Chapter 1

Introduction to Biology

There are millions of organisms on the earth. The study of living things and their life (both plants and animals) is called Biology.

(Gr. *Bios*-life, *logos*-discourse or knowledge). Thus, biology is a science devoted to the study of living organisms. In today's world science has progressed by breaking down complex subjects of study into their component parts and numerous branches of biology. This principle also considered to be the reductionist principle" as it includes logical conclusions of elementary forms of matter in living and non-living systems

An opposing approach based on the "vitalist principle" considers "life" an special and a unique, that explains life with the system as a whole. This concludes biology to be the explanation of living world in terms of scientific principles with structural and basic unit as cell Thus, the conclusion refers to the study of objects having cell and its components as a living object i.e life science

Life exists in two forms i.e., plants and animals.

- Term biology was coined by **Lamark** and **Treviranus**. Biology as a whole is divided into two major branches
  (a) Botany (***Botane***-herb or plant)
  (b) Zoology (***Zoon***-animal)
- **Botany/plant Science** is the branch of biology which deals with plants.
- **Zoology/Animal Science** is the branch of biology which deals with animals
- The father of Biology - **Aristotle**
- The father of Zoology - **Aristotle**
- The father of Botany-**Theophrastus**
- The father of Medicine - **Hippocrates**
- **Germ theory of disease** was given by **Louis Pasteur.**
- Cell theory was proposed by **M.J. Schleiden** (in plants) and **Schwann** (in animals).
- Theory of inheritance of Acquired character was proposed by Jean Baptiste De **Lamark** Binomial system of nomenclature was given by carolus
- **Theory pasteurization** was given by **Louis pasteur**
- **Robert Hook** is the father of cytology (study of cell structure and function) He studied the thin slice of bottle cork and discovered the cell wall.

- **Robert Brown** discovered the Nucleus of a cell
- **Carolus Linnaeus** father of taxonomy, he propounded 2 system classification, Binomial system of Nomenclature and Artificial system of classification.
- Five kingdom classification was given by **R.H. Whitaker**.
- **Watson and Crick** gave the double Helix model of DNA for which they were awarded the Nobel prize in 1962.

Living Characteristics

Living organisms have their own characteristics. On the basis of certain characteristics, living organisms can be distinguished from non-living. The insulating characteristics of living organisms from non-livings are pointed as:

1. Definite shape and size
2. Cellular structure and protoplasm
3. Movement and locomotion
4. Nutrition
5. Respiration
6. Metabolism
7. Excretion
8. Irritability
9. Reproduction
10. Growth
11. Life-cycle 13. Ageing and death
12. Repair of injured parts

1. Definite shape and size:

All living organisms have their definite shape and size whereas non-livings do not have definite shape and size. For e.g., stone, water. wood does not have a definite shape and size.

2. Cellular structure and Protoplasm:

All living beings have their components as cells. Thus, the cell is the structural and functional unit of the body containing protoplasm that functions the body organization. Hence, protoplasm is also called the Physical basis of life.

3. Movement and Locomotion:

The process in which the entire body moves from one place to another is called movement. Animals move from one place to another by their locomotory organs like, Amoeba by pseudopodium. Paramecium by ciha, Man by legs, Insects by wings Note: In case of plant movement takes place due to stimuli and shows slow movement and response like bending of plant towards light is also a kind of movement.

4. Nutrition:

Every living organism requires food for energy to perform various body functions. Thus, nutrition is a process of taking food. Plants are Autotrophs as they can synthesize food of their own by photosynthesis whereas animals are heterotrophs and are dependent on others for food.

- **Autotrophs** like plants can prepare their food themselves.
- **Heterotrophs are like** animals dependent on autotrophs for their food.

But non-living things do not have this type of nutrition.

5. Respiration:

All living things (plants and animals) perform respiration. In this process oxygen is taken in to oxidize the food in order to release energy. CO_2 and H_2O are released in the form of byproducts. Various respiratory organs are involved during this process. But nonliving cannot perform respiration. During respiration release of energy takes place by the breakdown phenomenon like $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O +$ energy.

This released energy is used to build up ATP (Adenosine triphosphate) that remains stored in the cell.

6. Metabolism:

The various physiological activities are going on inside the body of living organisms and are considered as metabolism. Metabolism can be divided into two parts:

a) Anabolism

b) Catabolism.

Anabolism is the constructive process like photosynthesis in which glucose is synthesized. Catabolism is the destructive process in which substances are broken down like respiration in which glucose is broken down into water, CO_2 and energy.

7. Excretion:

The discharge of metabolic wastes refers to excretion. During the metabolic process various excretory products like CO_2, water, inorganic salts, urea, uric acid, creatinine etc. are released inside the body. These substances are very toxic, hence are urgently required to expel out of the body.

8. Irritability:

The ability of organisms to respond to stimuli is called Irritability. Any change in the environment is called stimulus and Response of the organisms to the stimulus is due to irritability. expansion

The movement of plants towards light, contraction and expansion of pupil are due to change in the intensity of light etc., are the examples of sensitivity or irritability.

9. Reproduction:

Living organisms have the ability to produce young ones. Thus, the process of giving birth to the young ones of its own kind is called reproduction. Reproduction can be classified into two types:

a) Asexual (in lower organisms)

b) Sexual (in higher organisms)

Reproduction is essential for

i. To increase the number of its own kind.

ii. For the continuation of the race of the organism.

But a non-living thing like a stone cannot reproduce

10. Growth:

The increase in size followed by permanent change in its form is called growth. Living organisms as a result of building up of protoplasm within the cells and this is due to (internal) growth of the organism.

But in case of non-living increase in size may take place but this is due to deposition of materials on its outer surface (Excretion).

11. Life-Cycle:

During the development of an animal or a plant, they pass through different stages in the form of a cycle. So the different stages of an individual from the formation of zygote up to the adult stage are called life-cycles.

12. Repaired of injured part:

Living body can repair an injured part whereas a non-living body cannot do so. e.g., if a small part of stone is broken it cannot repair the broken end.

13. Ageing and Death:

Every living organism has a definite life but non living organisms do not have definite life .

Summary:

Differences between living and non-living

Character	**Living**	**Non living**
Shape and size	Definite	Not definite
Protoplasm	Present	Absent
Movement	Present	Absent
Nutrition	Present	Absent
Respiration	Present	Absent
Metabolism	Present	Absent
Ageing	Present	Absent

Zoology (Gr. zoo=animal)

It is a vast science that deals with animals and their life.

Branches of Zoology

Name of branches Deals with the

1. Entomology-study of insects.

2. Ichthyology-study of fishes.
3. Helminthology - study of helminths worm
4. Mammalogy-study of mammals
5. Ornithology - study of birds
6. Parasitology - study of parasitic worms.
7. Virology - study of viruses.
8. Herpetology-study of reptiles.
9. Anthropology - study of human evolution and culture.
10. Cnidology- study of coelenterates.
11. Euthenics study of improvement of human race through heredity.
12. Karyology - study of nucleus.
13. Malacology-study of molluscs.
14. Microbiology-study of micro-organisms.
15. Protozoology - study of unicellular organisms.
16. Ethology study of animal nature.
17. Bacteriology - study of bacteria.
18. Epidemiology - study of epidemic diseases.
19. Immunology - study of defense and resistance against disease.
20. Enzymology - study of enzymes.
21. Hematology - study of blood.
22. Cardiology study of the heart.
23. Osteology-study of bones.
24. Endocrinology - study of endocrine glands and hormones.
25. Paleontology - study of fossils.
26. Zoogeography study of distribution from gene rocks of earth.
27. Genetics-study of inheritance of characters.
28. Tectology study of structural organization and morphology of animals.
29. Cytology study of Acquired characters.
30. Exobiology (Exozoology + exobotany) - study of animals and plants on outer planets.
31. Carcinology - study of crustaceans.
32. Concho logy - study of cells of molluscs
33. Ophiology study of snakes.
34. Saurology-study of lizards.
35. Acrology study of ticks and mites.

36. Myrmecology - study of ants.
37. Nidology-study of nests of birds.
38. Lepidopterology - study of butterflies and moths..

On the basis of scopes (practical application).

39. Apiculture study of bees.
40. Pisciculture study of rearing of edible fish
41. Sericulture - study of silkworms.
42. Poultry-study of keeping domestic fowls.
43. Craniology-study of the skull.
44. Neurology - study of the nervous system.
45. Sarcology-study of muscles.
46. Hematology - study of blood/liver.
47. Serology study of serum.
48. Odontology - study of animal teeth.
49. Nephrology study of kidneys.
50. Dermatology - study of skin.
51. Syndesmology study of joints and ligaments
52. Mastology-study of breasts.
53. Otolaryngology study of larynx and cars
54. Rhinology study of Olfactory organs.
55. Oncology study of joints.

Scopes of Zoology

The scopes of applied zoology are innumerable and provide knowledge of medicine, dentistry, veterinary medicine, medical technology, nursing, museum work, zoological teaching, zoological research, agriculture, environmental science and conservation:

i) In the field of Health and Disease:

The various protozoans and helminths are responsible for causing many diseases. The transference of disease producing parasites are performed as Anopheles (malaria) sandfly (kala-azar), tsetse (sleeping sickness), house-fly (typhoid). The control and cure of these diseases are studied by economic zoologists.

ii) In the field of Agriculture:

The various types of living organisms are associated in a particular environment as earthworms bring soil aeration and water, bacteria decompose dead animals and plants are the part of applied zoology.

iii) In the field of Industry:

The various animal products of animals like coral, pearl, honey, wax, silk, bones, feathers, are of high demand and are part of applied zoology.

Important Scientific c names/Common Names:

1. Sycon-Crown Sponge.
2 Euplectella - Venus Flower Basket.
3. Euspongia - Bath Sponge.
4. Obelia-Seá Fur.
5. Physalia - Portuguese man of war.
6. Metridium-Sea Anemone.
7. Fungi (colonial) - Mushroom Coral.
8. Aurelia - Jellyfish
9. Pennatula - Sea Pain or Sea Feather.
10. Alcyonium - Dead Man's Finger.
11. Fasciola Hepatica - Liver Fluke.
12. Schistosoma - Blood Fluke.
13. Taenia solium - Tapeworm
14. Taenia Saginata- Beef Tape Worm.
15. Paragonimus-Lung Fluke.
16. Oxyuris PinWorm.
17. Ascaris - Roundworm.
18. Ancylostoma - HookWorm.
19. Trichuris- Whipworm or Serpent Worm.
20. Enterobius-Thread Worm.
21. Dracunculus-Guinea Worm.
22. Gordius-HorseHair Worm.
23. Wuchereria - Filaria Worm.
24. Pheretima Posthuma - EarthWorm.

25. Nereis- SandWorm.
26. Limulus- King Crab.
27. Epeira - Spider.
28. Astacus-CrayFish.
29. Melanopus - Grasshopper.
30. Musca-Housefly.
31. Apes Honey Bee.
32. Scolopendra - Centipede.
33. Julus Millipede.
34. Lepisma - SilverFish.
35. Gryllus - Cricket.
36. Palamnaeus - Cockroach.
37. Culex & Anopheles - Mosquito.
38. Helix - Garden Snail.
39. Mytilus-Sea-Mussel.
40. Unio-Freshwater Mussel.
41. Loligo-Squid.
42. Sepia-CuttleFish.
43. Octopus - Devil Fish.
44. Asterias - StarFish.
45. Echinus-Sea-Urchins.
46. Holothuria - Sea-Cucumber.
47. Antedon-Sea Lily.
48. Scoliodon- Dog Fish.
49. Sphyma-Hammer Headed Shark.
50. Torpedo-Electric Ray.
51. Pristis-Saw Fish
52 Chimaera- RatFish.
53 Salmo-Trout
54.Labeo rohita- Rohu.
55. Ophiocephalus -Charma
56. Anguilla-Eel Fish
57. Pierois-Scorpion Fish
58. Exocoetus- Flying Fish.

59. Hippocampus - Sea-Horse.
60. Sired-Mud Eel.
61. Hyla-Tree Frog.
62. Bufo-True Toad.
63. Rhacophorus - Flying Frog
64. Rana - Frog.
65. Hemidactylus - Wall Lizard.
66. Draco-Flying Lizard.
67. Zameris-Dhaman or Rat Snake.
68. Naja-Cobra.
69. Vipera Vipers.
70. Bungurus - Knit.
71. Trionyx-Kxchua..
72. Ornithorhynchus - Duck-Billed Platypus.
73. Echidna-Spiny AntEater.
74. Pteropus - Bat.
75. Funambulus - Squirrel.
76. Rattus rattus - Rat.
77. Macropus- Kangaroo.
78. Panthera tigris - Tiger.
79. Panthera leo - Lion.
80. Psittacula psittacula - Parrot.
81. Columba Livia - Pigeon.