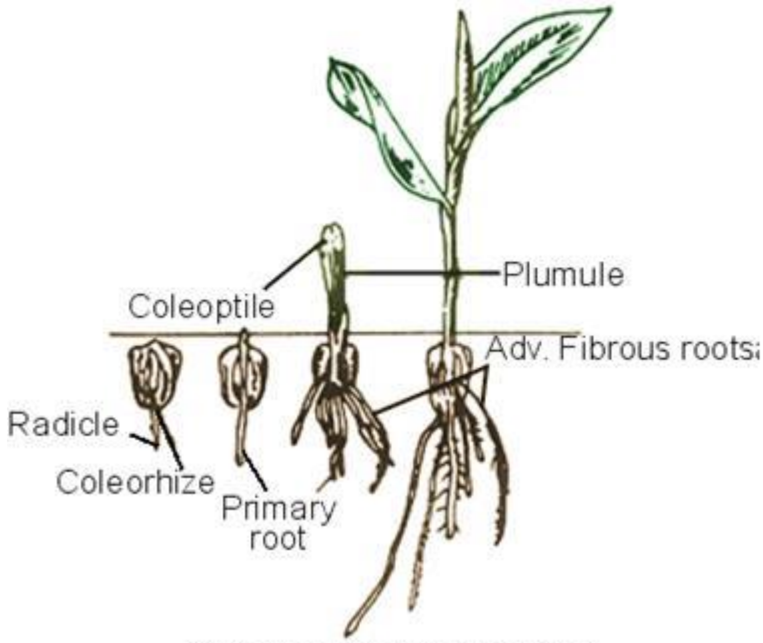
EVALUATION

1. (a) What is a seed (b) Describe the structure of a seed
2. Describe the stages involved in development of zygote in flowering plants

GERMINATION OF SEEDS
Germination is the process of gradual development of the embryo seed into the seedling or the young plant. The embryo of the developed seeds usually undergoes a rest period called dormancy and the seed remains in this condition as long as the conditions for germination are unfavourable. There are two types of germination

a. **Epigeal germination: -** This is when the seedling emerging from the soil carries the cotyledon above the soil surface e.g. dicotyledonous plant





Germination of maize grain

b. **Hypogeal germination: -** This is when the seedling emerges from the soil with the cotyledon left below the soil e.g. monocotyledonous plant.

CONDITIONS NECESSARY FOR SEEDS GERMINATION

1. Adequate supply of water or moisture which helps to activate the soil and make the seed coat soft for further development.
2. Oxygen is needed for respiration for the generation of energy needed for the growth of the seed.
3. Optimum temperature
4. Enzymes are needed to speed up the rate at which the food is broken down to release energy.
5. Food or energy (in dicot seed, the food is stored in the cotyledon while in monocot plant the food is stored in the endosperm).
6. The seeds must be viable.

EVALUATION
1. What is germination?
2. What are the conditions necessary for germination of seeds

ADAPTIVE FEATURES IN DEVELOPING ANIMALS

EGGS OF FISH, AMPHIBIANS, REPTILES AND BIRDS

All vertebrates except mammals are egg laying animals. The egg has the following features that help the embryo to develop inside it.
1. SHELL: - Hard, porous and rich in calcium carbonate. It protects the egg and aid respiration.
2. MEMBRANES: - Also aid protection of the egg.
3. ALBUMEN: - It is called the egg white and accounts for over 50% of the egg. It nourishes the embryo.
4. YOLK: - Located at the centre of the egg. It is rich in vitamins, protein and minerals to nourish the embryos.
5. CHALAZA: - A piece of thick protoplasm that extends to both side of the yolk to hold the embryo in position.

DEVELOPING EMBRYO/FOETUS IN MAMMALS

The embryo or foetus has the following adaptive features.
a. UTERUS: - Immediately after fertilization in the oviduct the embryo is planted in the wall of the uterus.
b. PLACENTA: - the connection between the embryo and the mother in mammals.
   - It carries oxygen, water and food from the mother blood to the embryo blood.
   - It also removes excretory waste like urea, salt and carbon dioxide from the embryos blood and transfers it to the mother's blood stream for elimination.
   - It produces hormones which helps the mother to adapt to the pregnancy.
c. UMBLICAL CORD: - It helps to attach the embryo to the placenta .The arteries and vein of the cord carry the blood of the foetus to and from the placenta .The blood of the mother and of the foetus are separated and so do not mix
d. EMBRYONIC MEMBRANES: - These membranes envelop the foetus to provide it adequate protection .The membranes include
   - Amnion which is the innermost membrane filled with the amnoiotic fluid which serves as a cushion or shock absorber for the embryo. The fluid also neutralizes the effect of changes of external temperature.
   - Chorion is the outermost membrane which absorbs oxygen for the embryo.
   - Allantois is a membrane which aids respiration and excretion in developing

EVALUATION
1. Describe the structure of egg in birds.
2. What are the functions of placenta in mammals

DEFINITION OF OVIPARITY, VIVIPARITY AND OVOVIVIPARITY
- OVIPARITY is a process of reproduction in which eggs are laid into the external environment where the embryos complete their development and hatch out of the eggs as young. Most fishes, amphibians, reptile and eggs undergo this type of reproduction.
- VIVIPARITY is a process of reproduction in which the young develops and nourished inside the female's body through the placenta and are born alive when fully developed. A few fishes, reptiles and all mammals are viviparous animals.
- OVOVIVIPARITY takes place in few fishes and reptiles where the laid eggs are retained in the body of the female without placenta and when fully develop the young hatch from the eggs and are released from the female's body.

EVALUATION

Differentiate between oviparity, viviparity and ovoviviparity.

GENERAL EVALUATION
1. Describe the process of zygote formation in flowering plants.
2. What is a seed
3. With a labeled diagram, describe a seed.
4. What is germination?

5. Define epigeal and hypogeal germination
6. What are the conditions necessary for seed germination
7. With the aid of a labeled diagram, describe the adaptive features of egg in birds
8. Differentiate between oviparity, viviparity and ovoviviparity giving one example in each case.

READING ASSIGNMENT

College Biology, chapter 16, page 324 – 326, 382 - 387

WEEKEND ASSIGNMENT

1. The process by which fruits develop without fertilization is known as a) germination b) pathenocarpy c) viviparity d) pollination
2. Which of these is not an oviparous animal a) goat b) pigeon c) lizard d) toad
3. A seed consists of the following parts except a) micropyle b) endosperm c) endocarp d) hilum
4. An embryonic shoot in plant is known as a) radical b) plumule c) endosperm d) cotyledon
5. The part of an egg that holds the embryo in position is the a) yolk b) albumen c) shell d) chalaza

THEORY

1. Describe the structure and functions of the placenta in mammals.
2. Differentiate between hypogeal and epigeal germination