BASICS

- The living organisms are recognised by life processes like, growth, metabolism, response to stimuli and reproduction.
- The number of organisms that are described so far **-1.7 tol.8 millions.**
- The taxonomists follow the different methods of classification for the study of animals.
- Five kingdom classification was proposed by - **R.H. Whittaker.**
- **Whittaker** classification is based on cell structure, complexity of body and nutrition.
- He placed prokaryotes in kingdom Monera, unicellular eukaryotes in kingdom Protista, multicellular autotrophs in kingdom Plantae, multicellular heterotrophs in kingdom Animalia and multicellular decomposers in kingdom Fungi.
- In kingdom Animalia, animals are included under different phyla based on different body plans.

Nature and scope of Zoology

- The branch of biology that deals with animals and animal life is known as **Zoology.**
- The term zoology is also used to study the animal life at particular area (or) period.
  Eg: The zoology of Alaska, The zoology of the Pleistocene.
- It is also used to study the particular animal group or category. Eg: The zoology of mammals.
- The science originated in the works of Hippocrates, **Aristotle** and **Pliny.**

The contribution of different scientists.

- Carolus Linnaeus - **System of nomenclature**
- Louis AgassisThomas H. Huxley Richard Owen **- Homology**
- Georges - Louis de Buffon - **Natural history**
- Georges Cuvier - **Comparative anatomy**
- Claude Bernard – **Homeostasis**
- Charles Darwin - **Natural selection**
- Mendel - **Inheritance**

Meaning of Zoology

- The term Biology was coined by**-Lamarck**
- Biology (bios = life, logos = study) deals with **- Study of living organisms**
- The branch of Science dealing with the study of plants - **Botany**
- The branch of Science dealing with the study of animals - **Zoology**
- The branch of Science dealing with the study of microbes - **Microbiology**

Branches of Zoology :

Taxonomy: It is the study of identification, nomenclature and classification of animals

- Study of the set of morphological and anatomical features which are useful indentifying the organisms is called - **Identification**
- Naming of organisms is called - **Nomenclature**
- Arrangement of organisms on the basis of their interrelationship- **Classification**

Morphology : it is the study of the external form, size, shape, colour, structure, and relative position of various organs

- Study of the external character of an organism is called - **External Morphology**
- Study of the internal characters is called **- Internal Morphology**
- Study of Internal Morphology includes - **Anatomy and Histology**

- Study of Internal arrangement of different organs or organ systems is called - **Anatomy**
- The study of Microscopic structure of tissues is called - **Histology** (or) **Microanatomy**
- The study of form and structure of the cell is called **-Cytology**
- Study of the cells as structural and functional units is called - **Cell biology**
- The study of different body functions and processes of various organs is called - **Physiology**
- The study of fertilization of gametes, cleavage, growth and differentiation is called
  - Embryology or Developmental Biology

- The study of origin of life and genetic adaptation of organisms to their environment is called - **Evolution**
- Evolution means Unfolding, The term organic evolution was coined by - **Herbert spencer**
- The study of fossils is called- **Palaeontology**
  - The study of plant fossils is called- **Palaeobotany**
  - The study of animal fossils is called- **Palaeozoology**
  - The study of distribution of living organisms in various regions is called - **Biogeography**
  - The study of distribution ofplants in various regions is called - **Phytogeography** The study of distribution of animals is called Zoogeography
  - The study of inheritance of parental characters by the offspring and variations among organisms is called**-Genetics**
  - The term Genetics was coined by - **Bateson**
  - Study of living organisms in relation to the living and non - living environment - **Ecology or Environmental biology** T
  - The term ecology was coined by - **Haeckel**
  - Study of nature of biomolecules and their interactions in an organism is - **Molecular Biology**
  - The study of animal behaviour based on physiological, ecological & evolutionary aspects is called - Ethology
  - The branch of biology that deals with the search for extra-terrestrial life and the effects of extra terrestrial surroundings on the living organisms is called - **Exobiology (or) Astrobiology (or) Space biology**

Relation between Zoology and other sciences:

- Scientific knowledge is acquired by the study of Pure science
- Application of scientific knowledge to the human welfare is - **Applied science**
- Zoology is more closely related to **Botany**
- Knowledge of chemistry related to biology is Bio-chemistry
- Branch required to understand the chemical processes like diffusion, osmosis bio membrane transport is - **Biochemistry**
- The study of application of physical principles to life processes of organisms - **Biophysics**
- Application of mathematics to Biology is Biometry
- Application of statistical methods in computation and analysis of data is - **Biostatistics**
- Study of fossils need knowledge of- **Geology**
- Study of zoogeography needs knowledge of **Geography.**
- Study of Zoology provide adequate knowledge about human diseases.
- The multidisciplinary study and analysis of origin and characteristics of human beings and their societies is - **Anthropology.**
- Science that deals with the application of knowl edge of genetics to the human welfare - **Eugenics**
- The Branch of genetics that deals with the practice of phenotypic improvement of humans after birth **Euphenics**
- Branch that deals with the branch of biochemistry concerned with the study of transformation and use of energy by living cells of organisms **Bioenergetics**
- Controlled use of microorganisms or cell components for the beneficial use of man is called **Biotechnology**
- **Genetic engineering** is Manipulation of genes which is a part of biotechnology
- The acquisition, storage, management, access and processing of data in molecular biology with the use of computers is - **Bioinformatics.**
- Zoology helps us in extensive tapping of animal products like - **Wool, Silk, Shellac, Pearls, Milk, Fat, Honey, Fish, Eggs.**

- Zoology is the branch which forms a part of Dairy sciences, Pharmacology, Veterinary science, Poultry, Aqua culture, Seri culture, Api culture

Basic principles of classification :

- The term Taxonomy was coined by - **A.P de Candolle**
- Theory and Practice of identifying, naming and classifying organisms is - **Taxonomy**
- Delimitation, ordering and ranking of taxa is called Classification
- The basic unit of taxonomy is **species**
- Systematics is the branch of science that deals with diversity of life, reveals the trends in evolution of animals
- Reconstructing phylogenetic history **of** organisms is **Systematics**
- **Taxonomy** is a key part of systematics
- Taxonomic hierarchy includes seven obligate categories - kingdom, phylum, class, order, family, genus & species.
- The intermediate categories are - subkingdom, grade, division, subdivision, subphylum, superclass, subclass, superorder, suborder, superfamily, subfamily & subspecies.
- Adding suffix "idae" to the generic name forms the name of family (Eg: Man belongs to family - Homi- nidae)
- Adding suffix "inae" to the generic name forms the name of sub family (Eg: Man belongs to the sub family - Homininae).
- Adding suffix "oidea" to the generic name forms the name of super family (Eg: Man belongs to the super family - Hominoidea).

Nomenclature:

Binominal nomenclature

Giving scientific name to an organism is called **-Nomenclature**

- Binomial nomenclature was described by **Carolus Linnaeus**
- Linnaeus described binominal nomenclature in his book - **Systema Naturae - (10th volume)**
- Binomial nomenclature of Linnaeus is referred now as - **Binominal nomenclature**
- The system providing organisms the appropriate scientific names consisting two words is **-Binomen**
- The first word in binomen refers to **Genus**
- The second word in binomen refers to **species**
- The generic name that refers to the genus is a noun
- The specific name that refers to the species is Adjective
- Generic name (it is a noun, begins with capital letter) Second name - Specific name (it is an adjective, begins with small letter)
- Scientific names are derived from**-Latin**
- Scientific names should be in- **Latinised form**
- Scientific names are written in - **Italics**
- Authors name can be either in full or in abbreviated form

(Ex:- Felis leo Linnaeus 1758 or Felis Leo L.1758 as per ICZN)

- If a genus or species is given accidentally two different names by different authors only the earlier one is valid - **Law of priority.**
- The later names for that organism are Junior synonyms
- The later uses of that name refer to different organisms are - **Junior homonyms.** If the name of the genus is changed or the species is transferred to the other genus the author's name is kept in – **Parenthesis** Ex:- Panthera Leo (Linnaeus 1758)
- Linnaeus originally placed the species 'leo' under the Genus- **Felis**
- The Genus Felis sub-sequently shifted to the Genus Panthera
- Rules of nomenclature were formulated by (ICZ) International congress of Zoology **Set of rules referred to as (ICZN) -** International code of Zoological Nomenclatu re

Trinominal nomenclature

- The extension of binominal system of nomenclature is - **Trinominal nomenclature**
- Using three names in naming the animal is - **Trinominal nomenclature**
- The system permits the designation of subspecies with a three worded name called**-Trinomen Ex. Homo sapiens sapiens**
- The word denoting the name of the sub species is also begins with a small letter and it is also a latinised word, printed in italics. Eg: **Homosapiens sapiens.**

Tautonymy

- If the generic and specific names are the same, the process of naming is - **Tautonymy**
- Such a name - **Tautonym** Ex. Spotted Deer - **Axis axis** Ex. Cobra - **Naja naja**

Biological classification

- The living organisms show diversity in structure habitats, habits and modes of life due to variations.
- So far over 1 -25 million animal species have been identified and described.

To understand the interrelationships among them a systematic classification is necessary.

History of Biological classification.

- Vedic literature recorded 740 paints and 240 animals.
- Chandyogya upanished classified the animals. Susrutha Samhitha classified all living beings into sthavara (plants) & Jangama (animals). Hippocrates, Aristotle, Greek scholars arranged animals into - Insects, birds, fishes & whales. John Ray the Father of British natural history described more than 18,000 plants and animals in his book " **Historia Generalis Plantarum".**
- John Ray coined the term 'species' and differentiated between genus & species.
- Carolus Linnaeus the **"Father of Taxonomy"** described binominal nomenclature in his book **"Systema Naturae"** and listed 4000 plants in the **"species plantarum".**
- In 19th and 20th centuries numerical Taxonomy & Phylogenetic classification emerged.

Systems of Biological classification

Artificial Classification

- Aristotle & Linnaeus follow this classification.

  Aristotle organized animals on the basis of their habitat - land, water, air etc.,
- In this system, quite unrelated animals are grouped under one category. Ex: Birds, bats, butterflies are in one category.
- Some times closely related animals may included under different groups.
- Linnaeus system of classification is based on different degree of mutual relatednessof species.

Natural system of classification

- In the natural system, organisms are classified on the basis of natural relationships.

Phenotypic or Numerical classification.

- This system is based on operational taxonomic units (OTU).
- All characters have equal weightage and "overall morphological similarity" is calculated by the similarities of different characters.
- This system does not consider the phylogeny of the organisms. In this classification species is defined as phenotypic trail

Phylogenetic classification

- It is an evolutionary classification and based on common ancestory.

- This classification summarizes the genetic distances between all species in the phylogenetic tree.
- In this classification analogous characters and homologous characters are followed. Ernst Haeckel representing phylogen by means of trees or branching diagram.

Systematic Hierarchy

- The taxanomic categorie established by Linnaeus called taxa established by - **Linnaeus (1758)**
- The taxanomic catagories are - **kingdom, class, order, genus and species.**
- The taxon phylum was introduced by **- Haeckel (1888)**
- The Morphological variations in species, sub species are - **Intraspecific variations.**
- Highest categoiy in(Metazoa) Multicellular animals which, all are included in the kingdom - **Animalia**
- A group of closely related classes are included in the order taxon - **'Phylum'** Ostracodermi, Cyclostomata, Placodermi Elasmobranchii, Osteichthyes, Amphibia, Reptilia Aves, Mammalia with protochordates belong to phylum - **Chordata**
- A group of closely related orders are included in the taxon - **Class**
- Carnivora (cats), Rodentia(rats), Chiroptera (bats), Cetacea(Whales), Primates (apes and humans) _ belong to class - **Mammalia**
- A group of closely related families are included in the taxon**-order**
- Felidae, canidae, hyaenidae [hyaenas], ursidae [bears] belong to the order - **Carnivora**
- A closely related genera are included in the taxon – Family Wolves, dogs & foxes belong to the family -Canidae
- Closely related species are included in the taxon Genus Panthera leo (lion), Panthera pardus (Leopard) Panthera tigris (Tiger) belongs to genus - Panthera.
- A group of similar organisms sharing a common gene pool and interbreeding freely producing fertile off spring is- **Species**
- A species occurs in the form of many interbreeding groups called - Populations.
- A species may include subspecies. Geographically isolated phenotypically similar population of a species inhabiting in a geographic sub division is - **Sub species.**
- Geographically the crows present in India, Pakistan, Myanmar and Srilanka are isolated and evolved into different subspecies. Sub species of India & Pakistan is Corvus splendens splendens **Sub species of Myanmar is -** Corvus splendens insolens **Sub species of Srilanka is -** Corvus splendens protegatus.

Taxonomic position of man:

Kingdom	Animalia
Sub Kingdom	Eumetazoa
Grade	Bilateria
Division	Deuterostomia
Sub Division	Entero coelomata
Phylum	Chordata
Sub Phylum	Vertebrata
Super Class	Gnathostomata
Class	Mammalia
Sub class	Eutheria
Order	Primates
Sub order	Anthropoidea
Super family	Hominoidea ,
Family	Hominidae
Sub Family	Homininae
Genus	Homo

Species Sapiens

Species concept:

- Species means - **Kind or appearance**
- John Ray used the term species in his book **"Historia Generalis plantarum".**
- Linnaeus considered species as the unit of classification and believed that a species never changes.
- The biological concept of species become more popular after the publication of the book **"The origin of species"** written by Darwin.
- Genetically distinctive, reproductively isolated natural population is a species - **Alfred Emerson.**
- An aggregation of individuals which may resemble each other with in some range of differences and always arises from common reproductive sequence is a species - **Lindsey.**
- A group of potentially interbreeding natural populations which reproductively isolated from others is a species - **Ernst Mayr.**
- Mendelian population is a species - **Dobzhansky.**
- Group of individuals in a particular area at a particular time and capable of interbreeding sharing a common genepool is - **Mendelian population.**
- Species is - **dynamic.**
- The member in a species show - assortative mating.
- A species is

i) a breeding unit as it is reproductively isolated from other species.
ii) an ecological unit as thfcy share the same ecological niche.
iii) a genetic unit as they show similarity in karyotype.
iv) an evolutionary unit as are of them have similar structure and functional characters.

- Some times closely related species interbreed but give rise - **Sterile offspring**
- Crossing of female horse with male donkey produces sterile offspring - **Mule.**

Classification of the living world :

- Carious Linnaeus proposed the two kingdom classification.
- Animals included in Animalia & plants included in Vegetabilia.
- Ernst Haeckel established the third kingdom protista and included unicellular organisms in protista kingdom.
- Copeland proposed a separate kingdom for prokaryotes (bacteria) - Monera. R.H. Whittaker created an additional kingdom for fungi and establish the five kingdom classification .(1969).
- The five kingdoms of Whittaker are (1) Monera (2) Protista (3) Fungi (4) Plantae (or) Metaphyta (5) Animalia (or) Metazoa. Kingdom Monera - Unicellular prokaryotes (All bacteria)
- Kingdom Protista - Unicellular eukaryotes. Kingdom fungi - Multicellular saprobic organism without cilia (or) flagella.
- Kingdom Plantae - Multicellular mostly autotrophic organisms (plants).
- Kingdom Animalia -Multicellular heterotrophs (Animals)

Outline classification of the kingdom - Animalia

Number of primary germ layers in the embryo:

- The embryos of diploblastic animals have two cell layers, an outer ectoderm and an inner endoderm.
- The embryos oftriploblastic animals have three layers, ectoderm, endoderm and mesoderm.

Division of labour:

- Body functions are performed by cells **Cellular grade of organisation.**
- Body functions are performed by tissues **tissue grade of organisation**.
- Body functions are performed by organs or organ systems **- organ system organisation**.

Body cavities.

- In acoelomates body cavity is absent. The space between the gut & body wall is filled with mesenchyme. Eg: Platyhelminthes.
- In pseudocoelomates coelom is not lined with peritoneal layers. Eg: Nematoda.
- In eucoelomates coelom cevelops with in the mesoderm and is lined with peritoneum. Eg:. Phylum Annelida to chordata.

Symmetry.

- In bilaterians antimeres are cut in only midsagittal plane.

Eg: Phylum platyhelminthes to chordata. In Radiata, antimeres are cut in any plane through oro- aboral axis.

Fate of Blastopore

- In protostomes blastopore develops into mouth.
- In deuterostomes blastopore develops into anus.

Gut

- A sac like gut has only one opening called mouth. Anus is absent. Food enters and leaves through the mouth only.
- A complete gut has two openings a mouth and an anus.

Circulation of blood

- In open type of circulation blood flows in the sinuses.
- In closed type of circulation blood flows in the blood vessels only.

Classification of the kingdom animalia.

Kingdom Animalia is divided into two subkingdoms **- Parazoa and Eumetazoa.**
Subkingdom Parazoa:

- They are multicellular animals without tissues. It includes Phylum Porifera.
- **Subkingdom Eumetazoa:** They are multicellular animals with tissues. It includes twograde Radiata and Bilateria.
- **Grade Radiata ordiploblastica:** They have diploblastic body. They are radially symmetrical. It includes phylum Cnidaria.
- **Grade Bilateria or Triploblastica:** They have triploblastic body. They are bilaterally symmetrical. It includes 2 divisions - Protostomia and Deuterostomia.
- **Division Protostomia:** In these animals blastopore develops into mouth. Cleavage is spiral and determinate. It includes three subdivisions.
- **Subdivision Acoelomata:** Coelom is absent. Body cavity is filled by parenchyma. It includes Phylum Platyhelminthes.
- **Subdivision Pseudocoelomata:** False coelom is present. Body cavity is not lined by mesodermal epithelium (peritonium). It includes Phylum Nematoda.
- **Subdivision Schizocoelomata:** Atrue coelom is present. It is formed by splitting of mesoderm. It includes Phylum Annelida, Arthropoda and Mollusca.
- Division Deuterostomia:

  In these animals blastopore develops into anus Cleavage is radial and indeterminate. It includes a single subdivision Enterocoelomata.
- **Subdivision Enterocoelomata:** A true coelom is present. It is formed from pouches of arehenteron. It includes Phylum Echinodermata and Phylum Chordata.