(NO. OF PAGES : 2)

(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2022 ONLY)

22UZY202

REG.NO.:

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS :MAY 2023

B.Sc. -ZOOLOGY **MAXIMUM MARKS: 50**

II SEMESTER **TIME : 3 HOURS**

PART – III

CHORDATA

SECTION - A (10 X 1 = 10)

ANSWER THE FOLLOWING QUESTIONS.

1. The distinguishing factor between rays and sharks are:

   a) Type of tail fin b) Position of Gill slits
   c) Position of Mouth d) Nature of their Scales

2. Extinct amphibians are placed in the subclass
   a) Stegocephalia b) Lissamphibia
   c) Lepospondyli d) Cyptobranchoidea

3. Snakes are sensitive to
   a) Noises made by birds b) Earth borne vibrations
   c) Thunder d) Air borne vibrations

4. In birds, the last 3 or 4 tail vertebrae are fused to form
   a) Synsacrum b) Furcula c) Pygostyle d) Wish Bone

5. Marsupial with true alalntoic placenta are _____
   a) Bandicoats b) Opossum c) Kangaroo d) Petaurus

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

6. State the functions of placoid scale.
7. What is the peculiarity of tongue in frog?
8. Where are the poison teeth (fangs) situated in a snake.
9. Write a short note on the significance of one ovary in birds.
10. Define homeostasis.

(CONTD…2)

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

11. a) Discuss the Affinities of Balanoglossus glavigerous (OR)
    b) Describe the Respiratory System of Pisces
12. a) Explain the general characters of class Amphibia. (OR)
    b) Describe the structure of Heart of frog with a neat diagram.
13. a) Differentiate between Poisonous & Nonpoisonous Snake. (OR)
    b) Explain the arterial system in calotes.
14. a) Give an account of the different kinds of feathers in Pigeon. (OR)
    b) Give an illustrated account of the role of flight muscles in Pigeon.
15. a) Explain the salient features of Protheria. (OR)
    b) Describe the structure of female reproductive system in Rabbit.

SECTION - C (5X5=25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.
(K4 (Or) K5)

16. a) Explain the various methods of Parental care in fishes.
    (OR)
    b) Write an essay on the reproductive system in fish.

17. a) Comment upon the girdles and limbs of frog.
    (OR)
    b) Give an account of different mode of respiration in Frog

18. a) Illustrate the circulatory system of Calotes.
    (OR)
    b) Describe the poison apparatus and biting mechanism of poisonous snake.

19. a) Write a brief note on flight adaptations of Birds.
    (OR)
    b) Comment upon the habitat and external features of Columba livia with a neat sketch.
20. a) Describe the digestive organs and process of digestion in Oryclolagus curiculus.
    (OR)
    b) Give an account of proto theria, Metatheria and Eutheria.

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N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : May 2023

Course Name: Chordata **Maximum Marks: 70**

Semester: Even **Time : 3 Hours**

PART – III

SUBJECT CODE: 22UZY202 **CHORDATA**

SECTION - A (10 X 1 = 10) ANSWER THE FOLLOWING QUESTIONS.

1. Position Of Gill Slits
2. Stegocephalia
3. Earth Borne Vibration
4. Pygostyle
5. Opossum

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

6. **Placoid scales** are packed tightly together, are supported by spines, and grow with their tips facing backward and laying flat- to protect a fish from predators and can even be used to injure or kill prey.

7. **Peculiarity of tongue of frog**Floor of mouth cavity lies large, muscular sticky protrusibletongue.Protrusion of the tongue is brought about by the change of pressure in large sublingual lymph sac.

8. **Poison teeth** (fangs) situated – attached to maxillary bones, long, curved, sharpand pointed.Hypodermicneedle for injecting person into body of victim.3 types of fands-solenoglyphous,proteroglyphous,opisthoglyphous.

9. **Significance of one ovary in birds**-loss of weight, decressing the number of eggs producedkeeping with the elimination of unnecessary weight- adaption to the flying habit of the birds.

10. **Homeostasis**Tendency to regulate the stability of the normal conditions in the internal environment of a living organism**.**

SECTION – B (5 X 4 = 20)

11. a) **Affinitities of Balanoglossusglavigerous**

Annelida: Vermiform body, Presence of coelom, Arrangement of blood vessels,Collar comparable to clitellum of Oligochaeta, Resemblances between Tornaria and Trochophora larva.
Phoronis: Disposition of the coelom, A ring of cilia surrounding the anus, Proboscis pore comparable to water pore.
Pogonophora: Coelom enterocoelous with similar divisions, Nervous system intra-epidermal.
Echinodermata: Ciliated bands twisted in Tornaria, Auricularia and Bipinnaria, Position of mouth and anus, Divisions of larval alimentary canal, Origin and development of coelom.
Chordata: Presence of gill clefts, Presence of lumen only in collar nerve cord, Feeding mechanism in Ammocoete larva and some amphibian larvae.
Urochordata: Pharynx and branchial apparatus, Development of central part of nervous system, Feeding mechanism.
Cephalochordata: Branchial apparatus, Arrangement of coelomic sacs.

11. b)**Respiratory System of Pisces**

The respiratory organs are the gills which are borne by the gill-pouches. There are five pairs of gill-pouches, each of which communicate with the pharyngeal cavity by a large internal branchial aperture and opens to the outside by exterior gill-slits.The mucous membrane lining the gill- pouches gives a series of horizontal branchial lamellae. The gill-pouches are separated by interbranchial septum which projects beyond the branchial lamellae. The pharyngeal end of each inter-branchial septum is supported by a visceral arch. **There are two types of gills:**Holobranch or complete gill, Demi branch or hemi branch or half gill

Mechanism of Respiration: During respiration the floor of the buccal cavity is lowered and the mouth is opened. Then the water rushes in to fill the greatly expanded buccal cavity. The mouth is now closed and the pharynx contracts.The water then enters the gill-pouches and goes out after gaseous exchange through gill-slits. The spiracles are occasionally used as accessory pathways for the entry of water for respiration, instead of the mouth when it is otherwise occupied.

12. a) **Differentiate between Poisonous & Nonpoisonous Snake**
Poisonous Snakes:Body colour generally bright, **Neck** constricted, **Head** long, triangular, and wide due to the presence of poison glands on two sides of the head, In majority, a **hood** is present,**Tail**

abruptly tapering except in sea snakes, Head shield very large,**scales** on the top of the head are small, scales on the **dorsal surface** of the trunk are smaller but spinal scales are large and hexagonal, **ventral surface** is covered with large transverse plates. No small scales are usually visible from below. All poisonous snakes must have **broad plates** on the belly but snakes having broad plates are not always poisonous, **Teeth** are not uniform .maxillary teeth are large and called **'fangs.'** Fangs are grooved or with a canal,Two**poison glands** are present.

Non-poisonous Snakes:Body colour not so bright. **Neck** un-constricted.Head usually narrow and elongated.**Hood** usually absent.**Tail** gradually tapering. Head shield small. **scales** are large and usually nine in number. **dorsal scales** are large but spinals are smaller and not hexagonal. **Ventral surface** is covered either with small scales or small scales are visible on both sides of the transverse plate below. **teeth** are uniform and solid. **Poison glands** absent.

12.b) Structure of Heart f Frog: Muscular central pumping station. It drives blood through the closed circulatory system.

External features: Heart lies mid-ventrally inside the anterior trunk region- protected by the pectoral girdle.- reddish in color- conical or triangular in shape. It has the broad base which is directed anteriorly and the narrow apex posteriorly.

Pericardium: It encloses the heart. It is thin, transparent, two-layered sac- inner wall of pericardium is termed as visceral pericardium.

Chambers of heart: There are 3 chambers in a heart of frog. Heart is made up of Two atria or auricles (right and left): It is dark colored and lies anteriorly. One ventricle: It is pink colored, conical and lies posteriorly- longitudinal inter-auricular groove demarcates the two auricles externally-Two additional chambers are present in the heart of the frog i.e. sinus venosus and truncusarteriosus.

Auricles: There are two auricles, left and right.They are thin walled and are completely separated from each other by a thin vertical inter-auricular septum.The left auricle is smaller than the right.Sinusvenosus opens into dorsal wall of the right auricle through the sinu-auricular aperture.Thesinu-auricular aperture is a large transverse oval aperture.

Ventricle: The ventricle has thick muscular and spongy wall.Its inner surface consists of: Columnaecarnae or trabeculae (irregular strands or ridges)Fissures(depressions)These highly reduce the cavity of ventricle.Chordaetendineae are thread like structure that connects the flaps of auriculo-ventricular valves to the wall of ventricle.

13.a)Differentiate between Poisonous & Nonpoisonous Snake

Poisonous Snakes:

Body colour generally bright,Neck constricted, Head long, triangular, and wide due to the presence of poison glands on two sides of the head, hood is present, Tail abruptly tapering except in sea snakes, Head shield very large.Scales on the top of the head are small, scales on the dorsal surface of the trunk are smaller but spinal scales are large and hexagonal,ventral surface is covered with large transverse plates. No small scales are usually visible from below. All poisonous snakes must have broad plates on the belly but snakes having broad plates are not always poisonous. Teeth are not uniform, Two poison glands are present.

Non-poisonous Snakes:

Body colour not so bright.Neck un-constricted,Head usually narrow and elongated.Hood usually absent, Tail gradually tapering.Head shield small, scales are large and usually nine in number, Dorsal scales are large but spinals are smaller and not hexagonal. Ventral surface is covered either with small scales or small scales are visible on both sides of the transverse plate below,Teeth are uniform and solid, Poison glands absent

13.b) Arterial system of calotessix pairs of arterial arches joining the dorsal aorta to the ventral aorta. Ventricle in Calotes tends to divide into left and right ventricles, the base of the ventral aorta splits into three parts, two of which remain in the right part of the ventricle and the third goes to the left part of the ventricle.

Pulmonary aorta: independently from the right portion of the ventricle, splits into two branches, each entering into a lung. It carries deoxygenated blood.

Left systemic aorta: Aorta originates independently from the right (left to pulmonary aorta) portion of the ventricle and moves forward for some distance. Then it curves round the heart and goes downwards to meet the right systemic aorta a little posterior to the apex of ventricle. It carries mostly the oxygenated blood.

Right systemic aorta: Emerges independently from the right ventral margin of the base of the ventricle and moves forward. It then curves to the right side of the heart. It meets the left systemic aorta posteriorly to form the dorsal aorta. It carries oxygenated blood. From the apex of the curvature of the right systemic aorta arises a single and common carotid artery which advances anteriorly and then splits into four arteries.

14.a)**Different kinds of feathers in Pigeon**

(I)**Quills or flight feathers:** strong out of which contour feathers are strongest enough-consists of central axis or mainstem, quill or calamus, and distal expanded portion called vexillum or vane.**Types of Quills: Remiges:**Flight feathers of wings are called remiges, or wing quill. there are 23 remiges in each wing. Each remix has inner broader posterior half than the outer or anterior half.**Rectrices:**In pigeon, 12 long rectrices on tail quills are arranged in a semi-circle fan like manner on tail. They help in steering the bird in flight. **Coverts:** There are two sets of coverts, one set at bases of wing quill and other set is at the bases of tail quill. Converts are smaller structurally similar to remiges. Both sides of vane are nearly equal.

(II) Contour feathers (Pennae): general covering of the body-central axis and a vane. These are smaller and woolly with purely developed soft barbules without interlocking barbicles.It provides fictional resistance and forms body insulation for temp.

(III) Filoplumes (Pin feathers or hair feathers): small, delicate, hair like feathers remain sparsely distributed all over the body. Each filoplume consists of a short calamus and a long thread like rachis. There are a very few weal separated barbs at the tip of rachis.

(IV) Down Feathers (Plumules): very small, soft, and woolly which are without rachis or shaft. The barbs are long, flexile with short barbules without interlocking pattern of arrangement. The barbs arising as a fluffy tuft from the top of the short calamus.

14.b) Flight muscles of Pigeon

The muscles which operate the forelimbs (wings) during flight are called flight muscles. These are pectoral, accessory and tensor.**(i) Pectoral Muscles:**Most significant flight muscles of birds. These muscles remain attached to the keel of the sternum and to the wings, and provide up and down movements to the wings.

(a) Pectoralis Major:very large, triangular and most powerful flight muscle which arises from the ventral side of the sternal keel and clavicle, one on each side, and forms the so-called **'breast'**. This muscle weighs about one-fifth as much as the entire body and has dark red colour due to rich blood supply.When the pectoralis major muscle contracts, the wing is pulled downwards and forwards, so that the body of pigeon is lifted up and propels itself through the air, because it causes the down stroke of wing, so also called **depressor muscle**.

(b)PectoralisMinor: Pectoralis minor, also called **deep pectoralis**, **supracoracoideus or subclavius**, is a small and elongated muscle which elevates the wing during flight. It lies deep to the pectoralis major. It arises from the anterior part of the sternum, dorsal to the pectoralis major. Elevator muscle and it causes the upstroke of the wing. When it contracts, the foramen triosseum acts like a pulley for its

tendon, pulling the humerus backwards and upwards, and, thus, raising the wing during flight. In pigeon, the pectoralis minor is especially developed and causes quick takeoff of the bird during flight.

(ii) Accessory Muscles: Besides pectoral muscles, the accessory muscles also elevate or depress the wing during flight. A coraco-brachialis longus or coraco-humeral lies beneath the pectoral muscles. It arises from the coracoid and the costal process of sternum, and its tendon is attached to the posterior side of the head of humerus.

(iii) Tensor Muscles: Three muscles called tensor longus, tensor brevis, and tensor accessorius keep the prepatagium fully stretched when the wing is extended in flight. Similar tensor posteriusalae keeps the postpatagium tensed during flight.

15.a)**Prototheria** contains the egg-laying mammals, which are the most ancestral forms in the class Mammalia. There are only three living species grouped into two families which comes under a single order, the Monotremata. Prototherians are endothermic-carnivorous, with their diets consisting of various invertebrates. Platypuses searched food in the benthos of lakes and streams, using their sensitive bills to find prey. They are generalist predators, whereas echidnas specialize on either ants and termites (Tachyglossus) or worms (Zaglossus). Both species of echidna are powerful diggers and use their claws and snouts to root through the earth to find food. Body is small , covered by hairs and spines. Snout produced into beaks. External ears inconspicuous or absent. Tail present or absent. Mammary glands are without teats or nipples. Males carry a hollow and horny ,tarsal spur on each hindleg , connected internally to a poison gland. A temporary mammary pouch , equivalent to teats , develops during breeding season on the abdomen of female.

15.b)**Female Reproductive System:** Itconsists of a pair of ovaries, a pair of oviducts, uterus, vagina, vestibule and some accessory glands.

1. Ovaries: The paired ovaries are small, whitish, oval bodies found attached to the dorsal wall of the abdomen behind the kidneys. Attached with the dorsal body wall by a double fold of mesentries, called mesovarium.Each ovary when ripe shows on its outer surface many tiny projections called ovarian or Graafian follicles. Each follicle contains a developing ovum. These projections rupture releasing the ova.

2. Oviducts: Fimbriated (lined by cilia) funnel or ostium close to the outer side of each ovary which leads into the oviduct. It receives the ovum after their discharge from the ovary. Each oviduct behind the funnel is differentiated into two parts- first part, the follopian tube, is coiled, narrow, internally ciliated and glandular and the second part is long, thick, muscular, glandular and coiled with wider diameter, called uterus.

3. Vagina and Vestibule: The uteri of both the sides join together along the median line to form a common wide passage, called the vagina. It lies over the urinary bladder. The vagina passes backwards and joins with the neck of the urinary bladder, forming a common passage, called urinogenital canal or vestibule. It extends backwards ventral to rectum and opens outside by a slit-like aperture, the vulva.

4. Clitoris: It is small, erectile, and knob-like, and attached to the anterior wall of vulva. It is homologous to the penis of male because it consists of a pair of erectile tissue (corpora cavernosa) which is highly sensitive.

5. Accessory Glands: A pair of small Bartholin's glands is found embedded in the dorsal wall of vestibule. The secretion of these glands is discharged in the vestibule which lubricates the vaginal passage. They are similar to the Cowper's glands of the males.

SECTION - C **(4 X 10 = 40)**

Answer any four out of six questions

(**16th question is compulsory** and answer **any three** questions (from qn. no : 17 to 21)

16. **Parental care in fishes**

- Parental care behaviour is universal among fishes.
- First either both parents, or one alone care for the offspring. Thus, there are paternal, maternal and biparental species.
- Second, the eggs and newly hatched young are either maintained on the substrate that is, on plants, under stones, in excavated pits and so on (these are called substrate-brooders or guarders) or carried about in the parent's mouth (these are called mouth brooders or incubators).
- Fishes have evolved many means of affording care to fertilized eggs and young ones by one or both sexes.

Different types of parental care in fishes include: Scattering eggs over aquatic plants,Depositing eggs in sticky covering,Laying of eggs at suitable places,Nestbuilding,Coiling round the eggs, Egg brooding in mouth and intestine, Brood pouches, By the formation of egg capsules, Attachment of eggs to the body,Viviparity

17.**Respiration in Frog**

In adult frog, due to its amphibian life, respiration occurs through skin (cutaneous respiration), lining of the bucco-pharyngeal cavity (buccal respiration) and the lungs (pulmonary respiration). Ordinary respiratory requirements are met by the skin and bucco-pharyngeal cavity, lungs are used only when the need of oxygen is great.

Cutaneous Respiration:

The skin of frog is very much suited for the respiratory function as it is very thin and richly supplied with blood capillaries and remains moist with the water and also mucus, secreted by mucous glands. During gaseous exchange the oxygen first dissolves in the moisture present over the body and then diffuses into the blood circulating in the blood capillaries, while the resultant carbon dioxide passes out from the blood into the surrounding medium (water) by diffusion. In cutaneous respiration, no movements are needed because skin always remains exposed to air or water.

Bucco-Pharyngeal Respiration or Buccal Respiration:

In this type of respiration, the mouth and glottis remain closed. Thus, no air enters or goes out from the lungs. When the floor of the buccal cavity is lowered, the air enters the buccal cavity through the nostrils or the nares. The oxygen of air dissolves in the layer of mucus and then goes into blood. At the same time carbon dioxide is given out into the buccal cavity from the blood which is expelled along with residual air through the nostrils when the floor of the buccal cavity is raised.

Pulmonary Respiration:

Respiration on land in air with the help of lungs is the pulmonary respiration. In frog, lungs are poorly developed. The intake of oxygen by lungs is not sufficient to the body. Therefore, oxygen intake through moist skin and buccal cavity is needed.

Mechanism of Pulmonary Respiration:

The incoming and outgoing of the air from the lung is brought about by the action of the floor of the buccal cavity which actually acts as a force pump. The actions of the floor of the buccal cavity are brought by two sets of muscles, the stemohyal and the petrohyal muscles,

(i) Sternohyal muscles arise from the coracoid and clavicle or sternum and attached to the lower surface of the hyoid apparatus located in the floor of the buccal cavity.

(ii) Petrohyal muscles are attached on one end with the squamosal bone above and on the other side with the upper surface of hyoid apparatus.

The respiratory mechanism involves two phases:

(a) Inspiration:

During inspiration the frog closes the glottis and mouth, and the nostrils remain open.-contraction of the sternohyal muscles the floor of the buccal cavity along with hyoid is lowered increasing the volume of the buccal cavity. Thus, the air enters the cavity through the external nares.

Now the glottis opens and bones of lower jaw push the premaxillae bones of the upper jaw upwards closing the nostrils. Now the petrohyal muscles contract, this results in lifting the hyoid apparatus along

with the floor of the buccal cavity forcing the air to enter into the lung through the glottis. This drawing in of air into the lungs is called inspiration.

(b) Expiration:

Before expiration, when lungs are filled with air, the glottis closes and the air is kept in the lungs for a short time. During this period buccal respiration occurs. Soon the glottis becomes opened and the air from the lungs is expelled into the buccal cavity by the contraction of the lungs and the abdominal muscles and by lowering the floor of the buccal cavity. Now the buccal floor is raised again, the glottis closes and external nares are opened, forcing the air out through the external nares.

Physiology of Respiration:

The erythrocytes of frog's blood contain, the haemoglobin to which the respiratory gases (O_2 and CO_2) can combine temporarily only in high partial pressure. In the respiratory surfaces the O_2 in the air is found in high concentration due to which it combines with haemoglobin of the blood to form oxyhaemoglobin.The resultant CO_2 formed due to a series of chemical reactions is in high concentration in the tissue, therefore, it passes into blood which has low CO_2 concentration. CO_2 taken by the blood is passed out from the respiratory surface. The absorbed O_2 oxidises the food to release the energy along with CO_2.

18.**Poison apparatus and biting mechanism of poisonous snake**

Poisonous apparatus of snakes include the following parts;

1**. Poison Glands** In poisonous snakes the poison glands are situated one on either side of the upper jaw. The poison glands are possibly the superior labial glands or parotid glands. Each poison gland is sac-like and provided with a narrow duct at its anterior end. Capsule sends vascular fibrous septa that separate the glandular substances into secretory pockets. The duct passes forward along the side of the upper jaw and loops over itself just in front of the fang and opens either at the base of the fang or at the base of the tunnel on the fang. The poison gland is held in position by ligaments.

2. **Poison Ducts** The duct passes forward along the side of the upper jaw and loops over itself just in front of the fang and opens either at the base of the fang or at the base of the tunnel on the fang. The duct actually opens in a pocket of mucous sheath that covers the basal part of the fang. In spitting cobras the poison duct is modified in that it has an "L" shaped bend, just prior to exiting the fang, with the discharge orifice being located on the front of the fang.

3. **Fangs**: The fangs of snakes evolved to inject venom into the pray of various snakes that possess them. the term fangs refers to a grooved or tubular tooth that is used to inject venom. It has pared pointed and hook like teeth, which are the modified form of maxillary teeth. They are long, curved,

sharp and pointed. Fangs are divided into three types on the basis of structure and position which are given bellow; (a) Proteroglyphous (b) Opisthoglyphous (c) Solenoglyphous

4**. Muscles** : The poison apparatus is associated with specialized bands of three types of muscles viz. i. digastrics ii. Sphenopterygoid iii, anterior and posterior

Biting Mechanism: The skull and jaw bones in poisonous snakes are loosely and movably articulated, thus, allowing an enormous gape and swallowing whole of large prey. Premaxilla, usually toothless and the bones of the upper jaw are loosely attached to rest of the skull. Quadrate jointed to the squamosal. There are movable joints between the frontals behind and prefrontals and nasals in front and also between several other bones of brain case, palate and jaws. These joints have loose ligaments and allow movement in several directions and so permit a huge gap. The two halves of the lower jaw are connected together by elastic ligamentous tissue. So they are capable of being widely separated from one another.

Four distinct phases when a poisonous snake bites: (i) The strike; (ii) opening of the mouth and elevation of the fangs; (iii) closing of the jaws and the injection of venom; (iv) retraction of the fangs.

19.**Kinds of Migration**

Migration is broadly divided into following 3 kinds.

1. **Return migration**:- Migration to a previously known place which has been visited earlier is called return migration.

2. **Exploratory migration**:- Migration to a completely unknown space which has not been visited earlier is called exploratory migration. Although ability to return to return to the known place is retained but is not exploited.

3. **Removal migration**:- Migration to a comparable spatial unit which is not followed by a reversal to the original spatial unit is called removal migration.

Depending upon the plane of movement of the migrants, migration is divided into 3 types:-

1. **Horizontal migration**:-Migration occurring on a path perpendicular to the gravitational force of the earth is called horizontal migration. Depending upon the directions of path, horizontal migration is further divided into following two kinds:-

(a) **Latitudinal migration**:- Horizontal migration occurring from north to south or vice-versa is called latitudinal migration- from north to south and it occurs from south to north in few cases only

(b) **Longitudinal migration:-** It takes place in East- West direction. They starting moves from towards the Atlantic coast to avoid the Continental winter.

2**. Vertical migration:-**Migration occurring in a plane parallel to the gravitational pull of the earth is called vertical migration.

3. **Altitudinal migration:-B**oth horizontal and vertical components- Birds fly up and down over mountain and hills- Generally migration occurs at relatively low altitudes.

On the basis of time of flight whichoccurs during migration

Diurnal migration& Nocturnal migration

On the basis of reasons of migration,

Climatic migration, Alimental migration, Gamatic migration

On the basis of seasons

Summer visitors,Winter visitors, Birds of passage

20.Flight adaptations of Birds

Morphological Adaptations

Body Contour spindle-shaped body to offer less air resistance during flight-helps the birds to conserve energy and become more efficient at flying.

Compact Body

The body of a bird is compact, dorsally strong and ventrally heavy to maintain equilibrium in the air. Their wings are attached on the thorax, the light organs like lungs and sacs are positioned high, the heavy muscles placed centrally are other features that help in flight.

Body Covered With Feathers

The feathers are smooth, directed backwards, and closely fitting which make the body streamlined and reduce friction during flight. It lightens the body weight and protects it from the effect of environmental temperature. They also have a wide surface area for striking the air.Feathersadd to the body buoyancy. It insulates the body and prevents any loss of heat from the body. This helps the birds to bear low temperatures at higher altitudes.

Forelimbs Modified into Wings

The forelimbs are modified into wings, which is the only organ of flight. These consist of a framework of bones, muscles, nerves, feathers, and blood vessels.The wings have a large surface area. They also support the bird in the air. The wings have a thick, strong leading edge with a concave lower surface and a convex upper surface. This helps in increasing the air pressure below and reducing the air pressure above. Thus the bird can fly upward and forward during flight.

Mobile Neck and Head

The birds have a long and flexible neck, which helps in the movement of head important for various functions. They possess a horny beak which helps them to pick the grains and insects while feeding.

Bipedal Locomotion

The anterior part of the body of a bird helps in taking off during flight. The anterior part of the body also helps birds to land. The hindlimbs help in the locomotion on land. They can support the entire body weight of a bird.

Perching

When a bird sits on the branch of a tree, its toes wrap around the twig. This is known as perching. The muscles are so well-developed that a bird can sleep in that position without falling.

Short Tail

The tail bears long feathers that spread like a fan and function as a rudder during flight. They also help in balancing, lifting, and steering while flying and perching.

Anatomical Adaptations

Flight Muscles The well-developed muscles control the action of the flight muscles. It weighs about 1/6th of the entire bird. The flight muscles are striated. The muscles on the wings are large. Other muscles help the above muscles in functioning.

Light and Rigid Endoskeleton The birds have a very stout and light skeleton. The bones are hollow, filled with air sacs. They are provided with a secondary plastering to increase their rigidity. The bones are fused and lack bone marrow.The birds lack teeth. The thoracic vertebrae are fused except for the last one. This plays an essential role in the action of wings striking the air.

Digestive System The birds have a very high rate of metabolism. The length of the rectum is reduced because of the minimum undigested waste. They have no gall bladder which reduces the weight of the bird.

Respiratory System The respiratory system of birds is designed in such a manner that the food is oxidised rapidly and a large amount of energy is liberated.

Circulatory System Rapid supply of oxygen is required by the blood due to rapid metabolism rate in birds. Therefore, birds require an efficient circulatory system. Birds have a four-chambered heart that performs double circulation. This prevents the mixing of oxygenated and deoxygenated blood. Also, the birds contain a large amount of haemoglobin in their red blood cells, which helps in the quick aeration of body tissues.

Warm Blooded The temperature of the body of a bird remains high and does not change with the change in the environment. This facilitates the birds to fly at very high altitudes.

Excretory System The nitrogenous waste is converted to less toxic organic compounds such as uric acid, and urates. They have no urinary bladder. The uriniferous tubules efficiently absorb water.

20.**Structure of Brain of Rabbit**

The brain is mainly divided into three parts. These are fore brain, mid brain and hind brain.

Fore Brain: The fore brain is also called prosencephalon, it is divided into two parts. These are telencephalon and diencephalon. Telencephalon contains two parts.

These are olfactory lobes and cerebral hemispheres.

i**. Olfactory lobes** These are a pair, clubshaped, lie side by side anteriorly. The olfactory lobes are longitudinallyseperated by groove, called longitudinal fissure. These are hollow. The cavities of olfactory lobes are called olfactory ventricles or rhinocoels. Each olfactory lobe develops a nerve at its anterior end. This first cranial nerve is called olfactory nerve.

ii. **Cerebral hemispheres** The cerebral hemispheres (called as Large brain) are a pair, lie side by side behind the olfactory lobes. Each is half globe shaped. Each cerebral hemisphere is broader at the posterior end and narrower at the anterior end. These are seperated by a longitudinal groove called cerebral fissure. The thin dorsal wall of cerebral hemisphere is called pallium. These are also hollow. The cavities are called lateral ventricles. The cerebral hemispheres contain thick ventro lateral walls. These walls are called corpora striata. The corpora striata are connected by transverse fibres, called anterior commissure.

iii. **Diencephalon**

It is an unpaired part of fore brain. The diencephalon is diamond shaped. It is anteriorly covered by posterior ends of cerebral hemispheres. The dorsal wall contains a pineal stalk and anterior choridphlexus. The pineal stalk contains pineal gland. The anterior choroid phlexus is net like.

Mid brain:

It is also called mesencephalon. The mid brain contains four optic lobes. These four optic lobes together called corpora quadrigemina. It is the characteristic feature of mammals brain. The optic lobes are hollow. The cavities are called optocoels. These open into iter or aquiductussylvius. The ventral walls of optic lobes are thick, called cruracerebri. They cross one another and form an 'X' shaped optic chiasma on the ventral surface of diencephalon

Hind brain:

It is also called rhombencephalon. The hind brain contains two parts. These are cerebellum and medulla oblongata. Cerebellum is the unpaired part. It lies only dorsally. The cerebellum is commonlycalled small brain. It contains three parts. The central part is called vermes. The two lateral lobes are called

floculi. The cerebellum is solid and lies transversely. It is the posterior part of brain. Medulla oblongata is the most important part of the brain. It is hollow. The cavity is called fourth ventricle or myelocoel. The third and fourth ventricles are connected by a tube called iter or aquiduct of Sylvius. The fourth ventricle posteriorly opens into the central canal of spinal cord. The medulla posteriorly continuous as the spinal cord. The dorsal wall of medulla contains nonnervous blood capillary net called posterior choroid phelxus called rhombencephalon. The hind brain contains two parts. These arecerebellum and medulla oblongata.

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