7. ANIMAL PHYSIOLOGY

NUTRITION

Nutrition is the procurement of substances nec-essary for growth, maintanerice and activities of Tig body. Energy is required for running life process. Green plants can directly utilise sunlight energy and they prepare their own food material. It is catod Autotroph mode of nutrition. - In ge: their energy in the form of Dord erergy e$^{£}$ organic molecules synthesized by Heterotropic mode of rutribon . Ultimately all animals get their energy from sunlight through plants.

Heterotrophic nutrition is of 2 types

Holozoic - eating v/holo animals or their parts.

Saprophytic - Living organisms feed on decaying organic materials of plants and animals.

DIGESTION :

The complex and large organic molecules have to be converted into simpler molecules in order to enter into the protoplasm of each and every cell for its rhetabolic activities.

Digestion is carried out by breaking the bonds of nutrient molecules by using a molecule of water for cleavage. This digestion is carried out by enzymes called Hydrolases

For unicellular protistans like Amoeba, the diges-tion is carried out within the animal (intra cellular digestion) but in multicelular animals, the diges-tion takes place outside the cell (extra cellular digestion).

The multicellular animals have a cavity called 'Alimentary canal'. In that enzymes are poured in by the cell. There, the food is digested and it is absorbed by the cells.

DIGESTIVE SYSTEM (MAN)

Food is taken into the Alimentary canal through the mouth and is propelled along by the move-ments of the muscles on its wall. Glands located in its wall (gastric glands) and in associated organs like liver and pancreas secrete enzymes into the lumen of the canal.

Alimentary system consists of a muscular tongue in the floor of the buccal cavity which helps in ingestion and teeth helps in mastication of food. The chewed food is mixed with saliva in the mouth secreted by 3 pairs of salivary glands.

Saliva contains a starch digesting enzyme and mucons which lubricate the food for swallowing.

Mouth leads the pharynx which communicates with long oesophagus which opens into stomach. Stom-ach is a large muscular sac which secretes hydrochloric acid and protien digesting enzyme Pepsin.

After digesting the protiens the food goes in to smali intestine.

Ruminant animals like cattle have a compound stomach. Some parts of the stomach ciive shelter to numerous bacteria and protozoa wiich carry out fermentation of cellulose.

The small intestine of mammals is a long, coiled, narrow tube. The inner walls project into finger like structure called "VILLI" which increase the surface area for absorption of digested materiai.

The first part of the small, intestine called Duo-denum is very important because bile duct, opens into it. Small intestine opens into large intestine. At the point of junction, a' small finger like projection called appendix is present. It is a vestigial organ. The undigested waste material is sentout through anus after absorbing water in the large intestine.

Liyer, the largest gland of the body secretes Bile juice containing Bile salts which help in digesting and absorbing fat. Pancreas secretes pancratic juice rich in enzymes for digesting starch, lipids, proteins.

DIGESTION OF CARBOHYDRATES

For herbivorous (plant eating) animals cellulose of plant food is the principle source of carbohy-drates but vertebrates- have no enzymes to digest cellulose. So, they have to depend on micro organismis like bacteria (symbiotic digestion) whic^{h} live in their digestive tracts., Man subsisting on cereal grains, tubers etc. consumes carbohy-drates mainly in the form of starch and also some disaccharides like sucrose and lactose.

Man secretes a starch hydrolysing enzyme in saliva called salivary amylase or ptyaiin. If we chew a piece of bread, it will taste sweater after some time because, starch is broken down into maltose (which is sweet) by ptyaiin.

The gastric juice contains no carbohydrate digest-ing enzyme. The pancreatic and intestinal juice digest carbohydrates in the small intestine. The pancreatic juice contains pancreatic Amylase, which hydrolySes the remaining starch into mal-tose. The enzyme Maltase hydrolyses maltose into glucose. Besides Maltase, intestinal juice contains sucrase and lactase, which converts sucrose and lactose into glucose.

Main Carbohydrates ⟶
Startch (Poly saccarides)
Sucrose (Disaccharide)
Lactose (Disaccharide)

Starch —ptyalin or salivary amylase⟶ Maltose (in mouth about 30%)

Starch —pancreatiric⟶ Maltose (in intestine)

amylase
Malase
maltose ⟶ Glucose

Sucrase
Sucrose ⟶ Glucose

Lactase
lactose ⟶ Glucose

Note : Maltase, Sucrase, Lactase - secreted by Intestinal wall.

DIGESTION OF PROTIENS

Food protiens are ultimately broken down Into aminoacids by gastro-intestinal enzymes. Protein digestion starts in stomach. Gastric juice-contains Hydrochloric acid (HCI) and pepsinogens. The inactive pepsinogen is converted into active pepsin by Hcl. Hcl provides Acidic P^h in stomach for the action of pepsin on proteins. Pepsin hydro-lyses proteins into peptones. Pepsin also hydrolyses casein (milk protein) into para casein.

Pancreas secretes Trypsinogen and Chymot-rypsinogen which are activated by enterokinase an intestinal juice e.nd transformed them into active trypsin arid chymotrypsin.

Trypsin acts best at alkaline pH- It is provided by Bile juice. Trypsin hydrolyses proteins into peptides. Amino peptidases of intestinal juice hydrolyse the peptides into aminoacids.

The following reactions take place in stomach (acidic medium)

Inactive pepsinogen ⟶ (Hcl) Pepsin (Active)

Proteins Proteins ⟶ peptides

Casein (milk protein) ⟶ (pepsion) para casein

The following reactions takes place in intastine (Alkaline Medium)

Trypsinogen ⟶ (Enterokinase) Trypsin

Chymotrypsinogen ⟶ (enterokinase) Chymotryspin

Trypsion
Proteins ⟶ peptides

Chymotrypsin
Peptides ⟶ Aminoacids

Aminopeptidases

DIGESTION OF FATS

Lipases are enzymes for hydrolysing fats and oils. Lipases are soluble In water. Fats are largely digested in small intesiine. Bile salts emulsify the fatty acids and these emulsified fats are converted into monoglycerides by pancreatic lipase and intestinal lipase.

Lipase
Fats ⟶ fatty acids, monoglycerides and glycerol

Absorption of digested food is taken up in villi of intestine either by simple digesion (passive ab-sorption) or energy dependent (active absorption).

NOTE

End products of Carbohydrate — Glucose
End products of Proteins — Aminoacid
End products of Fats — Fattyacids, glycerol monoglycides.

NOTE

1 gram of Carbohydrate will yeild 4k.cal of energy
1 gram of Protein will yeild 5.65 to 4 k.cal of energy
1 gram of Fat will yeild 9.45 k.cal of energy. NOTE

The excess glucose is converted into glycogen by liver. It is reconverted into glucose when ever the body needs.

VITAMINS

Vitamins are organic substances which are sup-plied through diet. A dificiency in the food produces diffeciency symptoms.

There are 2 types of Vitamins

Water soluble vitamin - Vitamin 'B' complex and Vitamin 'C'

Fat soluble vitamin - A, D, E, K

RESPIRATION

Oxidation of nutrients releases their bond energy utilisation in the body. The released energy is trachea temporarily stored in ATP.

In some lower organisms like bacteria, yeast, nutri-ents are oxidised without using oxygen. This proces is called Anaero-bic metabolism or fermentation.

In most of the animal tissue, oxidation is carried out by Aerobic Respiration. It-is carried out in two phases.

(a) External respiration - uptake of oxygen and release of carbondioxide into surrounding medium.

(b) Internal respiration - Oxygen uptake by tissues and tissue oxidation by enzymes and carbondioxide elimination from tissue cells:

The mammalian respiratory system (Man) con-sists of the external nostrils, nasal cavity, Naso pharynx, larynx, Trachea, bronchi, bronchiolus, and lungs.

Nasopharynx communicates with larynx through a long wide cartilaginous tube called trachea. Trachea runs through the neck infront of the oesophagus, enters the thorax and divides into right and left bronchi. They enter into elastic iungs and divide repeatedly into small branchioles. This branchiol opens' into thin walled sac called "Alveoli". Each alveolus., is supplied with blood capallaries. The pulmonary'artery which; is poor in

oxygen and rich in carbondioxide supplies blood to the alveoli. The oxygenated blood (after exchange of gases) is returned to pulmonary veins.

Lateral walls of thorax (ribs and intercoastal muscles), diaphragm (which seperates thorax from abdomen) help in respiration by contracting and relaxing.

GAS TRANSPORT IN BLOOD

Most of the oxygen that enters into the,blood is carried in chemical combinations in the erythro-cytes or Red Blood Corpuscles (RBC), Oxygen combines loosely with Fe^{+2} (Iron). Ions of Haemo-globin thus forms oxyhaemoglobin. This oxyhaemoglobin is carried to tissues and there molecular oxygen is released out. The carbondioxide ($CO_{2)}$ produced in'the tissues ehters the RBC by diffusion, reacts with water to form carbonic, acid (H_2CO_3). On reaching the lungs, blood is oxygenated. Here H_2CO_3 cleaved into water and CO_2 and this CO_2 is removed from the lungs during expiration.

CIRCULATORY SYSTEM

All parts of the body require nourishment and oxygen and metabolic wastes need to be re-moved from the body. This is carried out by blood through circulatory system.

HEART

It'is a pumping organ of the blood vascular system. It is hollow muscular organ made of cardiac, muscles. It consists of chambers, the chamber which receives blood is called Auricle and from there it goes to ventricle and it gives out blood to the lungs and body parts.

The Human heart'Is situated in the thorax between the lungs. It consists of two auricles and two ventricles. The deoxygenated blood from body parts is received in right auricle. The left atrium orauricle receives oxygenated blood from lungs. The two auricles open into the respective ventricles. The right ventricle which receives deoxygenated blood pumps into the pulmonary arteries, from there it goes to lungs for purification. The left ventricle which receives oxygenated blood from left Auricle pumps to all body parts.

The contraction and relaxation of cardiac Cham-bers are respectively known as systole and diastole. The systolic and diastoic pressure of a normal human beng is 120/80. The difference between systolic and diastolic pressure is called the "Pulse Pressure"

The Human heart beats at the rate of 70 per minute in the resting condition. Heart beat results from a wave of electrical potential called cardiac impulse spreading over the cardiac chambers. The impulse is myogenic in origin. It originates from cardiac muscle tissue that is from the "Sinoatrial Node".. In mammais it is called "Pace Maker" of the heart because it determines the rate of heartbeats. '

Circulations of blood from the left ventricle to the tissues and back to the right atrium is called the "systematic circulation", the circulation from the right ventricle to the lungs and back to the left atrium is called "Pulmonary Circulation". Some times a vein returning blood from cap-illaries breaks again into second set of capillaries in a tissue to form a "Portal systems". For example a hepatic portal vein returns blood from the intestine and; breaks into a portal system of capillaries in the liver. This enables the liver cells to take up from the portal blood, nutrients brought by it from the small intestine.

Blood flow is maintained in the veins largely, by the compression of veins by contracting muscles. The valves lodated in veins allow blood to flow in a single direction to the heart ,and block any reverse flow.

LYMPH

In the spaces between the cells of a tissue there occurs a fluid called the Interstitial fluid. Under the. pressure of blood,, in the capillaries, some of the water and dissolved solutes are filtered but from blood plasma into tissue spaces to form the tissue fluid. The composition of the fluid is similar to plasma except proteins. This is because the plasma' wall is impermeable to plasma proteins. This fluid enters into tiny channels called lymph channels;: and the fluid collected in them is called Lymph. They ulti-mately drain into two farge lymph vessels open into veins. Thus, it combines with general circulatory system.

BLOOD

Blood is a fluid connective tissue composed of blood cells, blood platelets and an extra cellular fluid called plasma. Blood is slightly alkaline and the volume of blood in an adult person is about 5 litres.

Plasma

It ia s viscous aqueous solution containing many organioc and inorganic substances. Plasma contains 92% water and 8% solids. The solutes include glucose, aminoacids, fatty acids, vitamins, enzymes, harmones, antibodies, oxygen, carbondioxide, and waste products such as urea, uric acid and creatinine.

Plasma contains 3 types of proteins namely albumin, globulin, and fibrinogens. Albumin and globulins retain water with their osmotic effects. Also they transport substances like thyroxine and iron Ions.

Immunoglobulins, a class of globulins act as Antibodies which inactivate invading microorgan-isms.

Erythrocytes (Red Blood Corpuscles)

They are numerous in blood. They contain haemoglobin. [Jhe red, oxygen carrying pigment] Mature RBC are dead cells. The entire volume of RBC is filled with Haemoglobin. In the foetus, RBC are mainly formed in the liver and spleen but in adults, RBC formed from bone marrow. RBC have an average life span of .120 days.

Old and damaged RBC. are. phagocytosed (eaten away by macrophages). The haemoglobin ca- tabolised

into the yellow pigment called Bilurubin which, is excreted in bile. The skin and mUcous membranes of eyes assume a yellowish colour, if all the bilurubin cannot creted from the body. This condition is called Jnundice.

LEUCOCYTES OR WHITE BLOOD CORPUSCLES (V/.B.C)

These are nucleated, colourless. Some of them posses cytoplasmic granules (called as granulocytes) and some do not posses granules (Arganulocytes)

Neutrophils and monocytes, of W.B.C protect the body against microbes by phagocytosing them. Lymphocytes of W.B.C secrete antibodies in the blood.

BLOOD PLATELETS OR THROMBOCYTES

They are non-nucleated, biconvex disc like bodies. Their life span is about a week. When any blood vessel raptures, platelets gets clumped at the injured spot and release certain chemicals called platelet factors. It promote blood coagulation.

BLOOD COAGULATION

When a blood vessel ruptures a gel sets in with in minutes. It is called coagulation. It is brought about by hydrolysis of soluble fibrinogen into' insoluble fibrin. It is catalysed by Thrombin enzyme.

The network of fibrin traps blood cells particularly RBC to form a red solid mass called the blood clot The clot stops bleeding. The straw coloured fluid left after clotting is called Serum.

Blood normally contains an anti coagulant 'Heparin' which .prevents the activation of prothrombin which is an inactive globulin of thrombin.

EXCRETION

Excretion is the elimination of waste products from the body. Large volume of carbondioxide (CO_2) and water are produced by the metabolism of carbohydrates, fats, and proteins. CO_2 is easily eliminated as a gas by respiration. The by products of metabolism have to be eliminated from the body in aqueous solution. Principle among them, are Nitrogenous substances like Ammonia, Urea, Uric Acid. All these are end products' of protein metabolism.

KIDNEY

The mammalian urinary system consists of two kidneys which form the Urine, two ureters which conduct the urine from kidneys to the urinary bladder (for storage of urint)) and urethra, through which the urine is sent out by. urinary bladder. The kidney contains many minute tubular Nephrons which form urine.

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Accessory excretory organs include skih which excretes water and sodium chloride in the Sweat and small amounts of lipids and sterols in the sebum (secreted by sebacious glands located in the skin in order to soften the skin).

Note : Basic unit of Kidney - Nephron

LOCOMOTION

Movement is an important characteristic feature of living organisms. It distinguishes the plants from animals. Most animals have developed contractile muscle fibres for carrying out the movements and this muscle contraction moves bones of the skeleton like levers to produce body movements.

Skeleton also forms the supporting frame work for the body and protects its softer internal organs. It is made up of calcium and phosphorus and houses the red bone marrow where the blood cells are formed.

Joints are the structures where two bories are fitted to each other. According to the mobility, joints are of three types

(a) Fixed or fibrous joints where dense bands of fibrous tissue held firmly together Eg: Skull bones.

(b) Slightly movable or cartilaginous joints which are seen in vertebral column. Here limited movement is possible.

(c) Movable or Synovial joints where articulating bones move upon each other. Here acticulating surface is covered with hyaline cartilage and a viscous slippery synovial fluid fills the space between these cartilages and lubricates the joints. These sinovial joints are of two types

i) Ball and socket joints - Shoulder and Hip Joints.

ii) Hinge Joints - Elbow joint, ankle, knee joint.

Each muscle fibre requires a specific minimum intensity of nery_e impulse or stimulus for stimu-lation. This is called muscle twitch. If a muscle is in. continued state of contrations caused by many repeated stimuli, then it is called 'Tetanus'.

Note : Fatigue occurs on repeated contraction of muscle due to the accumulation of lactic acid

NERVOUS SYSTEM

With the evolution of multicellularity, it is neces-sary to develop some system for coordinating the qptivities qf numerous cells in the body. For such co-ordination information- has to be exchanged between cells situated at a distance from each other. For co-ordination of all systems, nervous system has been developed.

In mammals, the nervous system consists of central nervous system (comprises brain & spinal cord) peripheral nervous system (coursing be-tween the central nervous system & different parts of the body) and the 3rd one is. autonomous, nervous system (has connections with central nervous system). It works independently to regu-late involuntary activities like heart beat etc.

Both brain & spinal cord are covered-by connec-tive tissue membrane called as Meninges. An extra cellular fluid called cerebro spinal fluid is present in the meninges-

it affords some protec-tion to the central nervous system, against injury & shock.

Braki is situated inside the cranium. The Brain s divided into Forebraini Midbrain & Hind brain. The Hind brain continues into spinal cord.

Brain is be easily differentiated into two regions. G'ey matter containing neive cells is situated on He surface and white matter containing nerve fibres located deep inside the brain.

The fore brain consist of CEREBRUM, the largest zar. cf tne human brain. The cerebrum consists of two central hemispheres joined by thick band csf nerve fibres called "Corpus callosum". The surface of cerebrum shows many convulasions called "GYRI" separated by depression called "sulci".

At the base of the brain, Hypothalmous is present. It contains nerve centres for temparature regu-lation, hunger, thirst & emotional reactions.

Mid brain consists of many groups of nerve cells. Some of these are involved in controlling muscle tone etc. The Hind brain consists of a cerebellum which is concerned with maintainance of posture & equilibrium of the body and for the muscle tone.

The brain stem consists, of pons yaroli and medulla oblongata. . **It** is the centre for" controlling respiratory centers, vaso motor centers, salivary centers etc. Medulla oblongata continues into spinal cord.

Spinal cord is a cylindrical cord like structure situated in vertebral column. From the lateral sides spinal nerves emerge & go to supply the peripheral tissue. The nerves coming out from different parts of the brain are called 'cranial' nerves.

The peripheral nervous system includes the nerves runnig outside the central nervous system. Each nerve is'compoed of many fibres enclosed in a connective tissue sheath.

Neuron is the basic unit of nervous system. Nerve fibres carry nerve impulses in a relay. The junction between two neurons is called "SYNAPSE". Basically a neuron consists of a cell body, long axon and a short, profusely branched dendrides. The axon is covered with myelin sheath. The axon of one neuron attaches with dendrides of other neuron.

The axon terminal contains membrane bound vesicles called synaptic vesicle in its cytoplasm. In this chemical substances like adrenaline & acetyl choline remain stored. When a nerve impluse passes the axon terminal, the synaptic vesicle releases stored chemicals. The chemical diffuse through synaptic cleft & reach the mem-brane of next neurons. This cause the nerve impulse to be transmitted along the next neuron.

EYES

Eyes are the sense organs of vision. They contain 2 types of photoreceptors called rods & cones. These cells, convert the energy of specific wave lengths of light into action potentials of nerve
fibres.

Eye ball is spherical & is located in ORBIT. It is capable of movement with the help of recti & oblique muscles. Wall of the eye ball consists of 3 layers, the outer opaque sclerotic coat but in front side of the eye it becomes transparent CORNEA. It is covered extenally in a thin membrane called CONJUNCTIVA.

The middle cloriod coat supplied with blood vessels in the front side it continuous with a muscular curtain called 'IRIS'. In the center of the Iris there is "small opening called PUPIL.

Retina is the innermost layer which is specialised for receiving the jmage. It consists of rods and cones named according to their shapes. Optic nerve is formed by the union of all the sensory cells of the retina.

Lens is behind the Iris. It divides the eye ball into two chambers anterior aqueous chamber & pos-terior vitreous chamber. Former is-filled with water fluid & the later is filled with jelly like fluid called vitreous humor.

Blind spot is a spot on the retina where optic nerve enters the eye ball and slightly, above it, ah acute vision spot is present called Fovea cantralis. There is presence of Lacrimal glands which secrete watery substance inorder to lubri-cate the eye.

Light rays from an object pass through cornea & aqueous humor. The intensity of light is regu-lated by pupil. It contracts in strong light and vice versa. Light rays passing through the .lens fall on Retina. The sensory cells of Retina (Rods & Cones) are stimulated and the light impulses are converted into nervous impulses which are re-ceived by the brain through optic nerve.

Comparision of eye with a Camera :

Eye ball	**Camera**
Retina	Photographic film
Convex Lens	convex lens.
Pupil	diaphragm.

ENDOCRINE SYSTEM

Endocrine glands are ductless glands which secrete harmones. This is secreted into the blood which distributes all over the body. Harmones are secreied in response to changes, in the environ-ment inside and outside the body. There is a co-ordination between nerves & hormones. The synthesis and release of hormones is regulated by nerves.

PITUITORY GLAND

There are several Endocrine glands spread over the body. Among them the most important one is pituitary gland. It is termed as a master gland because it controls the remaining Endo-crine glands. Pituitary is situated in Hypothalamus of the Brain.

The anterior Pituitary secretes growth harmone Thyrotropin which stimulates body growth.

Corticotropins secreted by pitutary gland stimulates the Adrenal cortex (Present in Kidney) to'secrete gluco carticoid harmones. Follicle stimulating harmone, & Lutenising harmones of pituitary regu-lates the gonads and finally Prolactin increases milk secretion.

The posterior Pituitary, releases vasopresin which increases renal reabsorption of water from the urine to make it hypertonic (high concentrated) & also increases the Blood perssure by constrict-ing arterioles.

Oxytosin, another harmone contracts the smooth muscles of uterus. (useful in Pregnancy)

THYROID

Gland situated in the neck close to the trachea secretes thyroxine. It enhances metabolic rate and promotes body growth. Failure' of thyroid secretion,, produces cretinism in young age and Myxedema in adults. The excess cf thyroid harmone leads to Graves desease. (Bulging of eye balls)

PARA THYROIDS

Para thyroids are 4 small glands situated very close to thyroid, secrete Parathormone which increases blood calcium level by increasing the mobilisation of bone calcium and renal reabsorp-tion of calcium from the urine. The deficiency of parathormone leads to muscle cramps or tetanus.

ADRENALS

Adrenals are two conical pyramid shaped glands. Each adrenal is made up of outer layer calledAdrenal cortex and a central portion called Adrenal Medulla. Adrenal cortex secretes:

(a) Mineralo Corticoids which increse the retention of Na' ions in the body & elimination of K^+ ions from the body."

(b) Gluco Corticoids regulate Metabolism of Car-bohydrates, Proteins & Fats.

(c) Sex Corticoids develop external male sex characters. Adrenal medulla secretes Adrenalin and nor- ,adrenalin. They act on heart beat, blood pressure etc.

PANCREAS A

Pancreas is situated along witfi the liver at deodenum it also secretes harmones in addition to the enzymes for digestion. The harmones Insulin and glucagon are secreted by Islets of Langerhans. Insulin lowers the blood sugar in increasing the utilization of glucose in the tissues. Its deficiency produces a disease called DIABETES MELLITUS with high blood sugar, usually excreted in the Urine. On the contrarary glucagon increses the blood sugar level. When ever the blood sugar level drops glucagon is produced & released which converts the glucagon into glucose.

GONADS

The GONADS, testes in males and ovaries in females secrete harmones which control repro-ductive organs. The harmones are collectively called sex harmones. Male sex harmone TesU> sterone is secreted by testis. It stimulates growth and secondary male sex organs. Failure of testosterene results in undeveloped external sex harmones.

Female sex harmones are of two types Estrogens and Progestrone. The ovary contains numerous sacs called ovarian follicles each with a mature ovum. Cells of a mature ovarian follicle, called Graph an follicle, secrete estrogen. This is acti-vated by follicle stimulating harmone of anterior Ptuitaty

These estrogens are responsible for development of sex organs & external sex characters and another harmone progesterone is responsible for pregnancy changes in female .sex organs.

REPRODUCTION

Reproduction is an important characterstic of living Organisms inorder to propagate its species, (ie) maintains continuity of the species.

The male reproductive system of human beings consists of 2 testes, suspended in the pouch of 'scrotum', a paired duct system consisting of epididymis, vas deference, ejacuiatpry duct, and male urethra and secordary sex organs including a prostrate, two seminal vesicles, two cowper's glands and a penis.

Testes form sperms and secrete testosterone. Prostate, cowpers glands secrete fluid which mixes with sperms to form the semen.

The female repoductive system consists of 2 ovaries and a duct system of two fallopian tubes, a uterus and a vagina. Ovaries produce ova and secrete esterogens & progesterones, The fallopian tubes conduct the ovaries towards the uterus. The uterus lodges the growing foetus and opens to the exterior through the VAGINA.

The menstrual cyclic consists of cyclic changes in the reproductive tract of primate female culmi-nating into a menstrual flow of blood from the vagina. It consists of two phases.

In the first/phase, growth and proliferation of tissues on the walls of uterus, .fallopian tubes and vagina.

The ovnm ejceted from the follicle near the end of the 1st phase (proliferative phase). The rup-tured follicle changes into a corpus luteum which secretes progesterone in the second phase, the utrine walls grow further and the glands secrete a fiuid in the uterus. If the ovum is fertilized with a sperm, it leads to pregnency. If fertilisation of eggs does not take place, uterus simply degenarates, progesterone secretion stops. The uterus breaks down and menstruation takes place.