UNIT V

Chapter 12

Trends in Economic Zoology

Chapter Outline

714F9X

Give a man a fish and you feed him for a day;
teach a man to fish and you feed him for a lifetime.

Learning Objectives:

- *Creating awareness on self employment opportunities in various fields*
- *Understands the economic importance of earthworm, honeybee, lac insect, silk worm, fish, cattle and birds*
- *Knows the techniques and tools required for various culture methods*
- *Learns to manage the culture practices*

Zoology is a branch of science which deals with the study of animals. For someone who is interested in pursuing a career in Zoology, there are several specializations that the students can venture into. There are physiologists, who study the metabolic processes of animals; there are taxonomists who deal with the naming and the classification of animal species; embryologist whose job is to study and focus on the early developmental stages of animal life. **Zoology as a career** as a number of specializations and students are presented with a plethora of career options once they chose to be associated with this field. This field is concerned with the preservation and management of animal kingdom and a career in it would mean that you are a part of that responsibility. A zoologist might even get to travel because the nature of his/her job. Channels like National Geographic, Animal Planet, and Discovery Channel are in constant need of Zoologists for research and documentaries. Zoologists are also hired for zoos, wildlife services, botanical gardens, conservation organizations, national parks, nature reserves, universities, laboratories, aquariums, animal clinics, fisheries and aquaculture, museums, research, pharmaceutical companies, veterinary hospitals, etc.

If you want to be an entrepreneur you have to learn the methods of culturing farm animals and their importance, since

farm animals possess great economic value. Since prehistoric time human beings taken maximum advantage from animals by keeping them under their control through domestication. The economic success of the industries, based on animals and their products, depends on the proper production, management and development of the next generation of farm animals.

12.1 Scope of Zoology

Studying Zoology can provide self employment opportunities and you can become an entrepreneur. Economic Zoology is a branch of science that deals with economically useful animals. It involves the study of application of animals for human welfare. The need of Zoology is not just to improve our economic condition but also to provide food security and provide employment opportunities. Based on the economic importance, animals can be categorized as:

1. Animals for food and food products
2. Economically beneficial animals
3. Animals of aesthetic importance
4. Animals for scientific research.

12.2 Vermiculture

Vermiculture is the process of using earthworms to decompose organic food waste, into a nutrient-rich material capable of supplying necessary nutrients which helps to sustain plant growth. The aim is to continually increase the number of worms to have a sustainable harvest. The excess worms can either be used to expand a vermicomposting operation or sold to customers. Vermicompost is the primary goal of vermiculture. Technically, the worm castings are pure worm waste and are fine and nutrient rich organic soil amendment. Vermicompost on the other hand, is comprised of the castings, bits of bedding and other organic matter. Essentially, though the terms are used interchangeably, they are both worm manure and are valuable for improving soil health. Applications of earthworm in technology of composting and bioremediation of soils and other activities is called Vermitech (Sultan Ismail, 1992).

The disposal of solid wastes (bio-degradable and non- biodegradable) remains a serious challenge in most of the countries. Earthworms play a vital role in maintaining soil fertility; hence these worms are called as **"farmer's friends"**. These are also called as **"biological indicators of soil fertility"**. The reason is that they support bacteria, fungi, protozoans and a host of other organisms which are essential for sustaining a healthy soil. The breakdown of organic matter by the activity of the earthworms and its elimination from its body is called vermicast. It is a finely divided granular material and is noted for its porosity, aeration, drainage and moisture holding capacity and serves as rich organic manure.

Earthworms are divided into two major groups. The first group, the humus formers, dwell on the surface and feed on organic matter. They are generally darker in colour. These worms are used for vermicomposting. The second group, the humus feeders, are burrowing worms that are useful in making the soil porous, and mixing and distributing humus through out the soil. There are different **endemic** (native) species of earthworms cultured

in India for vermicomposting such as *Periyonyx excavatus, Lampito mauritii, Octochaetona serrata*. Some earthworm species have been introduced from other countries and called as **exotic species** Eg. *Eisenia fetida, Eudrilus eugeniae.*

Vermicomposting

Vermicompost is the compost produced by the action of earthworms in association with all other organisms in the compost unit. Vermicompost bed may be selected on upland or an elevated level as it prevents the stagnation of water. You may construct a cement pit of 3x2x1m size (LxWxD) over ground surface using bricks. The size of pit may vary as per availability of raw materials. Cement pot or well rings are practically good. Provision should be made for excess water to drain. The vermibed should not be exposed to direct sunlight and hence shade may be provided (Figure. 12.1). The first layer of vermibed contains gravel at about 5 cm in height, followed by coarse sand to a thickness of 3.5 cm, which will facilitate the drainage of excess water.

Earthworms collected from native soil prefer a layer of local soil in their compost beds. If local soil earthworms are used, add a layer of native loamy soil for about 15 cm on top of the gravel sand layer and introduce earthworms into it. For exotic species such as *Eisenia fetida* and *Eudrilus eugeniae,* the layer of soil is not needed. The unit can now be loaded with digested biomass or animal dung such as cow dung that has lost its heat. The number of earthworms to be introduced in an unit depends on the size of the vermibed prepared. Earthworms such as *Periyonyx. excavatus, Eisenia fetida* or *Eudrilus eugeniae* are introduced on the top. Jute bags or cardboards or broad leaves are used to cover the unit. As worms require moisture, water management is most important for the survival of the earthworms. Too little or too much of water is not good for the worms.

Earthworms release their castings on the surface. One can start harvesting this from the surface on noticing the castings on the surface. It may take several days for the entire biomass to be composted depending on the amount of biomass. When all the compost is harvested, earthworms can be handpicked by creating small conical heaps of harvested compost and leaving in sunlight for a few hours. The earthworms then move down and settle at the bottom of the heap as a cluster. Earthworms from the lower layers of the compost can be recovered and the worms can be transferred to new composting units.

Vermiwash is a liquid collected after the passage of water through a column

Figure 12.1 Vermiculture unit and Earthworms

of vermibed. It is useful as a foliar spray to enhance plant growth and yield. It is obtained from the burrows or **drilospheres** formed by earthworms. Nutrients, plant growth promoter substances and some useful microorganisms are present in vermiwash.

Earthworms can be used for recycling of waste food, leaf, litter and biomass to prepare a good fertilizer in container known as **wormery** or **wormbin**.

Earthworm Pests and Diseases

Earthworms are subjected to attack by a variety of pests. Most outbreaks are the result of poor bed management. Earthworm enemies include ants, springtails, centipedes, slugs, mites, certain beetle larvae, birds, rats, snakes, mice, toads, and other insects or animals which feed on worms. The earthworm has a number of internal parasites including numerous protozoa, some nematodes, and the larvae of certain flies. Larger predators can be excluded from worm beds by proper construction of the bins, and by use of screens or gratings at the bottom and top of the beds.

My vermicompost manufacturing unit is plagued by a number of red ants. Are there any bio-friendly measures to tackle the menace as I do not want to use any chemicals?

Advantages of Using Vermicompost

People are aware about benefits of organic inputs in farming. Vermicompost is excellent organic manure for sustainable agro-practices. So, marketing vermicompost is now a potential and flourishing industry. Retail marketing of vermicompost in urban areas is most promising. Vermicompost is neatly packed in designed and printed packets for sale. People of different age groups are involved in the production and selling of vermicompost. Marketing of vermicompost can provide a supplementary income.

i. Vermicompost is rich in essential plant nutrients.
ii. It improves soil structure texture, aeration, and water holding capacity and prevents soil erosion
iii. Vermicompost is a rich in nutrients and an eco-friendly amendment to soil for farming and terrace gardening.
iv. It enhances seed germination and ensures good plant growth

12.3 Sericulture

Silk is Nature's gift to mankind and a commercial fiber of animal origin other than wool. Being eco-friendly, biodegradable and self-sustaining material; silk has assumed special relevance in present age. Sericulture is an agro –based industry, the term which denotes commercial production of silk through silkworm rearing. Historical evidence reveals that sericulture was practiced in China long back and they preserved the secret for more than 3000 years and maintained monopoly in silk trade with the rest of the world. According to Western historians, mulberry cultivation spread to India about 140BC from China through Tibet. The fabulous silk from China and India were carried to European countries. The 7000 mile lengthy road, historically called the "**Silk road**" passing through Baghdad, Tashkent, Damascus and Istanbul was used for silk transport. Today more than 29 countries in the world are practicing sericulture and producing different kinds of silk. India stands second in silk production next to China.

Production of silk from the silk worm, by rearing practices on a commercial

Table 12.1 Different types of Silkworm

Species of silkmoth	Silk Producing States	Preferred Food (Leaves)	Type Of Silk
Bombyx mori	Karnataka, Andhra Pradesh and Tamil Nadu	Mulberry	Mulberry Silk
Antheraea assamensis	Assam, Meghalaya. Nagaland, Arunachala Pradesh and Manipur	Champa	Muga Silk
Antheraea mylitta	West Bengal, Bihar and Jharkand	Arjun	Tassar Silk
Attacus ricini	Assam, Meghalaya. Nagaland, Arunachala Pradesh and Manipur	Castor	Eri Silk

scale is called sericulture. It is an agro-based industry comprising three main components: i) cultivation of food plants for the silkworms, ii) rearing of silkworms, and iii) reeling and spinning of silk. The first two are agricultural and the last one is an industrial component. Only few species of silkworms are used in the sericulture industry (Table 12. 1 and Figure 12. 2).

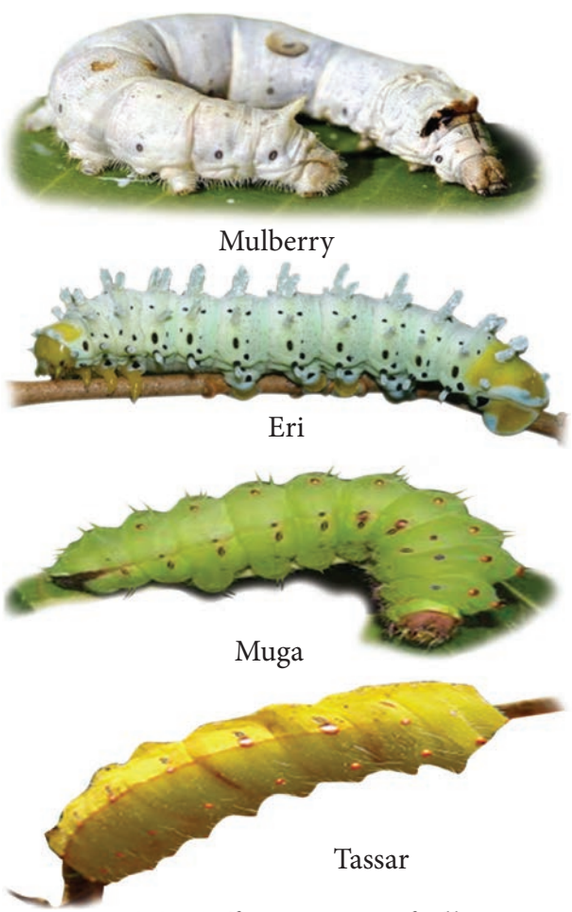


Figure 12.2 Different types of silkworms

Life cycle of *Bombyx mori*

The adult of *Bombyx mori* is about 2.5 cm in length and pale creamy white in colour. Due to heavy body and feeble wings, flight is not possible by the female moth. This moth is unisexual in nature and does not feed during its very short life period of 2-3 days. Just after emergence, male moth copulates with female for about 2-3 hours and if not separated, they may die after few hours of copulating with female. Just after copulation, female starts egg laying which is completed in1-24 hours. A single female moth lays 400 to 500 eggs depending upon the climatic conditions. Two types of eggs are generally found namely diapause type and non-diapause type. The diapause type is laid by silkworms inhabiting the temperate regions, whereas silkworms belonging to subtropical regions like India lay non-diapause type of eggs. The eggs after ten days of incubation hatch into larva called as caterpillar. The newly hatched caterpillar is

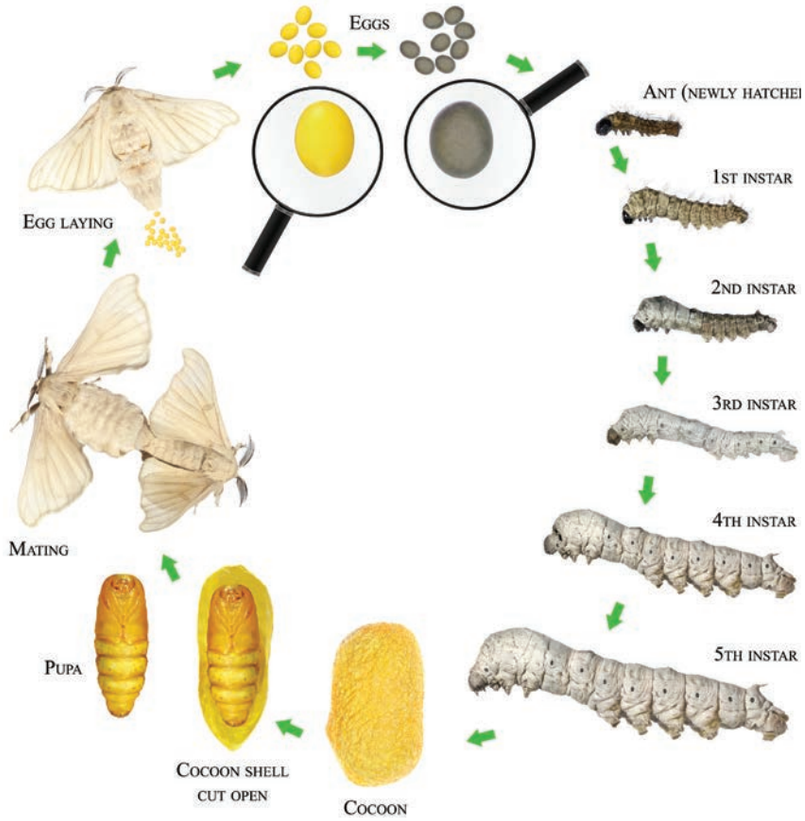


Figure 12.3 Life cycle of *Bombyx mori*

about 3 mm in length and is pale, yellowish-white in colour. The caterpillars are provided with well developed mandibulate type of mouth-parts adapted to feed easily on the mulberry leaves.

After 1st, 2nd, 3rd and 4th moultings caterpillars get transformed into 2nd, 3rd, 4th and 5th instars respectively (Figure12.3). It takes about 21 to 25 days after hatching. The fully grown caterpillar is 7.5 cm in length. It develops salivary glands, stops feeding and undergoes pupation. The caterpillars stop feeding and move towards the corner among the leaves and secretes a sticky fluid through their silk gland. The secreted fluid comes out through spinneret (a narrow pore situated on the hypopharynx) and takes the form of long fine thread of silk which hardens on exposure to air and is wrapped around the body of caterpillar in the forms of a covering called as cocoon. It is the white coloured bed of the pupa whose outer threads are irregular while the inner threads are regular. The length of continuous thread secreted by a caterpillar for the formation of cocoon is about 1000-1200 metres which requires 3 days to complete. The pupal period lasts for 10 to 12 days and the pupae cut through the cocoon and emerge into adult moth.

On the basis of the moults which they undergo during their larval life, *B. mori* is divided into three races – tri-moulters, tetra-moulters and penta-moulters. Based on voltinism (the number of broods raised per year), three kinds of races are recognized in mulberry silkworm – univoltines (one brood only), bivoltines (two broods only) and multivoltines (more than two broods).

India has the distinction of producing all the four types of silk i.e. (a) Mulberry silk (91.7%); (b) Tasar silk (1.4%); (c) Eri silk (6.4%); and (d) Muga silk (0.5%) which are produced by different species of silkworms. Name the species that produces large amount and least amount of silk in India.

Cultivation of food plants for the silkworms

The first component, is to grow the food plants for the silkworms. Mulberry leaves

are widely used as food for silkworm *Bombyx mori* and the cultivation of mulberry is called as **Moriculture**. Presently improved mulberry varieties like Victory1, S36, G2 and G4 which can withstand various agro - climatic and soil conditions are used for planting. The favourable season for cultivating of the mulberry plants is June, July, November and December. The mulberry crop production technology includes land preparation, preparation of cutting, planting techniques, maintenance of mulberry nursery, disease and pest management and uprooting for raising new mulberry gardens. Mulberry is also being grown as tree plant at an height of 123-152 cm with 20 x 20 cm or 25 x 25 cm spacing to harvest better silkworm cocoon crops.

Rearing of silkworms

The second component is the rearing of silkworm. A typical rearing house (6m x 4m x 3.5m) is constructed on an elevated place under shade to accommodate 100 dfls (disease free layings). Space of 1m should be provided surrounding the rearing house. Sufficient windows and ventilators should be provided for free circulation of air inside the rearing house. The windows and ventilators should be covered with nylon net to restrict the entry of uzi flies and other insects. Apart from the specified area of the rearing house; the following appliances such as hygrometer, power sprayers, rearing stands, foam pads, wax coated paraffin papers, nylon nets, baskets for keeping leaves, gunny bags, rotary or bamboo mountages and drier are needed for effective rearing of silkworms. The steps involved in rearing process of silkworm are disinfection of rearing house, incubation of eggs, brushing, young larval rearing and late age larval rearing.

The selected healthy silk moths are allowed to mate for 4 hours. Female moth is then kept in a dark plastic bed, it lays about 400 eggs in 24 hours; the female is taken out, crushed and examined for any disease, only certified disease-free eggs are reared for industrial purpose. The eggs are incubated in an incubator. The small larvae (caterpillars) hatch between 7-10 days. These larvae are kept in trays inside a rearing house at a temperature of about 20°C - 25°C. These are first fed on chopped mulberry leaves. After 4-5 days fresh leaves are provided. As the larvae grow, they are transferred to fresh leaves on clean trays, when fully grown they spin cocoons. Their maturity is achieved in about 45 days. At this stage the salivary glands (silk glands) starts secreting silk to spin cocoons.

Post cocoon processing

The method of obtaining silk thread from the cocoon is known as post cocoon processing. This includes **stifling** and **reeling.**

The process of killing the cocoons is called stifling. The process of removing the threads from the killed cocoon is called reeling. For reeling silk the cocoons are gathered about 8 -10 days after spinning had begun. The cocoons are first treated by steam or dry heat to kill the insect inside. This is necessary to prevent the destruction of the continuous fibre by the emergence of the moth. The cocoons are then soaked in hot water (95° -97°C) for 10-15 minutes to soften the gum that binds the silk threads together. This process is called cooking. The "cooked" cocoons

are kept in hot water and the loose ends of the thread are caught by hand. Threads from several cocoons are wound together on spinning wheels (Charakhas) to form the reels of raw silk. Only about one-half of the silk of each cocoon is reelable, the remainder is used as a silk waste and formed into spun silk. Raw silk thus obtained is processed through several treatments to bring about the luster on the thread.

New silkworm diet produces coloured silk. The Institute of Materials Research and Engineering (IMRE) in Singapore has developed a way to replace the traditional dying process necessary to make coloured silk. A simple dietary change (feeding a diet of mulberries treated with fluorescent dye) for the silkworm larva and they are able to produce silk in a variety of colors. The colour directly integrated into the fibers.

Uses of Silk

1. Silk fibers are utilized in preparing silk clothes. Silk fibers are now combined with other natural or synthetic fibers to manufacture clothes like **Teri-Silk, Cot-Silk** etc. Silk is dyed and printed to prepare ornamented fabrics. They are generally made from Eri-silk or spun silk.
2. Silk is used in industries and for military purposes.
3. It is used in the manufacture of fishing fibers, parachutes, cartridge bags, insulation coils for telephone, wireless receivers, tyres of racing cars, filter fibres, in medical dressings and as suture materials.

Diseases and Pests of Silkworm:

The profitable silk industry is threatened by various diseases caused by the virus, fungal, bacterial and protozoan infections but also by insect predators, birds and other higher animals. Ants, crows, kites, rats, feed upon silk worms thereby causing a great loss to silk industry. Pebrine, is a dangerous disease to in silkworms and the causative organism is *Nosema bombycis* , a protozoan. This silkworm disease is transmitted through the egg of the mother silkworm and also through ingestion of contaminated food. Flacherie generally occurs in the mature larvae and is caused mainly by bacteria like *Streptococcus* and *Staphylococcus*. Grasserie is a most dominant and serious viral disease. It is caused by *Bombyx mori* nuclear polyhedrosis virus (BmNPV) a *Baculovirus*, which belongs to sub group 'A' of the Baculoviridae. Among the fungal diseases, white muscardine is common. This disease is caused by fungus *Beauveria bassiana*.

12.4 Apiculture

Ever since the beginning of civilization, man has been trying to make use of organisms around him for various purposes and to rear them for increasing their number. One of the finest discoveries is our knowledge regarding the procurement of honey collected by honey bees. Care and management of honey bees on a commercial scale for the production of honey is called **Apiculture** or **Bee Keeping**. The word 'apiculture' comes from the Latin word '*apis*' meaning bee. Bees are reared in apiaries that are areas where a lot of bee hives can be placed. There are five well recognized types of bees in the world. They are *Apis dorsata* (Rock bee), *Apis florea* (Little bee), *Apis indica* (Indian bee), *Apis mellifera* (European bee) and *Apis adamsoni* (African bee).

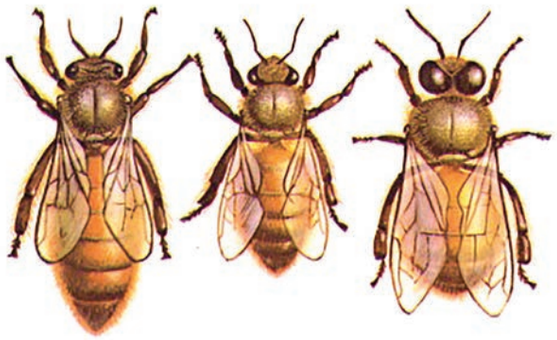
Social organization of honey bees

In honey bees, a highly organized division of labour is found. A well developed honey bee colony consists of the Queen, Drones and Workers (Figure 12.4). All the three types depend on each other for their existence. There is normally one queen, 10,000 to 30,000 workers and few hundred drones (male bees) in a colony.

Queen bee is a functional female bee present in each hive and feeds on Royal Jelly. Its sole function is to lay eggs throughout its life span. The virgin queen bee mates only once in her life. During the breeding season in winter, a unique flight takes place by the queen bee followed by several drones. This flight is called ***"nuptial flight".*** The queen bee produces a hormonal chemical substance called pheromone. The drones in the area are attracted to the pheromone and mating takes place. During mating, the drone releases large number of sperms for sufficient fertilization. In a life span of two to four years, a queen bee lays about 15 lakh eggs. When the queen bee loses its capacity to lay eggs, another worker bee starts feeding on the Royal Jelly and develops into a new queen.

Among the honey bees, **workers** are sterile females and smallest but yet function as the main spring of the complicated machinery in the colony. Worker bee lives in a chamber called 'Worker Cell' and it takes about 21 days to develop from the egg to adult and its lifespan is about six weeks. Each worker has to perform different types of work in her life time. During the first half of her life, she becomes a nurse bee attending to indoor duties such as secretion of royal jelly, prepares bee-bread to feed the larvae, feeds the queen, takes care of the queen and drones, secretes bees wax, builds combs, cleans and fans the bee hive.

Honey bee uses its long-tube like tongue to extract sugary liquid called nectar from the flowers. The nectar is stored in the stomach and the enzyme *invertase* transforms it into honey. This increases the storage life of honey and also contributes to its medicinal value.



Queen Worker Drone

Figure 12.4 Social organization of honey bees

Then she becomes a soldier and guards the bee hive. In the second half her life lasting for three weeks, she searches and gathers the pollen, nectar, propolis and water.

The **drone** is the functional male member of the colony which develops from an unfertilized egg. It lives in a chamber called drone cell. Drones totally depend on workers for honey. The sole duty of the drone is to fertilize the virgin queen hence called "King of the colony". During swarming (the process of leaving the colony by the queen with a large group of worker bees to form a new colony) the drones follows the queen, copulates and dies after copulation.

Structure of a Bee Hive

The house of honey bee is termed as bee hive or comb. The hive consists of hexagonal cells made up of wax secreted by the abdomen of worker bees arranged in opposite rows on a common base. These hives are found hanging vertically from the rocks, building or branches of trees. The young stages of honey bees accommodate the lower and central cells of the hive called the **brood cells**. In *Apis dorsata*, the brood cells are of similar in size and shape but in other species, brood cells are of three types *viz*., queen cell for queens, worker cell for workers and drone cells for drones (Figure.12.5). The cells are intended for storage of honey and pollen in the upper portion of the comb whereas the lower portions are for brood rearing.

Figure 12.5 Structure of a hive showing various cells

Methods of Bee keeping

The main objective is to get more and more quality honey. There are two methods used by apiculturists. They are indigenous method and the modern method. In indigenous method, the honey extracted from the comb contains wax. To overcome the drawbacks of the indigenous method, the modern method has been developed to improve the texture of hives. In India, there are two types of beehives in practice namely, **Langstroth** and **Newton.**

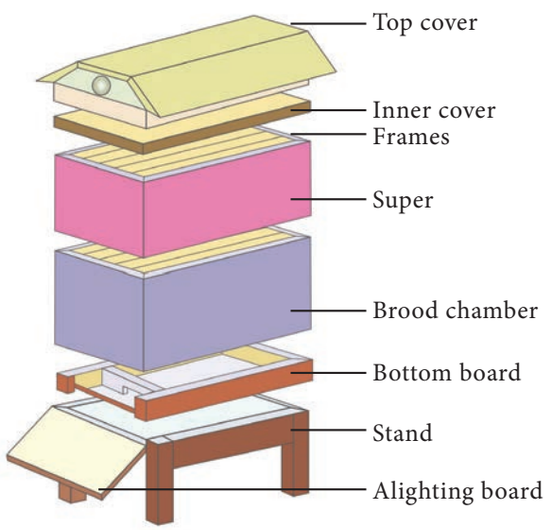


Figure 12.6 - Langstroth bee hive

The Langstroth bee hive is made up of wood and consists of six parts (Figure 12.6) namely **Stand, Bottom board, Brood chamber, Super, Inner cover** and **Top cover.** Besides the above primary equipments, other accessory equipments are used in beekeeping. They are **Queen Excluder, Comb foundation, Bee gloves, Bee veil**, **Smoker, Hive Tool, Uncapping knife, Bee brush, Queen introducing cage, Feeder, Honey Extractor** and **Hive Entrance Guard .**

Products of bee keeping and their economic importance

The chief products of bee keeping industry are honey and bee wax.

Honey is the healthier substitute for sugar. The major constituents of honey are: levulose, dextrose, maltose, other sugars, enzymes, pigments, ash and water. It is an aromatic sweet material derived from nectar of plants. It is a natural food, the smell and taste depends upon the pollen taken by the honey bee. It is used as an antiseptic, laxative and as a sedative. It is generally used in Ayurvedic and Unani systems of medicine. It is also used in the preparation of cakes, breads and biscuits

Bee wax is secreted by the abdomen of the worker bees at the age of two weeks. The wax is masticated and mixed with the secretions of the cephalic glands to convert it into a plastic resinous substance. The resinous chemical substance present in the wax is called **propolis** which is derived from pollen grains. The pure wax is white in colour and the yellow colour is due to the presence of carotenoid pigments. It is used for making candles, water proofing materials, polishes for floors, furniture, appliances, leather and taps. It is also used for the production of comb foundation sheets in bee keeping and used in pharmaceutical industries.

Bees teach us a lesson to work with cooperation. Imagine the hardwork of the bees! A single honey bee travels about double the distance of the circumference of the earth's globe for preparing 453.5ml of honey.

12.5 Lac Culture

The culture of lac insect using techniques for the procurement of lac on large scale is known as Lac culture. Lac is produced by the lac insect *Tachardia lacca* previously known as *Laccifer lacca.* It is a minute, resinous crawling scale insect which inserts its probosics into the plant tissues and sucks juice, grows and secretes lac from the hind end of the body as a protective covering for its body. Moreover the insect is a parasite on host plants i.e., Karanagalli (*Acacia catechu*), Karuvelai (*Acacia nilotica*) and Kumbadiri (*Schleichera oleosa*). The quality of lac depends upon the quality of the host plant. The female lac insect is responsible for large scale production of lac, which is larger than the male lac insect.

Economic importance of Lac

a. Lac is largely used as a sealing wax and adhesive for optical instruments. It is used in electric industry, as it is a good insulator.
b. It is used in preparations of shoe and leather polishes and as a protective coating of wood.

c. It is used in laminating paper board, photographs, engraved materials and plastic moulded articles.

d. Used as a filling material for gold ornaments

Hyper-parasitism - A condition in which a secondary parasite develops within a previously existing parasite or a hyperparasite is the parasite whose host is also a parasite.

12.6 Aquaponics

Aquaponics is a technique which is a combination of aquaculture (growing fish) and hydroponics (growing plants in non-soil media and nutrient-laden water). Aquaponics may also prevent toxic water runoff. It also maintains ecosystem balance by recycling the waste and excretory products produced by the fish. In India, aquaponics was started in 2013. Some primary methods of aquaponic gardening that are in use nowadays are as follows: (i) **Deep water culture** is otherwise known as raft based method. In this method a raft floats in water. Plants are kept in the holes of raft and the roots float in water. This method is applicable for larger commercial scale system. By this method fast growing plants are cultivated. (ii) **Media based method** involves growing plants in inert planting media like clay pellets or shales. This method is applicable for home and hobby scale system. Larger number of fruiting plants, leafy green plants, herbs and other varieties of plants can be cultivated (Figure 12. 7) (iii) **Nutrient Film technique** involves the passage of nutrient rich water through a narrow trough or PVC pipe. Plants are kept in the holes of the pipe to allow the roots to be in free contact with in the water stream. (iv) **Aqua vertica** is otherwise known as vertical aquaponics. Plants are stacked on the top of each other in tower systems. Water flows in through the top of the tower. This method is suitable for growing leafy greens, strawberries and other crops that do not need supporting solid substratum to grow.

Advantages of Aquaponic gardening

Water conservation: No need of water discharge and recharge as the water is maintained by recycling process.

Soil: Bottom soil may be loaded with freshwater. Microbes in water can convert the waste materials into usable forms like ammonia into nitrates which are used by the plants. Thus the soil fertility is maintained

Pesticides: In this system use of pesticides is avoided and hence it is eco-friendly.

Weeds: Since the plants are cultured in confined conditions, growth of weeds is completely absent. The utilization of nutrient by plants is high in this method

Artificial food for fishes: In this system plant waste and decays are utilized by fishes as food. So, the need for the use of supplementary feed can be minimized.

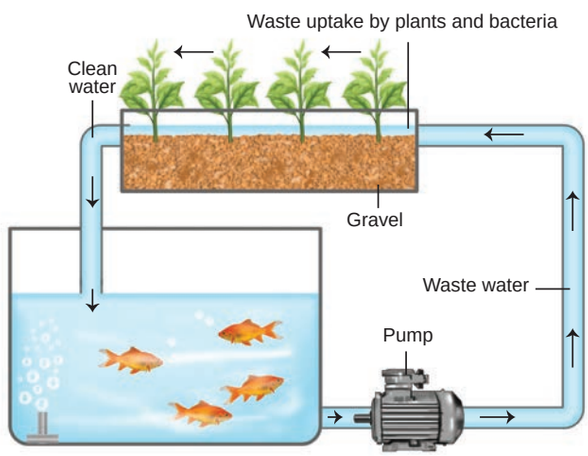
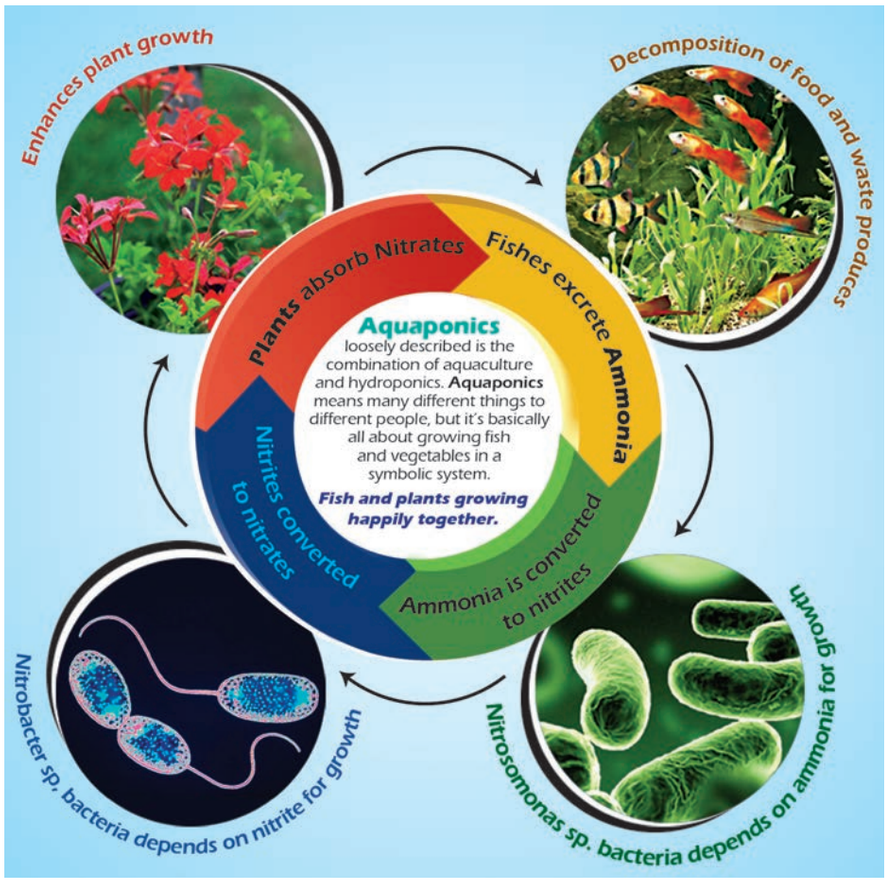


Figure12.7 Aquaponics – Media based method



a. Growing fish or other aquatic animals and plants together in an integrated system. The fish wastes provides nutrients for the plants and the plants filter the water. Additionally bacteria break down by-products such as ammonia.

b. Growing plants in a nutrient solution instead of soil. Fish kept in the water provide the required nutrients.

Write the appropriate scientific terms for above (a) and (b) and differentiate between them..

Fertilizer usage: Artificial or chemical fertilizers is not required for this system since the plants in the aquaponics utilize the nutrients from the fish wastes dissolved in water

Cultivable fishes like tilapia, trout, koi, gold fish, bass etc., are cultured in aquaponics. Common cultivable plants like tomato, pepper, lettuce, cucumber, and rose are co-cultivated in this method.

12.7 Aquaculture

Aquaculture has been practiced in varying forms for centuries dating to the time of the Phoenicians. India offers a huge potential for aquaculture development. Fish culture received notable attention in Tamil Nadu in 1911. Aquaculture is a branch of science that deals with the farming of aquatic organisms such as fish, molluscs, crustaceans and aquatic plants.

On the basis of source, aquaculture can be classified into three categories. They are (a) **Freshwater aquaculture** (b) **Brackish water aquaculture** (c) **Marine water aquaculture**. Culturing of fishes is called fish culture or pisciculture. Inland water bodies include freshwater bodies like rivers, canals, streams, lakes, flood plain wetlands, reservoirs, ponds, tanks and other derelict water bodies and ponds constructed for fresh water aquaculture. The pH of the freshwater should be around neutral and salinity below 5 ppt (parts per thousand).

Brackish water fishes spend most of its life in river mouths (estuaries) back

waters, mangrove swamps and coastal lagoons. Estuarine fish are more common in Bengal and Kerala. Culturing of animals in the water having salinity range 0.5 – 30 ppt are called as brackish water culture. Fishes cultured in brackish water are Milk fish (*Chanos Chanos)*, Sea bass ('Koduva'), Grey mullet ('Madavai'), *Pearl spots ('Kari'meen)* etc,

Marine Fisheries deal with fishing operations along seacoasts. The Indian subcontinent approximately has a 5600 kms long coastline. About 80% of India's marine fish are supplied by the west coast and the remaining 20% by the east coast. The premier varieties are mackerels, sardines, sharks, and catfish. Marine edible fishes of Tamilnadu coast include both cartilaginous and bony fishes. Culturing of animals in the water salinity ranges from 30 - 35 ppt is called Mariculture. Some fishes like *Chanos* sp, *Mugil cephalus* are cultured here. Culturing of animals in the salinity ranges from 36 - 40 ppt is called Metahaline culture. Eg, Brine shrimp (*Artemia salina)*. Artemia is commonly known as the brine shrimp. It is a crustacean and lives in high saline waters because of its high osmoregulatory capacity.

12.7.1 Fish culture

Characteristics of cultivable fishes

The special characteristic features of cultivable fishes are:

i. Fishes should have high growth rate in short period for culture.
ii. They should accept supplementary diet.
iii. They should be hardy enough to resist some common diseases and infection of parasites.
iv. Fishes proposed for polyculture should be able to live together without interfering or attacking other fishes.
v. They should have high conversion efficiency so that they can effectively utilize the food.

Types of cultivable fish

Cultivable fish are of 3 types(Figure 12. 8).

a. Indigenous or native fresh water fishes (Major carps, *Catla*, *Labeo*, *Clarias*)
b. Salt water fishes acclimatized for fresh water (*Chanos*, Mullet).
c. Exotic fishes or imported from other counties (Common carps)

Among these, major carps have proved to be best suited for culture in India, because the carps

1. Feed on zooplavnktons and phytoplanktons, decaying weeds, debris and other aquatic plants.
2. They can survive in turbid water with slightly higher temperature
3. Can tolerate O_2 variations in water.
4. Can be transported from one place to other easily.
5. They are highly nutritive and palatable.

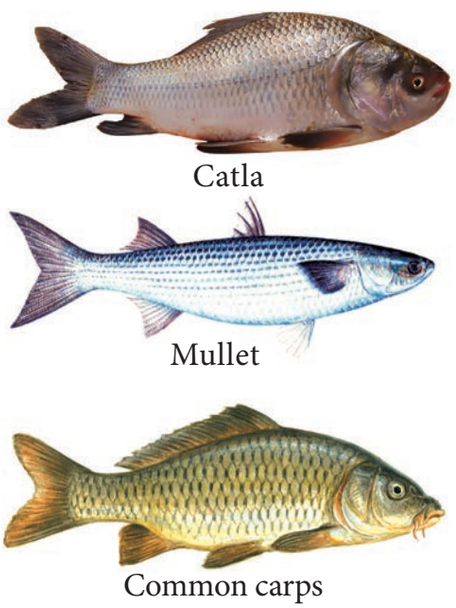


Figure 12.8 Different types of freshwater cultivable fishes

External factors affecting fish culture

The factors that affect fish culture are temperature, light, rain, water, flood, water current, turbidity of water, pH hardness, salinity and dissolved O_2. Light and temperature also play an important role in fish breeding.

Management of fish farm

To culture fish, one should have an idea about different stages of fish culture such as topographic situation, quality, source, physical, chemical and biological factors of water. Breeding, hatching, nursing, rearing and stocking fishes in ponds has to be managed properly. Keeping in view the various stages of fishes, the following different types of ponds have been recommended to manage them.

Breeding pond

The first step in fish culture is the breeding of fishes, therefore, for proper breeding special types of ponds are prepared called breeding ponds. These ponds are prepared near the rivers or other natural water resources.

Types of breeding

Depending on the mode of breeding, they are divided into

1. **Natural breeding** (Bundh breeding)

These are special types of ponds where natural riverine conditions or any natural water resources are managed for breeding of culturable fishes. There bundhs are constructed in large low-lying areas that can accommodate large quantity of rain water. The shallow area of such bundhs is used as spawning ground.

2. **Induced breeding**

The fish seed is commonly collected from breeding grounds but does not guarantee that all fish seeds belong to the same species. Hence advanced techniques have been developed to improve the quality of fish seed by artificial method of fertilization and induced breeding. Artificial fertilization involves removal of ova and sperm from female and male by artificial mechanical process and the eggs are fertilized. For artificial fertilization the belly of mature female fish is held upward. Stripping is done with the thumb of the right hand from the anterior to posterior direction for the ejection of eggs due to force. In this way eggs are collected separately. Further, the male fish is caught with its belly downwards. The milt of fish is striped and collected separately, and then the eggs are fertilized.

Induced breeding is also done by hypophysation (removal of pituitary gland). The gonadotropin hormone (FSH and LH) secreted by the pituitary gland influences the maturation of gonads and spawning in fishes. Pituitary gland is removed from a healthy mature fish. Pituitary extract is prepared by homogenising in 0.3% saline or glycerine and centrifuged for 15 minutes at 8000rpm. The supernatant is injected intramuscularly at the base of the caudal fin or intra-peritonealy at the base of pectoral fin. Male and female fishes start to spawn (release of gametes) and eggs are fertilized. The fertilized eggs are removed from the spawning place and kept into hatching **hapas**.

Fish seed

Fish seed is collected from breeding ponds. The spawn collecting net is commonly called Benchijal (Shooting net) and transferred to the hatching pits

Hatching pit

The fertilized eggs are kept in hatching pits. The hatching pits should be nearer to the breeding grounds, should be smaller in size with good quality water. There are two types of hatching pits, hatcheries are small sized pond in which unfertilized eggs are transferred and hatching happens. Hatching hapas are rectangular trough shaped tanks made up of mosquito net cloth supported by bamboo poles and fixed in the river (Figure 12.9).

Figure 12.9 A fish pond-showing fish breeding hapas

Nursery pond

The newly hatched fries are transported from the hatching happa to nursery ponds where they grow into fingerlings.

Rearing pond

Fingerlings are transferred to rearing ponds that is long and narrow and allows long distance swimming. The rearing pond should be free from toxicants and predators. Antibiotics are used for washing the fingerlings and then transferred to the stocking ponds.

Stocking ponds

Stocking ponds should be devoid of weeds and predatory fishes. Proper organic manuring should be done to increase the production with cow dung and chemical fertilizing should also be done.

Harvesting

Harvesting is done to capture the fishes from the water. Well grown fishes are taken out for marketing. Small sized fishes are again released into the stocking ponds for further growth. Different methods of fishing are carried out to harvest fishes. These include Stranding, Angling, Traps, Dipnets, Cast nets, Gill nets, Drag nets and purse nets. The harvested fishes are preserved by refrigeration, Deep freezing, freeze drying, sun drying, salting, smoking and canning.

Composite fish farming

Few selected fishes belonging to different species are stocked together in proper proportion in a pond. This mixed farming is termed composite fish farming or polyculture. The advantages include,

1. All available niches are fully utilized.
2. Compatible species do not harm each other.
3. No competition among different species is found.
4. *Catla catla, Labeo rohita* and *Cirrhinus mrigala* are the commonly used fish species for composite fish farming.

Exotic fishes

The fishes imported into a country for fish culture are called exotic fishes and such fish culture is known as exotic fish culture. Examples of such exotic fishes introduced in India are *Cyprinus carpio* and *Oreochromis mossambicus*.

Disease Management

Diseases can be of viral or bacterial origin. Regular monitoring of parameters

like water quality, aeration, regular feeding, observation for mortality should be checked. Parasitic infestations and microbial infections should be observed periodically.

Economic importance of fish

Fishes frrm a rich source of protein food and provide a good staple food to tide over the nutritional needs of man. Fish species such as sardines, mackerel, tuna, herrings have high amino acids concentrations particularly histidine which is responsible for the meaty flavor of the flesh. It is rich in fat such as omega 3 fatty acids. Minerals such as calcium, magnesium, phosphorus, potassium, iron, manganese, iodine and copper. Some of the fish by - products are;

Fish oil is the most important fish by product. It is derived from fish liver and from the fish body. Fish liver oil is derived from the liver which is rich in vitamin A and D, whereas fish body oil has high content of iodine, not suitable for human consumption, but is used in the manufacture of laundry soaps, paints and cosmetics.

Fish meal is prepared from fish waste after extracting oil from the fish. The dried wastes are used to prepare food for pig, poultry and cattle. The wastes obtained during the preparation of fish meal are widely used as manure.

Isinglass is a high-grade collagen produced from dried air bladder or swim bladder of certain fishes viz. catfish and carps. The processed bladder which is dissolved in hot water forms a gelatin having adhesive property. It is primarily used for clarification of wine, beer and vinegar.

Why are fish so efficient at converting feed to flesh?

12.7.2 Prawn Culture

Most important aquatic crustacean is prawn, which is widely cultured prawn flesh is palatable and rich in glycogen, protein with low fat content.

Types of prawn fishery

1. Shallow water prawn fishery – located on the west coast restricted to shallow waters.
2. Estuaries and back waters or saline lake prawn fishery - The area of production of prawns are the back waters seen along the Western coast, Ennur, Pulicat, Chilka lake and Estuaries of Ganga and Brahmaputra rivers.
3. Freshwater prawn fishery - Prawns are caught from the rivers and lakes throughout India.
4. Marine prawn fishery – Most of the marine prawns are caught along the Indian coast belonging to the family Penaeidae.

Species of prawn

A number of species of prawn are distributed in water resources such as *Penaeus indicus, Penaeus monodon, Metapenaeus dobsoni and Macrobrachium rosenbergii.*

Culture of freshwater prawn

Macrobrachium rosenbergii (Figure 12.10) is commonly seen in rivers, fields and low-saline estuaries. The prawn collected from ponds, river, and paddy fields are transferred to the tanks which are aerated. For fertilization, one pair of prawn are kept

in a separate tank. After mating, the eggs are laid. Spawning tanks of different sizes should be prepared with proper aeration. Temperature (24^0 C – 30^0 C) and pH (7-8) should be maintained in the hatching tank. The eggs hatch into first and second stage larva. Artificial feed is supplied. Young ones of 5cm length (60 days old) can be reared in fresh or slightly brackish water ponds and paddy fields. Harvesting of prawns can be done twice in a year.

Figure 12.10 *Macrobrachium rosenbergii*

Culture of marine prawn

Several factors that determine the success of marine prawn culture includes selection of site, water quality, soil quality and availability of seed.

Preparation of farm

For the preparation of ponds for algal growth and for the subsequent stocking of prawns it is essential to drain off the water and sundry the bottom followed by light tilling. Agricultural lime should be applied to absorb excess CO_2 and to supply calcium which is required for moulting. Fertilizers like rice, bran, poultry, and cattle dung are used to increase the fertility of the soil. Prawns are commonly caught in crafts and gears using different types of nets such as cast nets, bag nets, drag nets, trawl nets and barrier nets. Preservation of prawns is done by peeling and deveining or by cooking and peeling.

12.7.3 Pearl Culture

Pearl is a white, highly shining globular concretion found within the shell of an Oyster. Pearl oysters are sedentary animals. In India it was cultured for the first time in 1973 at Thoothukudi. Pearl oysters are found along the coast of Kanyakumari and in the Gulf of Kutch. High quality pearls are obtained from pearl oysters of Genus *Pinctada* that can be cultured in the salinity range of 30 ppt in racks, raft and long line methods. Freshwater bivalve *Lamellidens* is also used in artificial pearl culture. Mostly the pearl oysters inhabit the ridges of rocks or dead corals, forming extensive pearl banks. These pearl beds produce best quality of pearls called as "Lingha Pearl".

Pearl Formation

When a foreign particle accidently enters into the space between mantle and shell of the oyster, it adheres to the mantle. The mantle epithelium encloses it like a sac and starts to secrete concentric layers of nacre around it as a defensive mechanism. Nacre is secreted continuously by the epithelial layer of the mantle and is deposited around the foreign particle and over a period time the formation of repeated layers of calcium carbonate makes the hard and glossy pearl. When the pearl enlarges the oyster dies. The shell is then carefully opened and the pearls are manually separated and graded (Figure 12. 11).

Composition of pearl

Pearl comprises of water, organic matter, calcium carbonate and the residue.

(1) Water: 2-4% (2) Organic matter: 3.5-5.9%

(3) Calcium carbonate: 90% (4) Residue: 0.1-0.8%

Quality of pearl

The pearls obtained are of variable shapes and sizes. They may be white, or cream red or pink red in colour. The spherical pearls of rainbow colour are rarely found. The best quality of pearl is obtained from marine oysters. Pearl obtained from freshwater bivalves are not as valuable as those obtained from the marine oysters (Mishra, 1961).

12.8 Animal Husbandry and Management

Animal husbandry is the practice of breeding and raising livestock cattles like cows, buffaloes, and goats and birds etc. that are useful to human beings. Parameters such as adequate ventilation, temperature, sufficient light, water and proper housing accommodation should be taken into account to maintain dairy and poultry farms. Animals should be cared and protected from diseases. Records should be maintained after the regular visits by Veterinarian. More over the selection of good breeds with high yielding potential combined and resistance to diseases is very important.

Animal Breeding

Human beings have been depending on animals and animal products for food from very early times. Generally high yielding animals produced by hybridization are reared in poultry and dairy farms. In earlier days, animals were produced and selected based on specific characters. With the gain in knowledge on the principles of heredity and genetics, human beings have been successful in rearing animals with the superior qualities through hybridization experiments. Complex issues are faced by

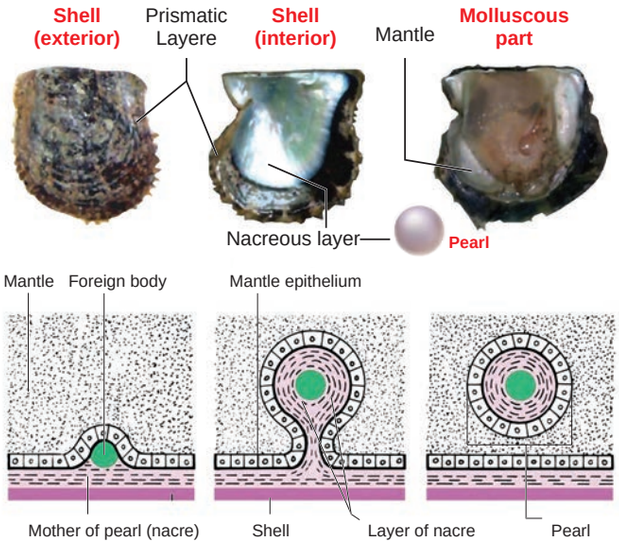


Figure 12.11 Pearl and Pearl Formation

the animal breeder during hybridization experiments. Hence animals with maximum desirable characters should be selected.

A group of animals related by descent and with similar characters like general appearance, features, size etc., are said to belong to a breed. Why should we breed animals? Through animal breeding, improved breeds of animals can be produced by improving their genotype through selective breeding.

Objectives of Animal breeding:

a. To improve growth rate
b. Enhancing the production of milk, meat. Egg etc.,
c. Increasing the quality of the animal products
d. Improved resistance to diseases
e. Increased reproductive rate

Methods of Animal breeding:

There are two methods of animal breeding, namely inbreeding and outbreeding

1. Inbreeding: Breeding between animals of the same breed for 4-6 generations is called inbreeding. Inbreeding increases

homozygosity and exposes the harmful recessive genes. Continuous inbreeding reduces fertility and even productivity, resulting in "inbreeding depression". This can be avoided by breeding selected animals of the breeding population and they should be mated with superior animals of the same breed but unrelated to the breeding population. It helps to restore fertility and yield.

2. Outbreeding: The breeding between unrelated animals is called outbreeding. Individuals produced do not have common ancestors for 4-6 generations. Outbreeding helps to produce new and favourable traits, to produce hybrids with superior qualities and helps to create new breeds. New and favourable genes can be introduced into a population through outbreeding.

i. **Out crossing**: It is the breeding between unrelated animals of the same breed but having no common ancestry. The offspring of such a cross is called outcross. This method is suitable for breeding animals below average in productivity.

ii. **Cross breeding:** Breeding between a superior male of one breed with a superior female of another breed. The cross bred progeny has superior traits (hybrid vigour or heterosis.)

iii. **Interspecific hybridization:**

In this method of breeding mating is between male and female of two different species. The progeny obtained from such crosses are different from their parents, and may possess the desirable traits of the parents. Have you heard about Mule? It was produced by the process of interspecific hybridization between a male donkey and a female horse.

Controlled breeding experiments

Artificial insemination:

Artificial insemination is a technique in which the semen collected from the male is injected to the reproductive tract of the selected female. Artificial insemination is economical measure where fewer bulls are required and maximum use can be made of the best sire.

Thawing means to melt or become liquid. When the semen collected for artificial insemination is taken to far off places/stored for a long time in frozen condition it should be brought to room temperature slowly before use. This process is called thawing.

Advantages of artificial insemination

i. It increases the rate of conception

ii. It avoids genital diseases

iii. Semen can be collected from injured bulls which have desirable traits.

iv. Superior animals located apart can be bred successfully.

Multiple ovulation embryo transfer technology (MOET)

It is another method of propagation of animals with desirable traits. This method is applied when the success rate of crossing is low even after artificial insemination. In this method Follicle stimulating hormone (FSH) is administered to cows for inducing follicular maturation and super ovulation. Instead of one egg per cycle, 6-8 eggs can be produced by this technology. The eggs are carefully recovered non-surgically from the genetic mother and fertilized artificially.

The embryos at 8-32 celled stages are recovered and transferred to a surrogate mother. For another round of ovulation, the same genetic mother is utilized. This technology can be applied to cattle, sheep and buffaloes. Advantage of this technology is to produce high milk yielding females and high-quality meat yielding bulls in a short time.

Breeds of Dairy animals

Dairying is the production and marketing of milk and its products. Dairy operation consists of proper maintenance of cattle, the collection and processing the milk and its by products. There are 26 well defined breeds of cattle and 6 breeds of buffaloes in India. Cattles are classified under three groups based on the purpose they serve to man (Figure 12. 12). They are

i. **Dairy breeds or Milch breeds**: They are high milk yielders with extended lactation. Eg., Sindhi, Gir, Sahiwal, Jersy, Brown Swiss, Holstein cattle.

ii. **Draught purpose breeds**: Bullocks are good for draught purpose. Eg. Kangayam, Malvi

iii. **Dual Purpose breeds**: Cows are meant for yielding more milk and bullocks are used for better drought purpose. Eg. Ongole, Hariana

Vechur breed is the smallest breed of Cow as per World Guinness Records.

Average length: 124cms

Average height: 87 cms

Origin: Vechur village, Kottayam District of Kerala

It produces large amount of milk in relation to the food consumption

India is the largest producer of Milk, globally.

India has many popular breeds of cows and buffaloes.

Prominent indigenous cow breeds in India - Gir, Red sindhi, Sahiwal, Hallikar, Amritmahal, Khillari, Kangayam, Bargur, Umblachery, Pulikulam, Alambadi, Tharparkar, Haryana, Kankrej, Ongole, Krishna valley and Deoni.

To meet the milk demand of the growing population, milk breeds are preferred by farmers in small scale farms. Goats are also used all over India for supplementing deficiencies in milk production. Some of the breeds of cattle that are good milkers are Jamunapari in Ganga-Jamuna riverine tracts, Beetal in Punjab, Bar–bari in Uttarpradesh.

Gir Kangeyam Ongole

Figure 12.12 Different breeds of cattle

Common diseases of cattle: A healthy animal eat, drinks and sleeps well regularly. Healthy cattle appear bright, alert and active in their movement with a shiny coat. Cattle are affected by a large number of diseases. Cattle in ill health appear dull, restless and change posture frequently with drop in milk yield. The main diseases of dairy cattle are rinderpest, foot and mouth disease, cow pox, hemorrhagic fever, anthrax.

Uses of dairy products:

Milk products: Milk is produced by dairy animals which is an emulsion of fat and lactose. Milk also contains enzymes which are destroyed during pasteurization. Milk is a rich source of vitamin A, B_1, B_2, and deficient in Vitamin C. Due to its high nutrition value, it serves as a complete food for infants. Dairy products such as yoghurt, cheese, butter, ice cream, condensed milk, curd, and milk powder processed from milk make dairy, a highly farming attraction.

Meat: Meat is rich in protein and also contains many minerals like iron, zinc, vitamins and selenium. It also contains vitamins needed for human diet.

Land management: Grazing of livestock is sometimes used as a way to control weeds and undergrowth.

Manure: Manure can be spread on agriculture fields to increase crop yields.

Poultry Farming

The word poultry refers to the rearing and propagation of avian species such as chicken, ducks, turkeys, geese, quail and guinea fowls. The most common and commercially farmed birds are chicken and ducks. Poultry farming is essential for the purpose of meat, eggs and feather production. Commercial poultry farming is also profitable. In this part we are discussing about an overview of the chicken and duck breeds, farming practices and its advantages.

Types of Chicken breeds: There are more than 100 breeds. The commonly farmed chicken breeds are categorized into five based on the purpose for which it is farmed. They are egg layers, broiler type, dual type, games and ornamental types (Figure 12.13).

1. **Egg layers:** These are farmed mainly for the production of egg.

Leghorn: This is the most popular commercial breed in India and originated from Italy. They are small, compact with a single comb and wattles with white, brown or black colour. They mature early and begin to lay eggs at the age of 5 or 6 months. Hence these are preferred in commercial farms. They can also thrive well in dry areas.

Chittagong: It is the breed chiefly found in West Bengal. They are golden or light yellow coloured. The beak is long and yellow in colour. Ear lobes and wattles are small and red in colour. They are good egg layers and are delicious.

2. **Broiler type:** These are well known for fast growth and soft quality meat.

White Plymouth rock: They have white plumage throughout the body. It is commonly used in broiler production. This is an American breed. It is a fast growing breed and well suitable for growing intensively in confined farms.

3. **Dual purpose breeds:** These are for both meat and egg production purpose.

Brahma: It is a breed popularly known for its massive body having heavy bones, well feathered and proportionate body. Pea comb is one of the important breed characters. It has two common varieties namely, Light Brahma and Dark Brahma.

Leghorn-Hen and Cock

White plymouth rock Hen and Cock

Silkie

Light brahma Hen and cock

Aseel - Hen and cock

Figure 12.13 Different types of chicken breeds

4. **Game breeds:** Since ancient times, special breed of roosters have been used for the sport of cockfighting.

Aseel: This breed is white or black in colour. The hens are not good egg layers but are good in incubation of eggs. It is found in all states of India. Aseel is noted for its pugnacity, high stamina, and majestic gait and dogged fighting qualities. Although poor in productivity, this breed is well-known for their meat qualities.

5. **Ornamental breeds:** Ornamental chicken are reared as pets in addition to their use for egg production and meat.

Silkie: It is a breed of chicken has a typical fluffy plumage, which is said to feel like silk and satin. The breed has numerous additional special characters, such as black skin and bones, blue earlobes, and five toes on each foot, while the majority chickens only have four. They are exhibited in poultry shows, and come out in various colours. Silkies are well recognized for their calm, friendly temperament. Silkie chicken is especially simple to maintain as pets.

Types of Poultry farming: There are different methods used to rear both broiler and layer chicken. The types of poultry farming are Free range farming, Organic method, Yarding method, Battery cage method and Furnished cage method.

Among these, Battery cage method is widely used in large scale poultry farms. The Free range, Organic and Yarding methods are eco-friendly and the eggs produced by such farming practices are preferred in the market.

Stages involved in rearing:

There are some steps involved in rearing of chicken.

1. Selection of the best layer: An active intelligent looking bird, with a bright comb, not obese should be selected.
2. Selection of eggs for hatching: Eggs should be selected very carefully. Eggs should be fertile, medium sized, dark brown shelled and freshly laid eggs are preferred for rearing. Eggs should be washed, cleaned and dried.
3. Incubation and hatching: The maintenance of newly laid eggs in optimum condition till hatching is called incubation. The fully developed chick emerges out of egg after an incubation period of 21 – 22 days. There are two types of incubation namely natural incubation and artificial incubation.In the natural incubation method, only a limited number of eggs can be incubated by a mother hen. In artificial incubation, more number of eggs can be incubated in a chamber (**Incubator**).

3. Brooding

Caring and management of young chicks for 4 – 6 weeks immediately after hatching is called brooding. It can also be categorized into two types namely natural and artificial brooding.

4. Housing of Poultry

To protect the poultry from sun, rain and predators it is necessary to provide housing to poultry. Poultry house should be moisture- proof, rat proof and it should be easily cleanable and durable.

5 Poultry feeding: The diet of chicks should contain adequate amount of water, carbohydrates, proteins, fats, vitamins and minerals.

Poultry products: The main products of poultry farming are eggs and meat. In India, the primary aim of poultry farming is to obtain eggs. The eggs and poultry meat are the richest sources of proteins and vitamins.

Poultry byproducts:

The feathers of poultry birds are used for making pillows and quilts. Droppings of poultry can be used as manure in fields. The droppings are rich in nitrogen, potash and phosphates.

A number of poultry byproducts like blood-meal, feather meal, poultry by-product meal and hatchery by-product meal are used as good sources of nutrients for meat producing animals and poultry. These byproducts supply proteins, fats, vitamins and good amount of minerals.

Poultry diseases: Ranikhet, Coccidiosis, and Fowl pox are some common poultry diseases.

Benefits of Poultry farming:

The advantages of poultry farming are

- It does not require high capital for construction and maintenance of the poultry farming.
- It does not require a big space.
- It ensures high return of investment within a very short period of time.
- It provides fresh and nutritious food and has a huge global demand.
- It provides employment opportunities for the people.

Chickens communicate with more than 24 vocalizations, each with a distinct meaning, including warning their friends about different types of predators or letting their mothers know whether they're comfortable

Duck Farming

Duck is an aquatic bird and forms only 6% of our country's poultry population. There are about 20 breeds of ducks. The native one includes Indian Runner and Syhlet meta. The exotic breeds include Muscori, Pekin, Aylesbury and Campbell. Domesticated ducks have been derived from the wild duck named Mallard (*Anas boscas*). Farming ducks is profitable as it can be combined with aquafarming practices.

Peculiarity of ducks:

The body is fully covered with oily feathers. They have a layer of fat under their skin which prevents it from getting wet. They lay eggs at night or in the morning. The ducks feed on rice bran, kitchen wastes, waste fish and snails.

Types of breeds: There are three types of ducks depending on the purpose for which it is formed. They are meat productive duck breeds, egg productive duck breeds, and breeds for both meat and egg production.

Advantages of duck farming:

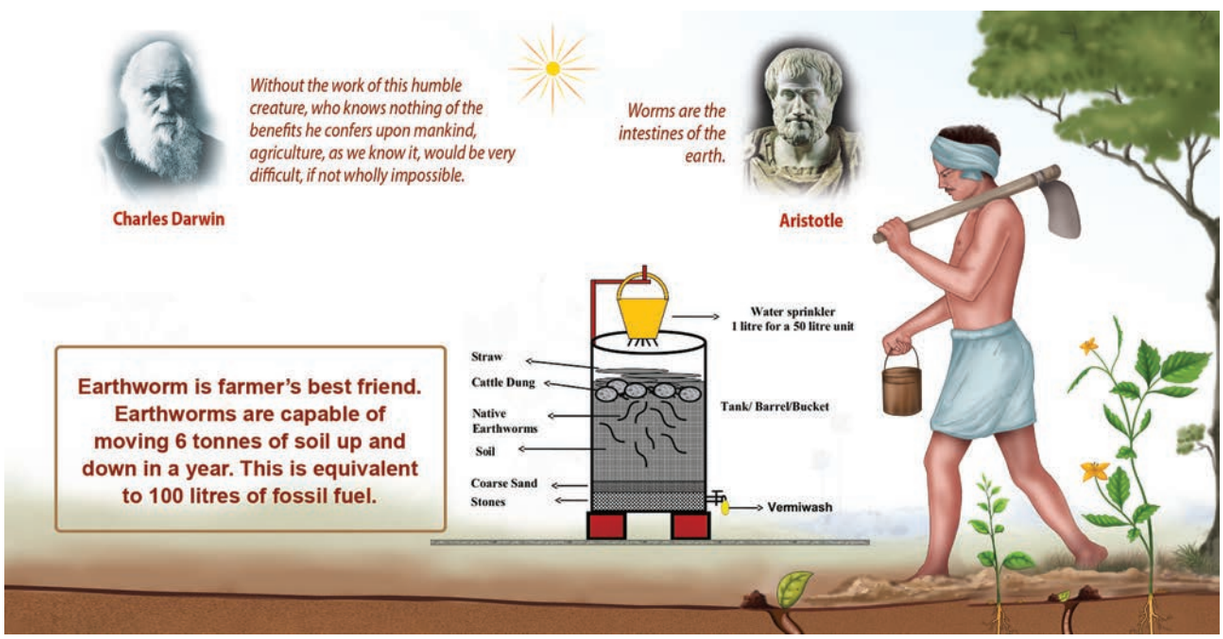
They can be reared in small backyards where water is available and needs less care and management as they are very hardy. They can adapt themselves to all types of environmental conditions and are breed for feed efficiency, growth rate and resistance to diseases.

Summary

Economic Zoology involves the study of application of animals for human welfare. The need of Zoology is to improve our economic condition, to provide food security and employment opportunities. Based on the economic importance, animals can be categorized as Animals for food and food products, economically beneficial animals, Animals of aesthetic importance and Animals for scientific research. Vermiculture is the process of using earthworms to decompose organic food waste, into a nutrient-rich material capable of supplying necessary nutrients to sustain plant growth. Sericulture is the production of silk from the silk worm. It is an agro-based industry comprising three main components. They are cultivation of food plants for the silkworms, rearing of silkworms and reeling and spinning of silk. Care and management of honey bees for the production of honey is called Apiculture. Lac is produced by the lac insect.

Aquaponics is a combined technique of aquaculture and hydroponics. It prevents toxic water runoff and also maintains ecosystem balance by recycling the waste and excretory products produced by the fish. Aquaculture deals with the farming of aquatic organisms such as fish, molluscs, crustaceans and aquatic plants. On the basis of water resources, aquaculture can be classified into Freshwater aquaculture, brackish water aquaculture and Marine water aquaculture. It includes culture of fishes, prawn, crab and oyster.

Animal husbandry is the practice of breeding and raising livestock cattles like cows, buffaloes, and goats and birds etc. that are useful to human beings. Dairying is the production and marketing of milk and its products. Dairy operation consists of proper maintenance of cattle, collection and processing the milk and its byproducts. Poultry refers to the rearing and propagation of avian species such as chicken, ducks, turkeys, geese, quail and guinea fowls. The commonly farmed chicken breeds are categorized into five based on the purpose for which it is farmed. They are egg layers, broiler type, dual type, games and ornamental types.



Evaluation

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1. Which one of the following is not related to vermiculture?
   a. Maintains soil fertility
   b. Breakdown of inorganic matter
   c. Gives porosity, aeration and moister holding capacity
   d. Degradation of non biodegradable solid waste
   a. a and b is correct
   a. c and d is correct
   b. b and d is not correct
   c. a and c is not correct
2. Which one of the following is not an endemic species of earthworm?
   a. Perionyx *a. Lampito*
   b. Eudrillus *c. Octochaetona*
3. Match the following
   1. *Bombyx mori* -
      a) Champa - I) Muga
   2. *Antheraea assamensis* -
      b) Mulberry - II) Eri
   3. *Antheraea mylitta* -
      c) Arjun - III)Tassar
   4. *Attacus ricini* -
      d) Castor - IV) Mulberry

   Select the correct one.

   A) 1 – b – IV B) 2 – a – I
   C) 3 - c - III D) 4 - d - II
4. Silk is obtained from ….
   a. *Laccifer lacca*
   b.*Nosema bombycis*
   c.*Attacus ricini*
   d.*Attacus mylitta*
5. **Assertion:** Nuptial flight is a unique flight taken the queen bee followed by several drones.

   Reason: The queen bee produces a chemical substance called pheromone. The drones in that area are attracted to the pheromone and then mating takes place.
   a. Assertion and reason is correct but not related
   b. Assertion and reason is incorrect but related
   c. Assertion and reason is correct but related
   d. Assertion and reason is incorrect but not related
6. Rearing of honey bee is called
   a. Sericulture
   b. Lac culture
   c. Vermiculture
   d. Apiculture
7. Which of the statement regarding Lac insect is TRUE?
   a. A microscopic, resinous crawling scale insect
   b. Inserts its proboscis into plant tissue suck juices and grows
   c. Secretes lac from the hind end of body.
   d. The male lac insect is responsible for large scale production of lac.
8. Aquaponics is a technique which is
   a. A combination of aquaculture and fish culture
   b. A combination of aquaculture and hydroponics
   c. A combination of vermiculture and hydroponics

d. A combination of aquaculture and prawn culture.

9. Prawn belongs to the class
   a. crustacea
   b. Annelida
   c. Coelenterata
   d. Echinodermata
10. Inland fisheries are
   a. deep sea fishing
   b. capturing fishes from sea coast
   c. Raising and capturing fishes in fresh water
   d. oil extraction from fish
11. Induced breeding technique is used in
   a. Marine fishery
   b. Capture fishery
   c. Culture fishery
   d. Inland fishery
12. Isinglass is used in
   a. Preparation
   b. Clearing of wines
   c. Distillation of wines
   d. Preservation of wines
13. Animal husbandry is the science of rearing, feeding and caring, breeding and disease control of animals. It ensures supply of proper nutrition to our growing population through activities like increased production and improvement of animal products like milk, eggs, meat, honey, etc.
   a. Poultry production depends upon the photoperiod. Discuss.
   b. Polyculture of fishes is of great importance. Discuss.
14. Choose the correctly matched pair
   1. Egg layers – Brahma
   2. Broiler types - Leghorn
   3. Dual purpose – White Plymouth rock
   4. Ornamental breeds – Silkie
15. Write the advantages of vermicomposting.
16. Name the three castes in a honey bee colony.
17. Name the following:
   i. The largest bee in the colony.
   ii. The kind of flight which the new virgin queen takes along with the drones out of the hive.
18. What are the main duties of a worker bee?
19. What happens to the drones after mating flight?
20. Give the economic importance of Silkworm.
21. What are the Nutritive values of fishes?
22. Give the economic importance of prawn fishery.
23. Give the economic importance of lac insect.
24. Name any two trees on which lac insect grows.
25. Define cross breeding.
26. What are the advantages of artificial insemination?
27. Discuss the various techniques adopted in cattle breeding?
28. Mention the advantages of MOET.
29. Write the peculiar characters of duck.
30. Explain the life cycle of *bombyx mori*.

GLOSSARY

Acetylecholine – A neurotransmitter found throughout the nervous system.

Acidosis – condition characterised by lower blood pH, due to the increase of keto acids (ketosis)

Acinus – Cells arranged into a circular secretory unit

Adenosine triphosphate (ATP) – A nucleotide molecule consisting of adenine, ribose and three phosphate molecules. It plays a central role in energy exchange in biological systems.

Adipocyte – Large cell (up to 200 microns) with only a thin film of cytoplasm due to the presence of a large fat droplet.

Adipose tissue – A group of adipocytes.

Alternation of generation – Alternation of haploid sexual and diploid asexual generation in the life cycle of an animal.

Ampulla of vater – Common duct called hepato-pancreatic duct

Ampulla – The widened opening for each of the semicircular canals, containing sensory innervations.

Apnoea – Temporary stopping of respiration.

Berger's waves – are neural oscillations in the frequency range of 7.5–12.5 Hz arising from synchronous and coherent (in phase or constructive) electrical activity of thalamic pacemaker cells in humans.

Bicuspid valve – also called mitral valve. Left Auricular ventricular valve with two flaps that is present between the left auricle and left ventricle.

Biological indicator – refers to organisms, species or community whose characteristics show the presence of specific environmental conditions.

Bipedal – Walk or stand on two feet.

Blood pressure – (BP) is the pressure exerted by the circulating blood against the walls of blood vessels.

Book gills – Respiratory organs in aquatic Limulus.

Book lungs – Respiratory organs of Scorpions and most spiders.

Brood – a family of birds produced at one hatching or birth.

Catecholamines – Naturally occurring amines that function as neurotransmitters. They are characterised by catechol group in which an amine group is attached. Example .Epinephrine

Cocoon – It is a bag like structure secreted by the clitellum. Eggs and sperms are deposited into it. Fertilization and development occurs within the cocoon.

Collagen – A triple helix protein which allows for great tensile strength.

Dioecious – Animals in which male and female reproductive organs occur in separate individuals.

Drilosphere – is the part of the soil influenced by earthworm secretions, burrowing and castings.

Dyspnoea – painful respiration.

Electromagnetic (EM) radiation – Electromagnetic radiation is a form of energy that is all around us and takes many forms, such as radio waves, microwaves, X-rays and gamma rays.

Evisceration (Autotomy) - Ejection of viscera as a defensive action by an animal.

Falciform ligament – It seperate lobes of liver connect the liver with diaphragm

Functional Respiratory Capacity (FRC) - Volume of air present after expiration in lungsGlossary

Goblet cell – special mucus secreting columnar epithelial cell located in the respiratory tract and intestine.

Hypopharynx – The hypopharynx is a somewhat globular structure, located medially to the mandibles and the maxillae. In many species it is membranous and associated with salivary glands. It assists in swallowing the food.

Hypoxia – the failure of tissues for any reason to receive an adequate supply of oxygen.

Incubator – is a device used to grow and maintain microbiological cultures or cell cultures. and maintains optimal temperature, humidity and other conditions such as the carbon dioxide

(CO2) and oxygen content of the atmosphere inside.

Isovolumetric ventricular contraction – Isovolumetric means constant volume and length. During ventricular contraction, when all valves are closed, no blood can enter or leave the ventricle during this time. Because no blood leaves or enters the ventricles the ventricular chamber has a constant volume and the muscle fibres stay at a constant length.

Juxtaglomerular apparatus – The ascending limb of Henle returns to the glomerular region of its own nephron, where it passes through the fork formed by the afferent and efferent arterioles. Both the tubular and vascular cells at this point are specialized to form juxtaglomerular apparatus that lie next to the glomerulus. (Juxta means "next to").

Juxtamedullary nephrons – the glomeruli of the juxtaglomerular nephrons lie in the inner layer of cortex next to the medulla and the loops of Henle plunges through the entire depth of the medulla Concentrated urine is formed in these nephrons.

Lacunae – A cavity or depression especially in the bone

Macrophages – Immune cells derived from monocytes; engaged in phagocytosis of microbes and debris.

Mast cells – Cells filled with basophilic granules found in numbers in connective tissue and releases histamine and other substances during inflammatory and allergic reactions.

Mesentery – A thin double walled epithelial membrane that support alimentary canal and other organs in the abdominal cavity.

Phylogeny – Relationships among various biological species based upon similarities and differences in their physical or genetic characteristics.

Piezoelectric Effect – It is the ability of certain materials to generate an electric charge in response to applied mechanical stress.

Pneumothorax – presence of air in the pleural cavity which causes collapsing of lungs.

Poikilotherms – Cold blooded organisms/ Body temperature fluctuates according to environmental temperature

Properioception – The ability to sense stimuli arising within the body regarding position, motion and equilibrium.

Sclerites – Sclerite is hard armor like structure for arthopods (even cockroaches) soft body. Sclerites are really deposition of Calcium or cross linking of protein to make the exoskeleton stronger.

Septum pellucidum – Located in the midline of the brain, between the two cerebral hemispheres. It separates the lateral ventricles I and II.

Setae – They are small, S- Shaped chitinous structures present in the pits of the body wall of earthworms. They aid in locomotion. Some setae are modified into Penial setae in the male genital opening and these help in copulation.

Shared character – A shared character is one that two lineages have in common

Spawning - Process of shedding of mass eggs or sperms in water.

Sphincter of boydon – Sphincter which guard opening of the bile duct before it joins with the pancreatic duct

Sphincter of oddi – Sphincter which guard the opening of the ampulla of vater into the duodenum

Taeniae coli – Longitudinal muscular chords in the colon

Typhlosole – A median dorsal internal fold in the intestine of several types of animals, including the earthworm,

Valves of kerkring or plicae circulares – Circular folds in the lumen of ileum

Vasa recta – (straight vessels) The peritubular capillaries of the juxtaglomerular nephrons forms vascular loops which run in close association with the loops of Henle.

Vectors –A vector is an organism that does not cause disease itself but which spreads infection by conveying pathogens from one host to another.

Villus – A minute finger-like process from intestinal lining of vertebrates

Yawning – prolonged inspiration due to increase in CO2 concentration.

Glossary

பாடம் 1 : Living world-உயிருலகு	
Diversity	பல்லுயிரியல்பு / பல்லுயிர்த்தன்மை
Systematics	இனத்தொடர்பு தொகுப்பமைவு
Hierarchy	படிநிலை
Nomenclature	பெயரிடும்முறைகள்
Biodiversity	பல்லுயிர் தன்மை
Autotrophic	தன்னூட்டம் ஊட்டமுறை
Phylogenentic tree	பரிணாம மரம்
Heterotrophic	சார்ந்துண்ணிகள், பிறஊட்ட உயிரிகள்
Thermoacidophiles	வெப்பம் மற்றும்அமிலத்தன்மையை தாங்கி வளரும் தன்மை
Tautonymy	பேரினப்பெயரும்/ சிற்றினப் பெயரும் / ஒரே மாதிரியாக இருத்தல்
Bioluminescence	உயிர் ஒளிர்தல்
பாடம் 2 : Kingdom Animalia - விலங்குலகம்	
Pinacocytes	கடற்பஞ்சுகளின் தட்டையான புறப்படை செல்கள்
Diploblastic animals	ஈரடுக்கு விலங்குகள்
Asymmetryical	சமச்சீரற்ற தன்மை
Radial symmetry	ஆரசமச்சீர் அமைப்பு
Biradial symmetrical	இரு ஆரசமச்சீர்
Para zoa	தளர்ச்சியான பலசெல்
Eumetazoa	பல செல் உயிரிகள்
Mesoglea	மீசோகிளியா
Deutrostomia	மூலக்குழியிலிருந்து மலவாய் தோன்றுதல்
Cnidocytes(or) cnidoblasts	கொட்டும் செல்கள்
Polyembryony	பல கருநிலை
Haemocoel	இரத்தம் உடற்குழி
Water vascular system	நீர் குருதியோட்ட மண்டலம்
பாடம் 3 : Tissue Level of Organisation - விலங்குத் திசுக்கள்	
Epithelial tissues	எபிதீலிய திசுக்கள்
Connective tissues	இணைப்புத்திசுக்கள்
Muscular tissues	தசைத்திசுக்கள்
Neural tissues	நரம்புத்திசு
Squamous epithelium	தட்டை வடிவ எபிதீலியம்
Cuboidal epithelium	கனசதுர வடிவ எபிதீலியம்
Columnar epithelium	தூண் வடிவ எபிதீலியம்
Ciliated epithelium	குறுஇழை கொண்ட எபிதீலியம்
Compound epithelium	கூட்டு
Simple epithelium	எளிய
Pseudostratified epithelium	பொய் அடுக்கினால் ஆன எபிதீலியம்
Stratified epithelium	அடுக்கு எபிதீலியம்
Histology	திசுவியல்
Basic/Primary tissue	அடிப்படை திசு
பாடம் 4 : Organ and organ system in Animals – விலங்குகளின் உறுப்பு மற்றும் உறுப்பு மண்டலங்கள்	
Worm castings	நாங்கூழ் கட்டிகள்
Epigeics	மேல்மட்ட புழுக்கள்
Anecics	நடு மட்ட புழுங்குக்கள்
Endogeics	அடிமட்ட புழுக்கள்
Peristomium	பெரிஸ்டோமியம்
Prostomium	புரோஸ்டோமியம்
Pygidium	பைஜிடியம்
Clitellum	கிளை டெல்லம்
Seta	சீட்டா

Coelomic fluid	உடற்குழி திரவம்
Sperma theca	விந்து கொள்பை
Nephridia	நெஃப்ரிடியா
Genital opening	இனப்பெருக்கத்துளை
Gizzard	அரைவைப்பை
Intestinal caeca	குடல் பிதுக்கங்கள்
Hydrostatic skeleton	நீர்ம சட்டகம்
Regeneration	இழப்பு மீட்டல்
Commissural vessels	இணைப்பு நாளங்கள்
Ganglion	நரம்பு செல்திரள்
Photoreceptor	ஒளி உணர்வி
Gustatory receptor	சுவை உணர்வி
Olfactory receptor	நுகர் உணர்வி
Tactile receptor	தொடு உணர்வி
Chemoreceptor	வேதிஉணர்வி
Thermo receptor	வெப்ப உணர்வி
Cocoon	புழுக்கூடு
Vermiwash	மண்புழு செறிவூட்டப்பட்ட நீர்
பாடம் 5 : Digestion & Absorption - செரித்தல மற்றும் உட்கிரகித்தல்	
Digestive system	செரிமான மண்டலம்
Digestive glands	செரிமான சுரப்பிகள்
Salivary glands	உமிழ்நீர் சுரப்பிகள்
Liver	கல்லீரல்
Pancreas	கணையம்
Gastro intestinal hormones	இரைப்பை-குடல் ஹார்மோன்கள்
Digestive enzymes	செரிமான நொதிகள்
Absorption	உட்கிரகித்தல்
Assimilation	தன்மயமாதல்
Protein	புரதங்கள்
Carbohydrates	கார்போஹைட்ரேட்டுகள்
Fats	கொழுப்புப் பொருட்கள்
Egestion	கழிவு வெளியேற்றம்
Nutrients	உணவூட்டப்பொருட்கள்
Minerals	கனிமங்கள்/ தாது உப்புகள்
Caloric value	கலோரி மதிப்பு
Malnutrition	ஊட்ட குறைவு
Indigestion	செரிமானம்
Constipation	மலச்சிக்கல்
Jaundice	கல்லீரல் அழற்சி, மஞ்சள் காமாலை
Peptic ulcer	இரைப்பை புண்
Appendicitis	குடல்வால் அழற்சி
Hiatus hernia	குடல் இறக்கம்
Autotrophs	தன்னூட்ட உயிரிகள்
Electrolytes	மின்பகுபொருட்கள்
Digestive juice	செரிமான திரவம்
Heterotroph	சார்ந்துண்ணிகள்
Foregut	முன்உணவுப்பாதை
Midgut	நடு உணவுப்பாதை
Hidgut	பின் உணவுப்பாதை
Buccal cavity/oral cavity	வாய்க்குழி
Terminal sulcus	முனைப்பள்ளம்
Cardial portion	இரைப்பை மேல்பகுதி
Fundic portion	இரைப்பை நடுப்பகுதி
Puloric portion	இரைப்பை பின்பகுதி

Duodenum	முன்சிறுகுடல்
Cardiac sphincter	கார்டியாக் சுருக்குத்தசை
Pyloric sphincter	பைலோரிக் சுருக்குத்தசை
Regurgitation	மீளத்திரும்புதல்
Gastric rugae	இரைப்பை உட்புற மடிப்புகள்
Jejunum	நடுச்சிறுகுடல்
Ileum	பின்சிறுகுடல்
Chyme	இரைப்பை பாகு
Microvilli	குடல் உறிஞ்சிகள், நுண்குடலுறிஞ்சிகள்
Goblet cells	கோப்பை வடிவச்செல்கள்
Lymphoid tissue	நிணநீர்த்திசு
Peyer's patches	பேயர் திசுத்தொகுப்பு
Lymphocytes	லிம்போசைட்டுகள்
Crypts	கிரிப்ட்ஸ்/ மடிப்புகள்
Succus entericus	சிறுகுடல் சாறு
Ceacum	பிதுக்கம்
Colon	பெருங்குடல்
Rectum	மலக்குடல்
Vermiform appendix	குடல்வால்
Herbivorous animal	தாவர உண்ணிகள்
Symbiotic bacteria	இணைவாழ் பாக்டீரியாக்கள்
Anal mucosa	மலவாய் கோழைப்படலம்
Anal column cells	மலவாய் தூண்செல்கள்
Piles/haemorrhoids	மூலம்
Serosa	செரஸ் உறை
Muscularis	தசை உறை
Sub mucosa	கோழைகீழ் படலம்
Mucosa	கோழைப்படலம்
Visceral peritonium	வயிற்றறை பெரிடோனியம்
Submucosa plexus	கோழை கீழ் வலைப்பின்னல்
Biological catalysts	உயிர் வினையூக்கி
Parotid	மேலண்ணச் சுரப்பி
Submaxillary gland	கீழ்த்தாடைச் சுரப்பி
Sub lingual gland	நாவடிச் சுரப்பி
Peptic cells	இரைப்பை செல்கள்
Parietal cells	இரைப்பை சுவர் செல்கள்
Falciform ligament	அரிவாள் வடிவம்
Hepatic lobules	கல்லீரல் நுண் கதுப்புகள்
Ampulla of vater	கல்லீரல், கணையப் பொது நாளம்
Mastication	மெல்லுதல்
Bolus	உணவுக் கவளம்
Peristalsis	அலையியக்கம்
lubrication	உயவூட்டுதல்
Churn	கடைதல்
Proenzyme	முன்நொதிகள்
Putrifaction	அழுகுதல்
Emulsification	பால்மமாதல்
Absorption	உட்கிரகித்தல்
Intestinal mucosa	குடல் கோழைப்படலம்
Lumen	வெற்றிடப் பகுதி
Facilitated transpot	பொருட்கள் வழி கடத்தல்
Concentration gradient	அடர்த்தி வேறுபாடு
Active transport	செயல்மிகு கடத்தல்

Passive transport	இயல்பு கடத்தல்
Bartholins duct (or) duct of rivinis	நாவடிச் சுரப்பி நாளம்
Cementum	பற்கள் ஈறுடன் இணைக்கும் கடினமானப் பொருள்
பாடம் 6 : Respiration - சுவாசம்	
Respiratory volume	நுரையீரல் கொள்ளளவு
Respirometer	சுவாச அளவி
Spirometer	ஸ்பைரோமீட்டர்
Surfactants	மேல்பரப்பிகள்
Bio-molecules	உயிர் மூலக்கூறுகள்
Respiratory disorder	சுவாசக்கோளாறுகள்
Pollutants	மாசுபடுத்திகள்
Nasopharynx	நாசிப்பகுதித் தொண்டை
Glottis	குரல்வளைத் துளை
Epiglottis	குரல்வளை மூடி
Cartilaginous rings	குருத்தெலும்பு வளையங்கள்
Alveolus	காற்று நுண்ணறை
Chocking	சுவாச அடைப்பு
Trachea	மூச்சுக்குழல்
Bronchus	மூச்சுக்கிளைக்குழல்
Bronchioles	மூச்சுக்கிளை நுண்குழல்கள்
Basement substance	ஆதாரப் பொருட்கள்/ அடிப்படைப்பொருட்கள்
Conducting zone	கடத்தும் பகுதி
Respiratory zone	சுவாசப்பகுதி
Pressure gradients	அழுத்த சரிவு வாட்டம்
Intercostal muscles	விலா எலும்பிடைத்தசைகள்
Thoracic chamber	மார்பறை
Inspiration	உட்சுவாசம்
Expiration	வெளிச்சுவாசம்
Snoring	குறட்டை
Residual volume	எஞ்சிய கொள்ளளவு
Total lung capacity	மொத்த நுரையீரல் கொள்ளவு
Inspiratrory capacity	உட்சுவாசக் கொள்ளளவு
Expiratory capacity	வெளிச்சுவாசக் கொள்ளளவு
Vital capacity	உயிர்ப்புத்திறன்
Inspiratory reserve volume	உட்சுவாச சேமிப்புக் கொள்ளளவு
Expiratory reserve volume	வெளிச்சுவாச சேமிப்புக் கொள்ளளவு
Partial pressure	பகுதி அழுத்தம்
Partial pressure gradient	பகுதி அழுத்தம் சரிவுவாட்டம்
Dead space	பயனற்ற இடம்
Bronchitis	மார்புச்சளி நோய்
Emphysema	நுரையீரல் அடைப்பு
Reversible manner	மீள்வினைத் தன்மை
Chemosensitive area	வேதிஉணர்பகுதி
Sputum	சளி
Nasal congestion	மூக்கடைப்பு
Sore throat	தொண்டை வலி
Fibrosis	நார்த்தசை நோய்
Carcinogens	புற்றுநோய்க் காரணிகள்
Hypoxia	ஆக்சிஜன் பற்றாக்குறை
Heart palpitation	இதயப் படபடப்பு
Nausea	வாந்தியுணர்வு
Anaemia	இரத்தசோகை

Congenital heart disease	பிறவிக்குறை இதய நோய்
Hyperbarisim	மிகைஅழுத்தத் தன்மை
Suffocation	மூச்சுத்திணறல்
Conjugated protein	இணைவுப்புரதம்
Haem moieties	ஹீம் பகுதியின் ஒரு பாதி
Respiratory quotient	சுவாசக்கெழு எண்
Cat ions	நேர்மின்அயனிகள்
Electrostatic attraction	மின்னிலைக் கவர்ச்சி
Irritants	எரிச்சலூட்டும் பொருட்கள்
Hiccups	விக்கல்
Aerobic respiration	காற்றுடைச் சுவாசம்
Anaerobic respiration	காற்றற்ற சுவாசம்
பாடம் 7 : Body fluids and circulation - உடல் திரவங்கள் மற்றும் சுற்றோட்டம்	
Cardiac activity	இதயச்செயல்பாடுகள்
Cardiac cycle	இதய சுழற்சி
Blood coagulating factors	இரத்த உறைதல் காரணிகள்
Vasovagal syncope	வேகஸ் நரம்பின் அதிகரித்த செயலால் ஏற்படும் மயக்கம்
Perfusion	மேற்பரவல்
Capillary	தந்துகி
Arteriole	நுண்தமனி
Hydrostatic pressure	இரத்த திரவ அழுத்தம்
Osmosis	ஊடுகலப்பு
Arterial end	தமனி முடிவுப் பகுதி
Venous end	சிரை முடிவுப்பகுதி
Formed elements	இரத்தச் செல்கள்
Hepatic portal vein	கல்லீரல் போர்ட்டல் சிரை
Hepatic vein	கல்லீரல் சிரை
Hepatic artery	கல்லீரல் தமனி
Erythropoiesis	சிவப்பணு உருவாக்கம்
Granulocytes	துகளுடையவெள்ளையணுக்கள்
Agranulocytes	துகளற்ற வெள்ளையணுக்கள்
Phagocytic nature	விழுங்கும் தன்மையுடைய
Pus	சீழ்
Inflammatory reaction	வீக்கம் ஏற்படுதல்
Cell mediated immunity	செல்வழி நோய்த்தடைகாப்பு
Macrophages	மாக்ரோஃபேஜ்கள்
Sinusoids	குழிப்பைஅடைப்பு
Antigen	எதிர்ப் பொருள்
Antibody	எதிர்வினைப்பொருள்
Blood transfusion	இரத்தம் செலுத்துதல்
Trauma	விபத்து
Meshwork	வலைப்பின்னல்
Lymph nodes	நிணநீர் முடிச்சுகள்
Inguinal	தொடைப்பகுதி
Axillaries	அக்குள் பகுதிகள்
Sub clavian vein	சப்கிளேவியன் (அ) சிரை
Lacteals	லாக்டியல் நாளங்கள்
Vasoconstriction	இரத்தக்குழல் சுருக்கம்
Vasodilation	இரத்தக் குழல் விரிவடைதல்
Anastomoses	இருவேறு தமனிகள் இணைப்பிடங்கள்
Abdominal cramps	வயிற்றுப்புறப் பிடிப்புகள்
Venules	நுண்சிரைகள்

Unidirectional flow	ஒருதிசை ஓட்டம்
Ventricular septum	வென்ட்ரிகுலார் இடைத்தடுப்பு
Auricular septum	ஆரிகுளார் இடைத்தடுப்பு
Double circulation	இரட்டைச் சுற்று ஓட்டம்
Pulmonary circuit	நுரையீரல் இரத்த ஓட்டம் (சுற்றோட்டம்)
Systemic circuit	சிஸ்டமிக்(அ) உடல் இரத்த ஓட்டம் (சுற்றோட்டம்)
Papillary muscles	பாப்பில்லரித் தசைகள்
Pericardial space	பெரிக்கார்டியல் குழி
Pericardial fluid	பெரிக்கார்டிய திரவம்
Auriculo ventricular valves	ஆரிக்குலோ வென்ட்ரிகுலார் வால்வுகள்
Inferior vena cava	கீழ்ப்பெருஞ்சிரை
Superior vena cava	மேற்பெருஞ்சிரை
Pulmonary veins	நுரையீரல் சிரைகள்
Myogenic heart	மயோஜெனிக் வகை இதயம்
Depolariation	மின்காந்த முனைப்பியக்கம்அகன்ற நிலை
Tachycardia	டாக்கி கார்டியா
Brady cardia	பிராடிகார்டியா
Stroke volume(SV)	வீச்சுக் கொள்ளவு
Semilunar valves	அரைச்சந்திர வால்வுகள்
Heart rate(HR)	இதயத்துடிப்பு வீதம்
Cardiac output (CO)	இதயத்திலிருந்து வெளிப்படும் இரத்த அளவு
Sphygmomanometer	இரத்தஅழுத்தமாணி
Pulse rate	நாடித்துடிப்பு
Atheroma	தமனிச்சுவரில் கொழுப்புப்படிவு
Hypertension	மிகையழுத்தம்
Atherosclerosis	இதய இரத்தக்குழல் அடைப்பு
Brain haemorrhage	மூளையில் இரத்தக் கசிவு
Cerebral infarction	பெருமூளைத் திசுச் சிதைவு
Myocardial infarction	இதயத்தசை நசிவுறல் நோய்
Angina pectoris	தீவிர மார்பு வலி
Rheumatoid heart disease	ருமாட்டிக் இதய நோய்
Rheumatic fever	ருமாட்டிக் காய்ச்சல்
Varicose veins	இரத்தநாளங்கள்சுருளுதல்
Embolism	தமனியில் இரத்தக் கட்டி அடைப்பு
Aneurysm	தமனி விரிசல், குருதிநாள நெளிவு
Catheter	உட்செலுத்திக் குழாய்
Scaffolding	சாரக்கட்டு, தூக்கிக் கட்டுதல்
Pump oxygenator	பம்ப்ஆச்சிஜனோட்டர் (ஆக்சிஜன்செலுத்தி)
Resuscitation	செயல் தூண்டல்
Cessation of breath	மூச்சு நிறுத்துதல்

பாடம் 8 : Excretion - கழிவுநீக்கம்	
Nephron	நெஃப்ரான்
Nephron tubules	நெஃப்ரான் நுண்குழல்கள்
Osmoregulation	ஊடுகலப்பு ஒழுங்குபாடு
Ionic regulation	அயனி ஒழுங்குபாடு
Ammonotelic	அம்மோனோடெலிக் – அம்மோனியா நீக்கிகள்
Uriotelic	யூரியோடெலிக் – யூரியா நீக்கிகள்
Uricotelic	யூரிக்கோடேலிக்–யூரிக்அமில நீக்கிகள்
Flamecells	சுடர்ச்செல்கள்
Green glands	பச்சை சுரப்பிகள்
Malpighian tubules	மால்பிஜியன் நுண்குழல்கள்

Renal tubule	சிறுநீரக நுண்குழல்
Proximal Convoluted Tubule	அண்மை சுருள் நுண்குழல்
Distal convoluted Tubule	சேய்மை சுருள் நுண்குழல்
Bowman's capsule	பௌமனின் கிண்ணம்
Hydrostatic pressure	நீர்ம அழுத்தம்
Filtrate	வடி திரவம்
Collecting duct	சேகரிப்பு நாளம்
Micturition	சிறுநீர் வெளியேற்றம்
Renal failure	சிறுநீரக செயலிழப்பு
Renal calculi	சிறுநீரகக் கற்கள்
Ultra filtration	நுண்வடிகட்டுதல்
Interstial fluid	இடையீட்டு திரவம்
Body fluid	உடல் திரவம்
Hypotonic	தாழ் உப்படர்வு
Hypertonic	உயர் உப்படர்வு

பாடம் 9 : Locomotion and movement - இடப்பெயர்ச்சி மற்றும்இயக்கம்	
Amoeboid movement	அமீபா போன்ற இயக்கம்
Ciliary movement	குறு இழை இயக்கம்
Flagellar movement	நீளிழை இயக்கம்
Muscular movement	தசை இயக்கம்
Myocytes	தசை செல்கள்
Skeletal muscles	எலும்புத் தசை
Visceral muscles	உள்ளுறுப்புத் தசைகள்
Cardiac muscles	இதயத் தசைகள்
Tendon	தசை நாண்
Fascicle	∴பாசிகிள்
Epimysium	எபிமைசியம்
periusium	பெரிமைசியம்
Endomysium	என்டோமைசியம்
Sarcolemma	சார்கோலெம்மா
Anisotropic bands (A bands)	மாறுபட்டதன்மையுடைய பட்டைகள்
Isotropic bands (I bands)	ஒத்த தன்மையுடைய பட்டைகள்
Muscle fibre	தசையிழை
Myofibril	தசை நுண்ணிழை
Myo filaments	தசை நாண்
Meromyosin	மீரோளமையோசின்
Troponin	ட்ரோபோனின்
Tropomyosin	ட்ரோபோமையோசின்
Sliding – filament hypothesis	சறுக்கும் இழை கோட்பாடு
Neuro muscular junction	நரம்பு தசை சந்திப்பு
Motor end plate	இயக்க முடிவுத் தட்டு
Dark band	அடர்த்தி மிகு பட்டை
Light band	அடர்த்தி குறை பட்டை
Active sites/	செயற்படு பகுதி/செயல் மிகு பகுதி
Cross bridge	குறுக்குப்பாலம்
Power stroke	விசைத்தாக்கம்
Motor unit	இயக்க அலகு
All or none principle	உண்டு அல்லது இல்லை விதி
Isotonic contraction	சமநீளச் சுருக்கம்
Isometric contraction	சம இழுப்புச் சுருக்கம்
Oxidative contraction	ஆக்ஸிஜனேற்ற தசைச் சுருக்கம்
Glycolytic contraction	கிளைக்கோஜன் சிதைவு தசைச் சுருக்கம்
fast fibres	துரித இழைகள்
Slow fibres	மெதுவான இழைகள்
Skeletal system	எலும்பு மண்டலம்
Hydrostatic skeleton	நீர்ம நிலைச் சட்டகம்

Exoskeleton	புறச் சட்டகம்
Endoskeleton	அகச்சட்டகம்
Axial skeleton	அச்சுக் சட்டகம்
Appendicular skeleton	இணையுறுப்புச் சட்டகம்
External auditory meatus	வெளிச் செவித்துளை
Ear ossicles	செவிச்சிற்றெலும்புகள்
Foramen magnum	மண்டையோட்டுப் பெருந்துளை
Neural canal	நரபுக் கால்வாய்
True ribs	உண்மை விலா எலும்புகள்
False ribs	போலி விலா எலும்புகள்
Floating ribs	மிதக்கும் விலா எலும்புகள்
Girdle	வளையம்
Collar bone	காரை எலும்பு
Acromion	ஏகுரோமியன்
Olecranon process	ஓலிகிரானன் நீட்சி
accetalrlum	எலும்புக்குழி
Pubic symphysis	பூப்பெலும்பு இணைவு
Miscle fatigue	தசைக் சோர்வு
Muscle pull	தசைப் பிடிப்பு
Muscular dystrophy	தசைச்சிதைவு நோய்
Rigor mortis	மரண விறைப்பு
Arthritis	மூட்டு வலி
Osteoarthritis	ஆஸ்டியோ மூட்டு வலி
Rheumatiod arthritis	ருமாடிக் மூட்டுவலி
Gout	கௌட்
Osteoporosis	எலும்புப்புரை
Parietal bone	சுவரெலும்பு
Temporal bone	பொட்டெலும்பு
Frontal bone	நெற்றி எலும்பு
Sphenoid	ஆப்புருவ எலும்பு/ஸ்பீனாய்டு
Occipital	பிடரிஎலும்பு
Ethmoid	எத்மாய்டு
Maxilla	மேல்தாடை எலும்பு
Zygomatic	கன்னத்தின் வளையயெலும்பு
Palatine	அண்ணவெலும்பு
Lacrymal	கண்ணீர்ச் சுரப்பியன்மை எலும்பு
Nasal	மூக்கினிடைத்தட்டெலும்பு
Inferior nasal koncha	மூக்கினிடைக்கீழ் காஞ்சா
Mandible	கீழ்த்தாடை எலும்பு
Vomer	இடைராசி எலும்பு
Malleus	சுத்தி எலும்பு
Incus	பட்டடை எலும்பு
Stapes	அங்கவடி எலும்பு
பாடம் –10 : Neural control and Co- ordination - நரம்பு கட்டுப்பாடு மற்றும் ஒருங்கிணைப்பு	
Neuron	நியூரான் (நரம்பு செல்)
Sensory neuron	உணர்வு நியூரான்
Motor neuron	இயக்கு நியூரான்
Automatic functions	தானியங்கு வேலைகள்
Afferent neurons	உட்செல் நியூரான்கள்
Efferent neurons	வெளிச் செல் நியூரான்கள்
Inter neurons	இடை நியூரான்கள்
Nissles granules	நிஸ்சல் துகள்கள்
Node of Ranvier	ரான்வியர் முடிச்சு / கணு
Myelin sheath	மயலின் உறை
Nerve impulse	நரம்புத் தூண்டல்
Axon hillock	ஆக்ஸான் மேடு
Synapsis	நரம்பு செல் சந்திப்பு

Synaptic knob	நரம்பு செல் சந்திப்பு முடிச்சு
Synaptic vesicles	நரம்பு செல் சந்திப்பு பகுதி நுண்பைகள்
Neurotransmitters	நரம்புணர்வு கடத்திகள்
Extra cellular fluid	செல்வெளித் திரவம்
Intra cellular fluid	செல்உள் திரவம்
Resting membrane potential	ஓய்வுநிலை சவ்வின் மின் அழுத்த அளவு
Action potential	செயல்நிலை மின் அழுத்தம்
Polarization	முனைப்பியக்கம்
Sodium-potassium pump	சோடியம்-பொட்டாசியம் உந்திக் கடத்தல்
Depolarization	முனைப்பியக்க நீக்கம்
Threshold stimulus	அவசியமான குறைந்தபட்ச தூண்டல்
Repolarization	முனைப்பியக்க மீட்சி
Spike potential	கூர்முனை மின் அழுத்த அளவு
Hyper polarization	மிகை முனைப்பியக்கம்
Synaptic cleft	நரம்பு செல் சந்திப்பு இடைவெளி
Exocytosis	செல்வெடித்தல்
All or none principle	உண்டு – இல்லை கோட்பாடு
Cranial nerves	மூளை நரம்புகள்
Olfactory nerve	நுகர்ச்சி நரம்பு
Optic nerve	பார்வை நரம்பு
Trigeminal nerve	முக்கிளை நரம்பு
Facial nerve	முக நரம்பு
Hypoglossal nerve	நாவடி நரம்பு
Sympathetic nervous system	பரிவு நரம்பு மண்டலம்
Para sympathetic nervous system	இணைப் பரிவு நரம்பு மண்டலம்
Mechanoreceptors	தொடு உணர்விகள்
Myopia	கிட்டப் பார்வை
Hyper metropia	தூரப் பார்வை
Cataract	கண்புரை
Proprioception	அசைவுகளை உணரும் உணர்வு
பாடம் 11: Chemical co- ordination and integration - வேதி ஒருங்கிணைப்பு	
Goose bumps	ரோமங்கள்சிலிர்த்த நிலை
Hormones	ஹார்மோன்கள்
Homeostasis	உடல்சமநிலைப் பேணுதல்
Exclusive endocrinme glands	முழுமையான நாளமில்லாச் சுரப்பிகள்
Neuroendocrine glands	நரம்புசார் நாளமில்லாச் சுரப்பிகள்
Partial endocrine glands	பகுதி நாளமில்லாச் சுரப்பிகள்
Neuro secretory cells	நரம்பு சுரப்பு செல்கள்
Releasing hormone	விடுவிக்கும்ஹார்மோன்
Inhibiitory homone	மட்டுப்படுத்தும் ஹார்மோன்
Hypothalamic hypophyseal portal blood vessel	ஹைபோதலாமிக் ஹைபோ:பைசியல் போர்ட்டல் இரத்தக் குழல்
Hypothalamic hypophyseal axis	ஹைபோதலாமிக் ஹைபோ:பைசியஸ்அச்சு
Limbic system	உணர்வுச் செயலித் தொகுப்பு
Sella turlica	செல்ல டர்சிகா
Infundibulam	இன்:பன்டிபுலம்
Anterior lobe	முன் கதுப்பு
Tropic hormone	தூண்டும் ஹார்மோன்
Feed back	பின்னூட்டம்
பாடம் 12 : Basic medical instrument ad techniques - அடிப்படை மருத்துவக் கருவிகள் மற்றும் தொழில் நுட்பங்கள்	
Diagnostic and monitoring Instruments	பரிசோதனை மற்றும் கண்காணிப்புக் கருவிகள்
Imaging Instruments	நிழலுரு கருவிகள்
Therapeutic Instruments	சிகிச்சை கருவிகள்
Biomedical Techniques	உயிரி – மருத்துவ தொழில் நுட்பம்
Stethoscope	ஸ்டெத்தஸ்போப்
Sphygmomanometer	ஸ்பிக்மோமானோமீட்டர் (இரத்த அழுத்தமானி)

Autoanalyser	ஆட்டோ அனலைசர் (தானியங்கி பகுப்பய்வி)
ECG	எலக்ட்ரோகார்டியோகிராம் (இதய துடிப்புமின் வரைவி)
EEG	எலக்ட்ரோ என்செ:பாலோகிராம்
Ultra ound scanner	அல்ட்ராசவுண்ட் ஸ்கேனர்
CT Scanner	கம்ப்யூட்டட் டோமோகிராபி ஸ்கேனர்
Prognosis	முன் கணிப்பு
பாடம் 13: Trends in Economic zoology - வணிக விலங்கியலின் போக்குகள்	
Apiculture	தேனீவளர்ப்பு
Drone	ஆண் தேனீ
Nuptial flight	புணரும் பறத்தல்
Pheromone	:பிரோமோன்
Fertilization	கருவுறுதல்
Sterile	மலட்டுத்தன்மை
Hive	தேன்கூடு/தேனடை
Necter	பூந்தேன்
Propolis	புரோபோலிஸ்/ தேன் பிசின்
Swarming	கூட்டமாகசெல்லுதல்/கூட்டமாகபறத்தல்
Inoculation	நோய்தடுப்பு ஊசிமருந்து
Predators	கொன்றுண்ணிகள்
Queen Excluder	இராணித்தேனீ தடுப்பான்
Comb foundation	தேன்கூட்டு அடித்தளம்
Bee glove	தேனீக்கையுறை
Bee veil	முகத்திரை/ தேன் எடுக்க உதவும் முகத்திரை
Hive Tool	தேன்கூட்டு சாதனம்
Honey extractor	தேன்பிழி சாதனம்
Hive entrance guard	தேன் கூடு முகப்பு தடுப்பு
Antseptic	நச்சுத்தடை
Laxative	மலமிளக்கி
Sedative	மயக்கமூட்டி
Masticated	மெல்லுதல்
Hyper parasitism	ஒட்டுண்ணி மேல் ஒட்டுண்ணி வாழ்க்கை
Aquaponics	நீர் உயிரி பயிர் வளர்ப்பு
Deep water culture	ஆழ் நீர் வளர்ப்பு
Media based culture	ஊட க அடிப்படை வளர்ப்பு
Nutrieut film technique	ஊட்டப் பொருள் படல (தொழில் நுட்ப முறை) வளர்ப்பு முறை
Aqua vertica	செங்குத்து முறை
Polyculture	கலப்பின மீன் வளர்ப்பு
Zooplankton	விலங்கு மிதவை உயிரிகள்
Phytoplankton	தாவர மிதவை உயிரிகள்
Isinglass	இஸ்லிங்கிளாஸ்
Milch breed	கறவை இனம்
Drought breed	இழுவை இனம்
Duel purpose breed	இரு உபயோக இனம்
Incubator	அடைகாப்பு சாதனம்
Brooding	பேணிக்காத்தல்
Drilospheres	மண்புழு ஏற்படுத்திய குழி
Reeling	பின்னுதல்
Spinning	நூற்றல்
Moricultere	மல்பெரி தாவர வளர்ப்பு
Moulting	தோலுரித்தல்
Diapause type of egg	விரைவில் பொரிக்கும் முட்டைகள்
Non – diapause type of egg	மெதுவாகப் பொரிக்கம் முட்டைகள்
Stifling	புழுக்கூட்டை கொன்று பதப்படுத்துதல்
Brood cells	இளம்தேனீ வளர் அறை
Smoker	புகையூட்டி
Hive tool	தேன்கூட்டுக்கருவி

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MCQs for Higher Studies

1. Taxonomically a species is …….(PMT-94)
a. A group of evolutionary related population
b. A fundamental unit in the phylogeny of organisms
c. Classical evolutionary taxonomy
d. A community taken into considerationa. an evolutionary base

2. A community includes ……. (CET-98)
a. a group of same genera
b. a group of same population
c. a group of individuals from same species
d. different populations interacting with each other

3. Carl Linnaeus is famous for …. (GGSPU-2002)
a. coining the term 'systematics'
b. introducing binomial nomenclature
c. giving all natural system of classification
d. all of these

4. Which form of reproduction is correctly matched? (AIIMS 2007)
a. Euglena - transvers binary fission
b. Paramecium - longitudinal binary fission
c. Amoeba - multiple fission
d. Plasmodium - binary fission

5. The primitive prokaryotes responsible for the production of biogas from the ruminant animals (2016)
a. Thermoacidophiles
b. methanogens
c. Eubacteria
d. Halophiles

6. Salient features of Arthropoda is (RPMT-2003)
a. Aquatic and free living
b. Chitinous exoskeleton and jointed appendages
c. Radulla
d. None of those

7. Mollusca is (JCECE-2006)
a. Triploblastic, acoelomate
b. **Triploblastic, coelomate**
c. Diploblastic, acoelomate
d. Diploblastic, coelomate

8. Osphradium of Pila globosa is (BHU 1994, 2000, 2007)
a. Thermoreceptor
b. Pheretima
c. Chemoreceptor
d. Tangoreceptor

9. The endocrine gland of insects, wich secretes they juvenile hormone, is (UP-CPMT 1995)
a. corpora allata
b. corpora albicans
c. corpora myecaena
d. all of these

10. Wuchereria is found in (UP-CPMT 2007)
a. **lymph nodes** b. lungs
c. eye d. gonds

"Turbellarians" are free living (UP-CPMT 2008)
a. **flatworms** b. trematodes
c. nematodes d. cesrtodes

11. Mouth parts of housefly are
a. Piercing and sucking type
b. Biting and sucking type
c. Sponging and sucking type
d. biting and chewing type

12. Fasciola hepatica is (AFMC 2007)
a. hermaphrodite. Self fertilizing
b. hermaphrodite, cross fertilizing
c. unisexual
d. both (a) and (b)

13. Match the excretory organs listed under column I with the animals given under column II. Choose the answer which gives the correct combination of alphabets of the column.

Column I	Column II
A Nephridia	p *Hydra*
B Malpighian tubules	q Leech
C protonephridia	r Shark
D kidneys	s Round worms
	t Cockroack

a. A = q; B = t; C= s; D = r
b. A =s ; B= q; C= p; D= t
c. A = t; B = q; C = s; D = r
d. A = q; B = s ; C =t ; D= p

14. Which of the following cell type is capable of giving rise to other cell types in sponges?
a. Pinacocytes

b. Archaeocytes
c. Thesocytes
d. Collenocytes

15. Sea cucumbers belong to class
a. Echinoidea
b. Holothuroidea
c. Ophiuroidea
d. Asteroidea

16. Camouflage of chameleon is associated with (AIIMS1995)
a. Chromoplast
b. Chromosome
c. Chromatophore
d. Chromomere

17. Which of the following are uricotelic animals? (AIIMS2002)
a. rohu and frog
b. camela and frog
c. lizard and crow
d. earthworm and eagle

18. Which of the following does not come under the class mammals?(AIIMS2007)
a. flying fox
b. hedgehog
c. manatee
d. lamprey

19. Excretory organ in Balanoglossus are (DPMT 1991,2008)
a. nephridia
b. antennary gland
c. collar cord
d. proboscis gland

20. Reptiles share which of the following character with birds and mammals?(DPMT 1994)
a. Amnion
b. Homeothermy
c. Diaphragm
d. nipple

21. Match the names of branches of science listed under column- I with the field study given under column-II choose the choice which gives the correct combination of the alphabets. (AMU2000)

Colum – I (Branch of Science)		Colum –II (Field of study)	
A	Mycology	p	Study of birds
B	Ornithology	q	Study of worms
C	Herpetology	R	Study of fishes
D	lethylogy	S	Study of fungi
		t	Study of reptiles

a. A=s, B=p, C=t, D=r
b. A=q, B=s C=r, D=t
c. A=s, B=t, C=p, D=r
d. A=p, B=s, C=r, D=t

22. Which of the following statements is true?(AMU 2003)
a. All chordates are vertebrates
b. All vertebrates are chordates
c. Invertebrates possess a tubular nerve cord
d. Nonchordates a have a vertebral column

23. An important characteristic that Hemichordates share with chordates is (NEET 2017)
a. Ventral tubular nerve cord
b. Pharynx with gill slits
c. Pharynx without gill slits
d. Absence of notochord

24. Match the animals listed in column-I to blood listed in column-II. (KCET 2010)

Column-I	**Column-II**
(P) Man	(i) Plasma and cells are colourless
(Q) Earth worm	(ii) Plasma colourless and nucleated RBC
(R) Cockroach	(iii) Plasma colourless and enucleated RBC
(S) Frog	(iv) Plasma red and nucleated colourless RBC
	(v) Plasma and RBS have haemoglobin

a. (P-iii), (Q-iv), (R-i), (S-ii)
b. (P-iv), (Q-v), (R-iii), (S-ii)
c. (P-i), (Q-iv), (R-ii), (S-iii)
d. (P-v), (Q-iii), (R-i), (S-iv)

25. The body cells in cockroach discharge their nitrogenous waste in the haemolymph mainly in the form of (NEET 2015)
a. Calcium carbonate
b. Ammonia
c. **Potassium urate**
d. Urea

26. Frog's heart when taken out of the body continues to beat for sometime. Select the best option from the following statements. (NEET 2017)
(i) Frog is a poikilotherm.
(ii) Frog does not have any coronary circulation.
(iii) Heart is "myogenic" in nature.
(iv) Heart is autoexcitable Options:
(a) Only(iv) (b) (i) and (ii)
(c) (iii)and(iv) (d) Only(iii)

27. How pepsin is differing from trypsin? (DPMT – 1993)
a. It digests protein in acidic medium
b. It digests protein in alkaline medium
c. It digests carbohydrate in acidic medium
d. It digests carbohydrate in alkaline medium

28. In human being cellulose is digested by
a. Enzyme
b**. Symbiotic bacteria**
c. Symbiotic protozoans
d. None of the above

29. Dental formula shows (M.P.P.M.T. -2000)
a. Structure of teeth
b. Monophyodont or diphyodont condition
c. Number and type of teeth in both jaws
d. Number and type of teeth in one half of both jaws

30. Which of the following statement is not correct ?(NEET 2015)
a. Bruner's glands are present in the submucosa of stomach and secrete pepsinogen
b. Goblet cells are present in the mucosa of intestine and secrete mucus.
c. Oxyntic cells are present in the mucosa of stomach and secrete Hcl.
d. Acini are present in the pancreas and secrete carboxypeptidse

31. Which hormones stimulate the production of pancreatic juice and bicarbonates ? (NEET 2016)
a. Cholycystokinin and secretin
b. Insulin and glucogon
c. Angiotensin and epinephrine
d. Gastrin and Insuline

32. A baby aged two years is admitted to play school and passes through a dental check-up . The dentist observed that the boy had twenty teeth . Which teeth were absent. (NEET 2017)
a. Canines
b. Pre- Molars
c. Molars
d. Incisors

33. Which cells of Crypts of Lieberkuhn' secrete antibacterial lysozyme ? (NEET 2017)
a. paneth cells
b. Zymase cells
c. Kupffer cells.
d. Argentaffin cells

34. Volume of air remaining in lungs after maximum respiratory effort is (J.K.C.M.E.E.1992,Har.PMT.2003)
a. Vital capacity
b**. Residual volume**
c. Total lung capacity
d. Tidal volume

35. Presence of large number of alveoli around alveolar ducts opening into bronchioles in mammalian lungs is
a. Inefficient system of ventilation with little of residual air
b. Inefficient system of ventilation with high percentage of residual air
c. An efficient system of ventilation with no residual air
d. An efficient system of ventilation with little residual air

36. CO_2 is transported
a. dissolved in blood plasma
b. As carbonic acid
c. In carbaminohaemoglobin
d**. As carbaminolaemoglobin and carbonic acid**

37. Bicarbonate formed inside erythrocytes moves out to plasma while chloride of plasma pass into erythrocytes. The phenomenon is called
a. Bicarbonate shift
b. Carbonation
c. Hamburger phenomenon
d. None of the above

38. Vital capacity of lung is equal to
a. IRV+ERV+TV

b. IRV+ERV+TV-RV
c.IRV+ERV+TV+RV
d.IRV+ERV

39. Asthma may be attributed to (AIPMT/NEET 2016)
a. bacterial infection of the lungs
b. allergic reaction of the mast cells in the lungs
c. inflammation of the trachea
d. accumulation of fluid in the lungs

40. Name the chronic respiratory disorder caused mainly by cigarette smoking: (RE-NEET 2016)
a. Emphysema
b. Asthma
c. Respiratory acidosis
d. Respiratory alkalosis

41. Lungs are made up of air-filled sacs, the alveoli. They do not collapse even after forceful expiration. (NEET 2017)
a. Inspiratory Reserve Volume
b. Tidal Volume
c. Expriatory Reserve Volume
d. Residual Volume

42. Regulation and initiation of heartbeat is indicated by (CBSE - 95)
a. AV Node – bundle of His muscule – SA node – purkinje fiber
b. SA Node – purkinje fiber – AV Node – Bundle of His muscle
c. Purkinje fiber – AV Node – SA node – Bundle of His muscle
d. SA Node – AV Node – Bundle of His muscle – Purkinje fiber

43. Which is the correct statement for blood ? (APMEE – 96)
a. WBC is more than RBC
b. RBC is more than WBC
c. RBC is less than platelets
d. Platelets is less than RBC

44. There is no DNA in
a. Mature RBCs
b. Mature spermatozoa
c. Hair root
d. Ovum

45. What P indicates in ECG ?
a. End of atrium systole
b. Starting of atrium systole
c. End of ventricle systole
d. Starting of ventricle systole

46. The mechanism of urine formation in nephrone involves (CPMT 1992)
a. Utrafiltration b. Secretion
c. Reabsorption
d. All of the a**bove**

47. Part not belonging to uriniferous tubule is
a. Glomerules
b. Henle's loop
c. Distal convoluted tubule
d. Connecting tubule

48. Angiotensinogen is a protein produced and secreted by. (AIPMT 2006)
a. Juxtaglomerular (JG) cells
b. Macula densa cells
c. Endothelial cells of blood vessels
d. Liver cells

49. Grafted kidney may be rejected in a patient due to (RE-AIPMT 2015)
a. Innate immune response
b. Humoral immune response
c. Cell-mediated immune response
d. Passive immune response

50. Which of the following statement is correct? (NEET 2017)
a. The descending limb of loop of Henle is impermeable to water.
b. The ascending limb of loop of Henle is permeable to water
c. The descending limb of loop of Henle is permeable to electrolytes.
d. The ascending limb of loop of Henle is impermeable to water

51. Ratio of which is more in red muscle? (JIPMER -2002)
a. Myoglobin b. Actin
c. Myosin d. Albumin

52. Given below is a table comparing the effects of sympathetic and parasympathetic nervous system for four features (1-4) which one feature is correctly described? (A.I.I.M.S.2006)

	sympathetic	parasympathetic
a. Salivary gland	inhibit secretion	stimulate secretion
b. pupil of the eye	**dilate**	**constricts eye**
c. heart	rate decreases	increases
d. intestinal	stimulates	inhibits peristalsis

53. Which option is correct for the few statements are given for the function of cerebrum, which of few following option is shows all correct statements.

(i) to control the sensitivity, movement, memory, vocabulary etc. through the

(ii) to control the vision and adaptation through the occipital and frontal lobes

(iii) to control the contraction of voluntary muscles through the frontal lobe

(iv) to control the temperature, taste, touch, pain etc, through the parietal lobe

a. (i),(ii),(iii) b. (iii),(iv),(i)

c. (i),(iii),(iv) d. (i),(ii)

54. Match item in column-I with those given in column-II

column-I	column-II
p. ADH	a. Pituitary
q. ACTH	b. mineralocorticoid
r. aldosterone	c. diabetes mellitus
s. insulin	d. diabetes inspidus
t. adrenaline	e. vasodilator

a. (p – d) (q – a) (r – c) (s – b) (t – e)

b. (p – a) (q – d) (r – b) (s – c) (t – e)

c. (p – d) (q – a) (r – b) (s – c) (t – e)

d. (p – d) (q – b) (r – a) (s – c) (t – e)

55. Match the endocrine gland, given under column-I with their respective position in the body given under column-II choose the answer which gives the correct combination of alphabets of two columns: (K.C.E.T.1998)

column-I (Endocrine glands)	column-II (Position in body)
a. pituitary gland	p. Above kidney
b. Thyroid gland	q. Inside pancreas
c. Adrenal gland	r. On larynx
d. Islets of langerhans	t. At the base of brain

a. (a – t) (b – r) (c – p) (d – q)

b. (a – s) (b – t) (c – p) (d – q)

c. (a – p) (b – q) (c – r) (d – t)

d. (a – q) (b – s) (c – t) (d – p)

56. What is the function of enterogastrone?

a. It stimulates the secretion of digestive juices in the stomach

b. It stimulates the flow of pancreatic juice

c. It regulates the flow of bile

d. It inhibits the secretion of gastric juice

57. Doctors use stethoscope to hear the sound; produced during each cardiac cycle. The second sound is heard when: (RE-AIPMT-2015)

a. AV node receives signal from SA node b. AV valves

c. Ventricular wall vibrate due to gushing of blood from atria

d. **Semilunar valves close down after the blood flows into vessels from Ventricles.**

58. Sliding filament theory can be best explained as (NEET 2015)

a. when myofilaments slide pass each other actin filaments shorten while myosin filaments do not shorten

b.actin and myosin filaments shorten and slide pass each other

c.actin and myosin filaments do not shorten but rather slide pass each other

d. when myofilaments slide pass each other myosin filaments shorten while actin filaments do not shorten

59. A cranial nerve with maximum branches in the body is (M.P.P.M.T.1997,A.P.M.E.E 1999)

a. Auditory **b. Trigeminal**

c. Vagus d. Facial

60. A person undergoing prolonged fasting his urine will be found to contain abnormal quantities of (MP PMT 2005)

a. Fats b. Amino acid

c. Glucose **d. Ketones**

HIGHER SECONDARY FIRST YEAR BIOLOGY-ZOOLOGY PRACTICALS

General Instruction

In order to get maximum benefit and good training it is necessary for the students to follow the following instructions.

1. The students must attend all practical classes. Each experiment in practicals has got important relevance to theory subjects.
2. Bring this practical manual to your practicals class.
3. Bring the following objects to the practicals class – Pencils (HB), Pen, Eraser, a scale and a small hand towel.
4. Record the title, date and findings of the experiment in the observation note book.
5. Carefully listen to the instructions given by your Teacher.
6. While observation slides or models draw the structure of the specimen as you see it neatly in your observation note book. Use pencil for drawing.
7. While doing experiments neither consult your neighbours nor look into their readings or observations.
8. If the object under the microscope remains without proper focusing immediately bring it to the notice of the Teacher.
9. Do not touch or lift the models or equipments kept for your identification.
10. **No need to draw diagrams from part III to VII in the record note. Relevant photograph can be collected, pasted and notes to be written.**

MODEL QUESTION

TIME: 75 Minutes

Marks: 7½

I.	Identify the given animal 'A' (picture/specimen) draw and write any 2 diagnostic features.	(1)
II.	Identify the given animal tissue 'B' (slide/photograph /picture) and write any 2 comments with diagram	(1)
III.	Identify and comment on the given bone/joint 'C'.	(1)
IV.	Identify the deficiency disease / disorder in the given picture/photograph "D". Write any three symptoms.	(1)
V.	1. Identify the given sample solution 'E' for the presence/activity of Ammonia/Urea/Salivary amylase (Any one).	(1½)
	2. Observe and write about the given experiment 'F' - Determine Your Blind Spot / Identify the sex of cockroach (Any one)	(1)
VI.	Identify the photograph / picture and write its economic importance 'G'	(1)
	Total	**(7½)**

MARKS ALLOTMENT

TIME: 75 Minutes

Marks: 7½

I.	Identification and Diagram - ½ ; Diagnostic features (any 2 points) -½	(1)
II.	Identification and Diagram - ½; Comments (any 2 points) – ½	(1)
III.	Identification – ½; Comments – ½ (any two points)	(1)
IV.	Identification – ½; Symptoms – ½ (any three points)	(1)
V.	1. Procedure – ½; Experiment- ½ ; Result - ½	(1½)
	2. Procedure - ½; Result - ½ / Identification - ½; Reason - ½	(1)
VI.	Identification – ½; Economic importance – ½ (any two points)	(1)
	Total	**(7½)**

NOTE: Any relevant points, diagnostic features and comments apart from those provided in the practical manual must also be considered for evaluation.

CONTENT

QUESTION NO-I (A)	
S.No	**List of Specimens/Photographs**
1	Spongilla
2	Sea Anemone
3	Pleurobrachia
4	Tapeworm
5	Ascaris
6	Earthworm
7	Cockroach
8	Pila
9	Starfish
10	Balanoglossus
11	Rat

QUESTION NO-II (B)	
S.No	**List of Slides/Pictures/Photographs**
1	Squamous Epithelium
2	Columnar Epithelium
3	RBC
4	WBC

QUESTION NO-III (C)	
S.No	**List of models/pictures/Photographs (Human)**
1	Humerus
2	Pelvic girdle
3	Rib cage (True ribs, Pseudo ribs, Floating ribs)
4	Ball and Socket joint

QUESTION NO-IV (D)	
S.No	**List of Slides/Pictures/Photographs**
1	Addison's disease
2	Marasmus
3	Exopthalmic Goitre

QUESTION NO-V (E and F)	
S.No	**List of Experiments**
1	Test for Ammonia
2	Test for Urea
3	Test for Salivary Amylase
4	Determine Your Blind Spot
5	Identify the sex of cockroach (using hand lens)

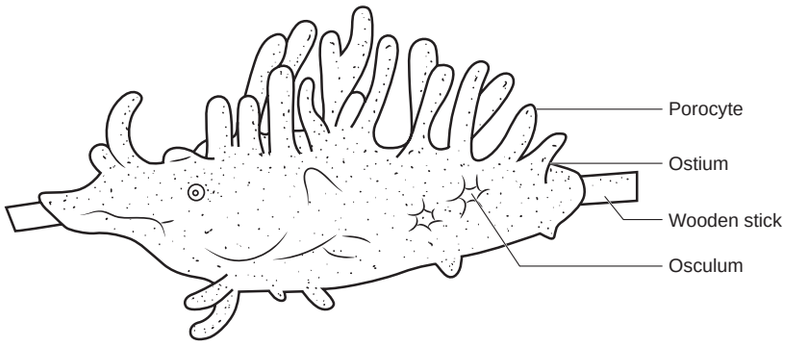
QUESTION NO-VI (G)	
S.No	**List of Photographs/pictures**
1	Kangayam bull
2	Aquaponics
3	Honey bee
4	Bombyx mori

I. Identify the given animal 'A' (picture/specimen) and write any 2 diagnostic features with diagram.

1. SPONGILLA

Identification:

The given specimen is identified as ***Spongilla***. It belongs to the Phylum **Porifera.**



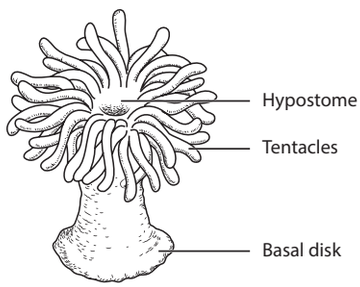
Reasons for identification:

- It is a pore bearing animal.
- It is an aquatic multicellular animals with cellular level of organization.
- It possess a canal system where the water enters into the central cavity, spongocoel through minute pores called ostia.
- The spongocoel is lined with special flagellated cells called choanocytes.

2. SEA ANEMONE

Identification:

The given specimen is identified as **Sea anemone.** It belongs to the Phylum **Cnidaria.**



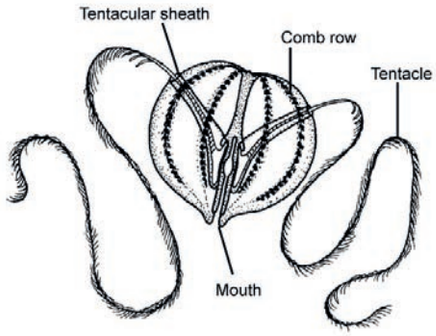
Reasons for identification:

- Sea anemone is diploblastic and the first group of animals to exhibit tissue level of organization.
- It has stinging cells called nematocysts on their tentacles.
- The central vascular cavity is called coelenteron which opens out through the hypostome.
- The nervous system is formed of a diffused nerve net.
- Cnidarians exhibit 2 basic body forms, polyp and medusa.
- The polyp represents the asexual generation and the medusa represents the sexual generation (Alternation of generation).
- Development includes a ciliated Planula larva.

3. PLEUROBRACHIA

Identification:

The given specimen is identified as **Pleurobrachia.** It belongs to the Phylum **Ctenophora.**



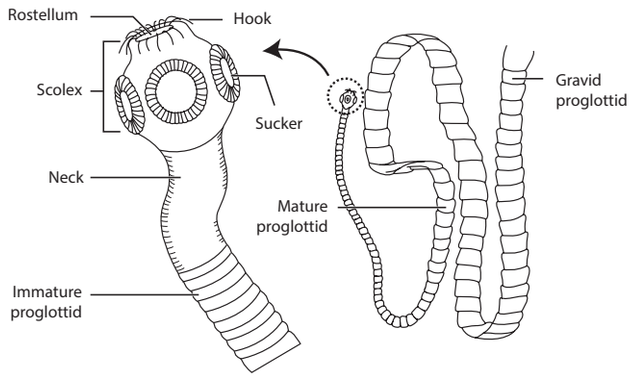
Reasons for identification:

- Pleurobrachia are exclusively marine, biradially symmetrical, diploblastic animals with tissue level of organisation.
- They have eight external rows of ciliated comb plates (comb jellies) which help in locomotion.
- Bioluminescence is well marked in ctenophores.
- They lack nematocysts but possess special cells called colloblasts which help in food capture.
- They reproduce only by sexual means. Fertilization is external and development is indirect and includes a larval stage called cydippid larva.

4. TAPEWORM

Identification:

The given specimen is identified as **Tapeworm.** It belongs to the Phylum **Platyhelminthes.**



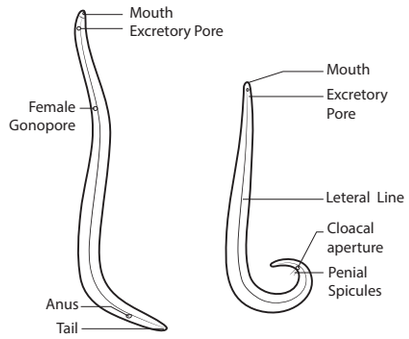
Reasons for identification:

- It is a dorsoventrally flattened, triploblastic, acoelomate animal with organ level of organization.
- It is an endoparasite.
- Hooks and Suckers act as organs of attachment.
- Excretion is carried out by specialized cells called flame cells.

5. ASCARIS

Identification:

The given specimen is identified as ***Ascaris*.** It belongs to the Phylum **Aschelminthes.**



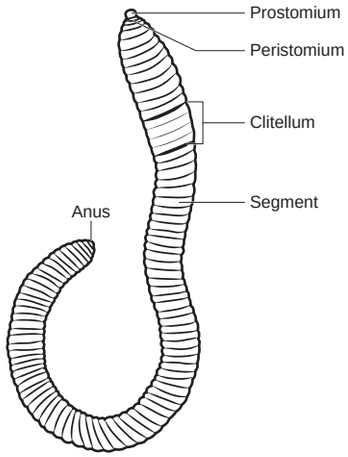
Reasons for identification:

- Ascaris is a roundworm because it is circular in cross section.
- It is a triploblastic, pseudocoelomate animal.
- The unsegmented body is covered by a protective layer called cuticle.
- Alimentary canal is complete with a well developed mouth, pharynx and anus / cloaca.
- Sexes are separate and exhibit sexual dimorphism.
- Excretion is carried out through Rennet glands.
- It is an endoparasite.

6. EARTHWORM

Identification:

The given specimen is identified as **Earthworm.** It belongs to the Phylum **Annelida.**



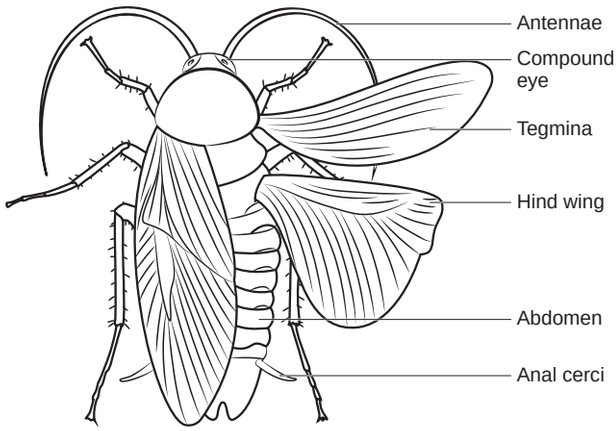
Reasons for identification:

- Earthworm is a triploblastic, schizocoelomate animal.
- Its elongated body is segmented.
- The longitudinal and circular muscles in the body wall help in locomotion.
- The circulatory system is of closed type and the respiratory pigment haemoglobin is present in the plasma.
- It is a hermaphrodite animal.

7. COCKROACH

Identification:

The given specimen is identified as **Cockroach.** It belongs to the Phylum **Arthropoda.**



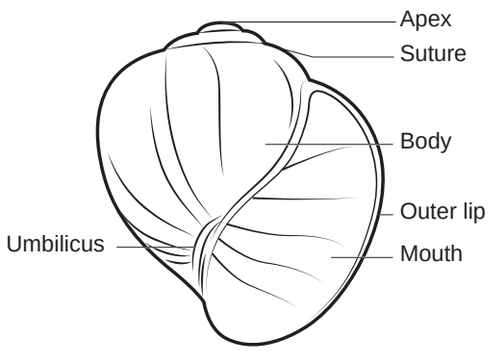
Reasons for identification:

- It is a triploblastic, schizocoelomate animal.
- It has jointed appendages which are used for locomotion.
- Body is covered by a chitinous exoskeleton which is shed off periodically by a process called moulting/ecdysis.
- Respiration is through trachea.
- Excretion is by malpighian tubules.

8. PILA

Identification:

The given specimen is identified as ***Pila*.** It belongs to the Phylum **Mollusca.**



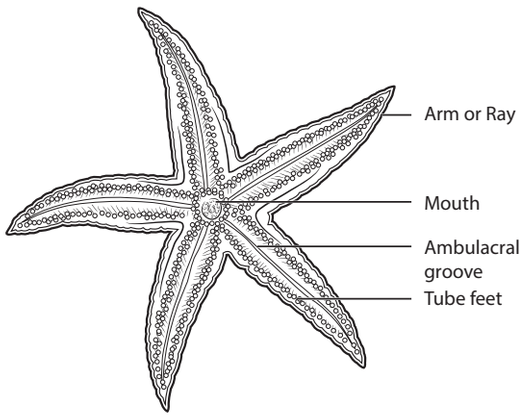
Reasons for identification:

- It is a triploblastic, coelomate animal.
- Body is covered by a calcareous shell.
- Internal organs are covered by a soft layer of skin called mantle.
- Respiration is carried out through a number of feather like gills called ctenidia.
- The mouth contains a rasping organ called radula.
- Excretory organs are the nephridia.
- Blood contains a copper containing respiratory pigment, haemocyanin.
- Their development includes a Veliger larva.

9. STARFISH

Identification:

The given specimen is identified as **Starfish**. It belongs to the Phylum **Echinodermata.**



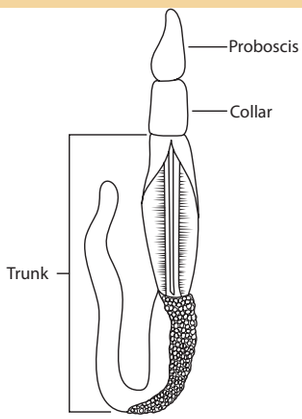
Reasons for identification:

- It has spiny skin.
- It has Water vascular system.
- Tube feet help in locomotion.
- The adults are radially symmetrical.
- Larvae are bilaterally symmetrical
- Circulatory system is open type without heart and blood vessels.
- It exhibits autotomy with remarkable power of regeneration.
- Bipinnaria is the first larva in its development.

10. BALANOGLOSSUS

Identification:

The given specimen is identified as ***Balanoglossus***. It belongs to the Phylum **Hemichordata.**



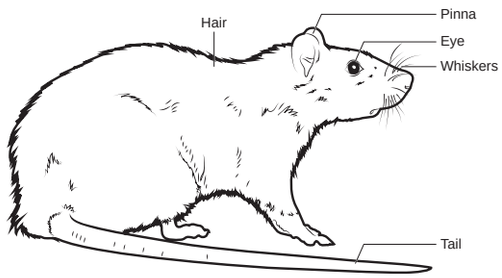
Reasons for identification:

- It is a connecting link between invertebrates and chordates.
- The body is divided into anterior proboscis, a short collar and a long trunk.
- It is a marine and bilaterally symmetrical animal.
- Excretion is by a single proboscis gland.
- Development is indirect with a free swimming Tornaria larva.
- Presence of buccal diverticulum is the significant character of this animal.

11. RAT

Identification:

The specimen kept for identification is the **Rat**. It belongs to the Phylum Chordata, Subphylum Vertebrata and Class **Mammalia**.



Reasons for identification:

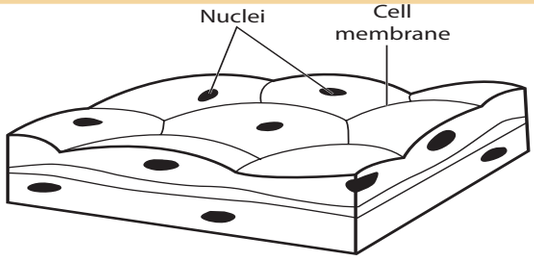
- Presence of mammary gland is the unique feature of mammals.
- Pair of pinnae or external ears are present.
- Heart is 4 chambered.
- Kidneys are metanephric and are ureotelic animal
- Rats are homeothermic and viviparous.

II. Identify the given animal tissue 'B' (slide/photograph/picture) and give any 2 comments with diagram.

1. SQUAMOUS EPITHELIUM

Identification

The given slide/ picture is identified as **squamous epithelium.**



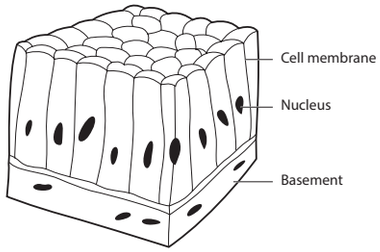
Notes:

- Squamous epithelium is a type of simple epithelium
- It is made of a single thin layer of flattened cells with irregular boundaries.
- Found in cheek, kidney glomeruli, air sacs of lungs, lining of heart and blood vessels.
- It is involved in diffusion and filtration.

2. COLUMNAR EPITHELIUM

Identification:

The given slide/ picture is identified as **columnar epithelium**.



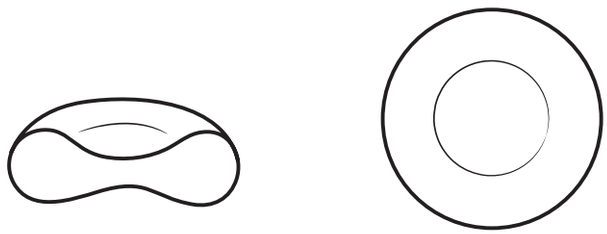
Notes:

- Columnar epithelium is a type of simple epithelium.
- It is composed of a single layer of tall cells with round oval nuclei at the base.
- It lines the digestive tract from the stomach to rectum.
- It is involved in absorption, secretion of mucus, enzymes and other substances.

3. RBC

Identification:

The given slide is identified as **Red blood corpuscles (Erythrocytes).**



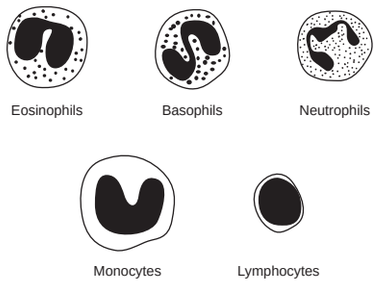
Notes:

- The red colour of the RBC is due to the presence of a respiratory pigment, haemoglobin.
- Haemoglobin plays an important role in the transport of respiratory gases.
- RBC's are produced in the red bone marrow of large bones and are destroyed in the spleen and liver.
- The average life span of an RBC in a healthy individual is about 120 days.

4. WBC

Identification:

The given slide is identified as **white blood corpuscles (leucocytes).**



Notes:

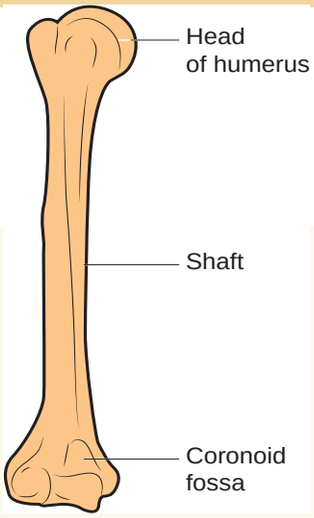
- Leucocytes are colourless, amoeboid, nucleated cells devoid of haemoglobin and other pigments.
- Based on the presence (or) absence of granules, WBC's are divided into two types, granulocytes (Neutrophil, Basophil and Eosinophil) and agranulocytes (Lymphocyte and Monocyte).
- WBCs are involved in protecting the body against pathogens.
- The life span of a white blood cell ranges from 13 to 20 days. These are destroyed in the lymphatic system.

III. Identify and comment on the given bone/joint 'C'.

1. HUMERUS BONE

Identification:

The given specimen/picture kept for identification is the **human – humerus bone.**



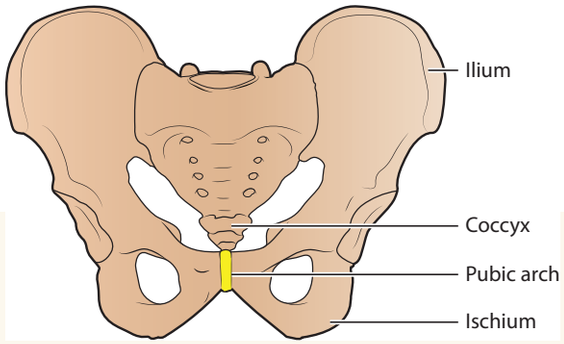
Comments:

- It is found between the shoulder and elbow.
- The head of humerus articulates with the glenoid cavity of the pectoral girdle.
- The other end of the humerus articulates with the two forearm bones namely the radius and ulna.

2. PELVIC GIRDLE

Identification:

The given specimen kept for identification is the **human pelvic girdle**.



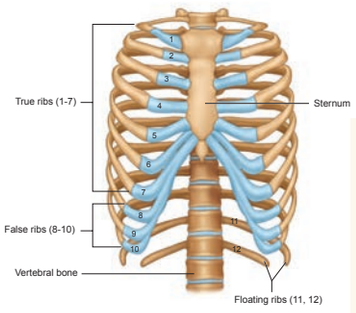
Comments:

- It is composed of 2 hip bones called coxal bones together with the sacrum and coccyx.
- It is a heavy structure specialized for weight bearing.
- Each coxal bone consists of 3 fused bones namely the ilium, ischium and pubis.
- At the point of fusion of the 3 bones, a socket called acetabulum is present.
- The acetabulum is meant for the articulation of the lower limbs.

3. RIB CAGE

Identification:

The given specimen kept for identification is the **human ribcage**.



Comments:

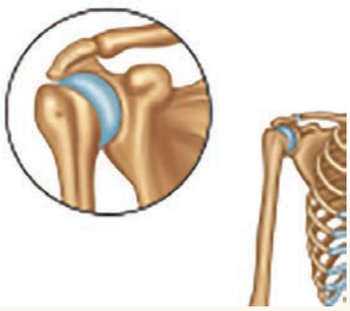
- There are 12 pairs of ribs.
- Each rib is connected dorsally to the vertebral column and ventrally to the sternum.

- The first 7 pairs of ribs are called true ribs.
- The 8th, 9th and 10th pairs of ribs do not articulate with the sternum but is joined with the 7th rib. They are called as false ribs.
- The last 11th and 12th pairs of ribs are not connected with sternum. They are called as floating ribs.

4. BALL AND SOCKET JOINT

Identification:

The specimen/model/picture kept for identification is the **Ball and Socket joint.**



Comments:

- It is a type of synovial joint.
- In this type, the ball shaped rounded bone fits into the cup like depression of another bone.
- It allows multi directional movements and rotation.
- This type of joints are found between the upper arm and shoulder and between the upper leg and hip.

IV. Identify the deficiency disease/disorder 'D' in the given picture/photograph and write any 3 symptoms.

1. ADDISON'S DISEASE

Identification:

The picture kept for identification depicts **Addison's disease.**

Comments:

- It is a disorder in which the adrenal glands do not produce enough hormones.
- It is caused due to hyposecretion of glucocorticoids and mineralocorticoids from the adrenal cortex.
- Muscular weakness, low BP, loss of appetite, vomiting, hyper pigmentation of the skin are the symptoms of Addison's disease.

2 MARASMUS

Identification:

The picture kept for identification depicts **Marasmus.**

Comments:

- It is a disorder due to protein deficiency in children.
- It is an acute form of protein malnutrition.
- This is due to a diet with inadequate carbohydrate and protein.
- Diarrhoea and emaciation are the symptoms of this disease.

3. EXOPTHALMIC GOITRE

Identification:

The picture kept for identification depicts Exopthalmic goitre.

Comments:

- The hyper function of thyroid gland results in exopthalmic goitre/gravis disease.
- It is characterized by increased BMR (50% - 100%) with increased pulmonary ventilation and protrusion of eye balls from the sockets (exophthalmos)
- Elevated respiratory and excretory rate with increased body temperature are the general symptoms.

V. 1. Identify the given sample solution 'E' f or the presence/activity of salivary amylase/ ammonia/urea.

2. Observe and write about the given 'F' experiment / specimen / picture. Determine Your Blind Spot / Identify the sex of cockroach

1. TEST FOR AMMONIA

Aim : To test the presence of Ammonia in the given sample solution.

Materials Required: Test tube and holder.

Solution Required: Sample solution and Nessler's Reagent.

Procedure:

1) Take 2ml of the given sample solution in a clean test tube.
2) Add few drops of Nessler's reagent in the test tube containing sample solution.
3) Appearance of dark yellow/brown colour confirms the presence of Ammonia in the given sample.

Inference: It is inferred that ammonia is present in the given solution.

2. TEST FOR UREA

Aim: To test the presence of urea in the given sample solution.

Material Required: Test tube, sample solution, test tube holder and pipette / dropper.

Required Reagents: Phenol red and Horse gram powder (which contains the enzyme urease).

Procedure:

1. Take 2 ml of sample solution in a clean test tube.
2. Add few drops of phenol red in the test tube containing sample solution.
3. Add a pinch of horse gram powder in the test tube and mix well.
4. Appearance of dark pinkish colour indicates the presence of urea in the given sample.

Inference: It is confirmed that the given sample solution contains urea.

3. TEST FOR SALIVARY AMYLASE

Aim: To test the presence of Amylase enzyme in the human saliva.

Materials Required: Test tubes, Potato, Mortar and Pestle.

Solutions Required: Iodine solution, Human Saliva.

Procedure:

1) Add mashed potato pieces in a test tube and add warm water. Shake well.
2) Collect the clear supernatant in a test tube.
3) Add few drops of iodine solution to the liquid in the test tube.
4) Note the bluish black (dark blue) colour in the test tube.
5) Collect a few drops of saliva in a clean test tube.
6) Transfer the saliva into the test tube containing the sample solution and shake well.
7) Leave the sample undisturbed for 5 minutes. Observe the colour change in the sample solution.
8) The solution gradually becomes colourless.
9) This confirms the presence of amylase in the human saliva.

Inference: It is inferred that human saliva contains the enzyme amylase that digests the starch.

4. DETERMINE YOUR BLIND SPOT

Procedure:

1. Cover your left eye.
2. Hold the figure shown about 50 to 60 cm away from your face and directly in front of your right eye.

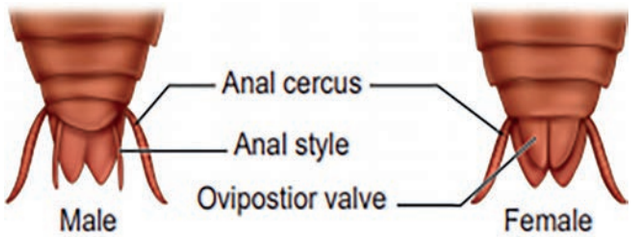
3. Stare at the cross in the shown figure. You can also see the circle.
4. Continue to stare and slowly bring the figure nearer to your eye.
5. Note the point at which the circle will seem to disappear. This is your blind spot.
6. Record the distance.
7. Test your other eye in a similar manner, but focus on the circle and watch for the cross to disappear.

Result:

1) Blind spot of my right eye is _____cm
2) Blind spot of my left eye is_____cm

5. Identify the sex of the cockroach by observing the given specimen/picture /model and write two reasons.

Identification :



Reasons:

VI. Identify the photograph / picture 'G' and write its economic importance

1. KANGAYAM BULL

Identification:

The photograph kept for identification is Kangayam bull.

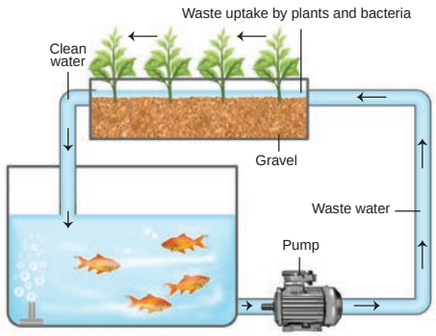
Economic importance:

1. It is originated from the place called Kangayam in Tamilnadu.
2. This breed is meant for pulling carts, ploughing fields etc.
3. This breed is exclusively used in the traditional game called Jallikattu (manju virattu) in Tamilnadu.
4. It is a best example for a draught breed.

2. AQUAPONICS

Identification:

The photograph kept for identification is Aquaponics.



Economic importance:

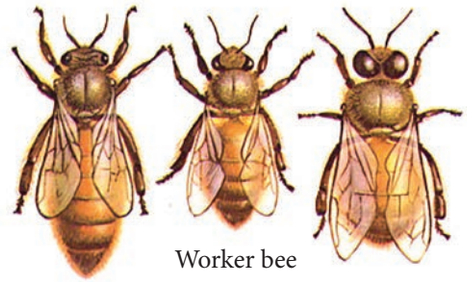
1. Aquaponics is a technique which is a combination of Aquaculture and Hydroponics.
2. It maintains balanced ecosystem by recycling the waste and excretory products produced by the fish.
3. Cultivable fishes like Tilapia, Gold fish, Koduva etc. are cultured in aquaponics.
4. Plants like tomato, pepper and cucumber can be cultivated in this method.

3. HONEY BEE

Identification: The photograph kept for identification is Honey bee.

Economic importance:

1. The chief products of bee keeping industry are honey and bee wax.
2. Honey is the healthier substitute for sugar.
3. It is used as an antiseptic, laxative and as a sedative.
4. Bee wax secreted by the abdomen of the worker bee is used for making candles, polishes for floors and furniture etc.



Queen bee Worker bee Drone bee

4. BOMBYX MORI

Identification:

The photograph kept for identification is silkworm Bombyx mori

Economic importance:

1. Silk fibre produced by this silkworm is called mulberry silk.
2. It mainly feeds on mulberry leaves
3. It is used in manufacturing silk cloths, fishing fibres, tyres of racing cars, in medical dressings, parachutes etc.

Biology - Zoology – Class XI
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