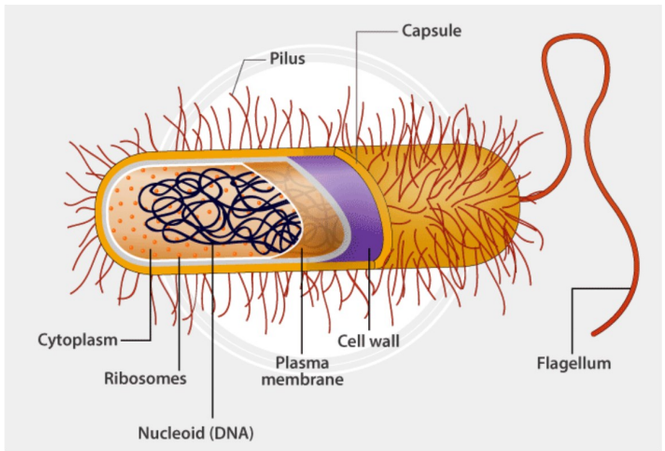
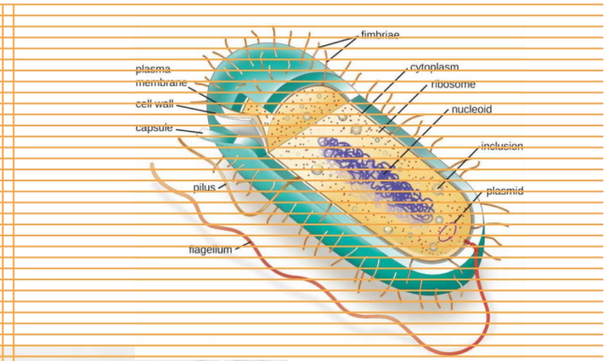


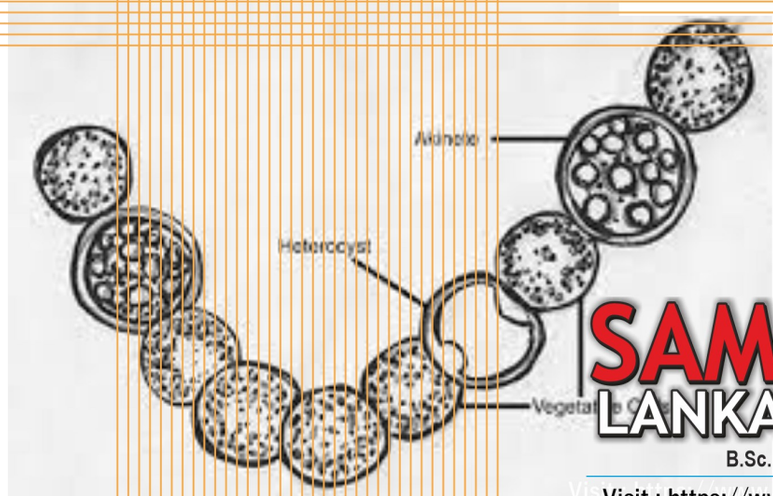
UNIT 03 Book 2

ADVANCED LEVEL

Biology Revision 2025

in English Medium





Hierarchy of taxa on scientific basis

Methods of artificial and natural classification

Arrangement of organisms into groups on the basis of the common characteristics is called classification. Taxonomy is the scientific study on classification, identification, nomenclature and description. This includes placing groups of organisms in a hierarchical sequence.

Two methods of classification

(1) Artificial classification - grouping is based on a few pre selected unifying characters.

- The characters are selected first according to convenience and organisms are grouped based on the selected criteria
- Evolutionary relationships are ignored
- Only system used before 18th century
- Easy to use, easy to expand by adding more groups

e.g. Plants can be classified as cereals, ornamental plants, medicinal plants, poisonous plants etc. Animals can be classified as two legged, four legged, six legged, eight legged etc.

(2) Natural classification - grouping based on true relationships.

- Represents evolutionary relationships based on phylogeny- evolutionary history of a species or groups of species
- Systems developed after the study of evolution.
- Based on many characteristics.

Characteristics used can be morphological, anatomical, cytological or molecular biological such as DNA and RNA base sequences

e.g. Plants can be classified into phyla; Bryophyta, Lycophyta, Pterophyta, Cycadophyta, Coniferophyta and Anthophyta etc. Animals can be classified into phyla Cnidaria, Platyhelminthes, etc.

History of classification

The early classification systems were all artificial systems and were mostly based on human uses.

Aristotle was the first to classify organisms scientifically. He divided organisms into plants and animals. Animals were further classified according to criteria such as mode of locomotion, reproduction and presence or absence of red blood cells. Aristotle's pupil Theophrastus classified plants according to habit. e.g. trees, shrubs and herbs, and according to lifespan e.g. annuals, biennials and perennials.

Essay 01
(a) Describe key characters of domain bacteria and how they are different from domain Archaea.

Up to the time of Linnaeus scientists have used many different methods for naming of organisms. Carolus Linnaeus(1753), Swedish botanist, introduced binomial nomenclature and also classified about 6,000 plants into a hierarchical order of taxa, classification level such as; Species, genus, order, and class. His classification of flowering plants was based on the number of stamens and styles of flower. He identified two kingdoms of organisms; plants and animals.

With the discovery of the microorganisms the scientists understood that there were organisms which could not be assigned into either plants or animals. To get over this difficulty Ernest Haeckel (1866) introduced a third kingdom: Protista. He also introduced the taxon Phylum and classified many organisms.

With the discovery of the electron microscope biologists identified prokaryotic and eukaryotic cellular organization. Robert H Whittaker (1969) introduced the five kingdom system of biological classification; Monera, Protista, Fungi, Plantae and Animalia. His classification was based on the nature of cellular organization, unicellular or multicellular and mode of nutrition.

With the acceptance of Darwin's theory of the evolution and unitary origin of life, taxonomists began to use natural systems with interpreting evolutionary relationships. With the recent advancement of molecular biology and the use of molecular methods in studying evolutionary relationships it became apparent that in the very early evolution some prokaryotes differ as much from each other as do from eukaryotes. Such difficulties have lead biologists to adopt three Domain system of classification. The three domains are Bacteria, Archea and Eukarya, which are taxonomic ranks higher than the Kingdom. Carl Woese (1977) introduced this three domain system.,

In this tree of life the first major split in the history of life occurred when bacteria diverged from others. Eukarya and Archea are mostly related to each other than bacteria.

Present system of classification and its basis

The present system of classification is mainly based on the rapid advance of molecular biology and the new information on the evolutionary relationships of organisms.

- the sequence of bases of DNA of important genes
- the sequences of bases of DNA of mitochondria and chloroplasts
- the base sequence of ribosomal RNA
- the sequence of amino acids in common proteins
- the molecular structure of cellular components

are used as important taxonomic criteria in modern systematics.

However, the kingdom Protista is not a natural group. It is an artificial group including organisms which have different evolutionary origins.

Viruses do not have cellular organization, and therefore do not belong to any of the kingdoms. They are also an artificial group considered separately.

Hierarchy of Taxa from Domains to Species

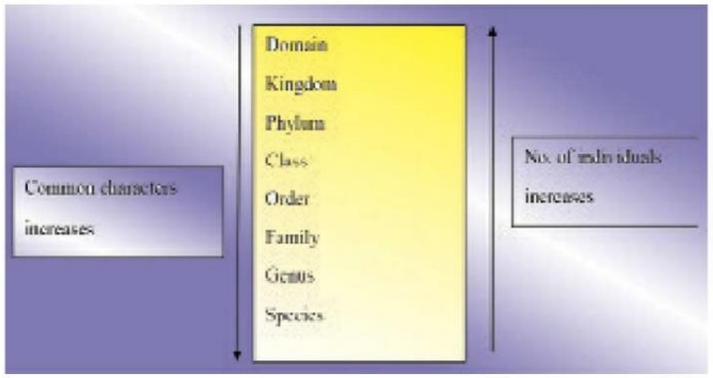
The taxonomic unit at any level/ rank of the hierarchy is called a taxon (plural-taxa). Each taxon has a rank and a name.

e.g. *Panthera* is a taxon at the Genus level/ rank

Mammalia is a taxon at the Class level/ rank

Under the hierarchical system there are levels/ ranks of taxa. Each Domain is divided into kingdoms. A Kingdom is divided into phyla (singular phylum), phylum into classes .etc. Many of these categories may also be subdivided.

e.g. Super class, Sub-family, Subspecies, etc.



From domain to species, the number of shared characteristics among the members in the taxa increases. From species to domain, the number of individuals in the taxon increases.

Biological definition of a species

Species is a group of organisms who shares similar characteristics and has the ability to interbreed and produce viable and fertile offspring.

Other definitions of species

- Morphological species concept- use of morphological criteria to distinguish species such as body shape and other structural features

28. Members of a population of grey squirrels, *Sciurus carolinensis*, are classified in the same species because they
(1) Obtain their food in the same manner (2) Produce enzymes by synthesis
(3) Can mate (4) Live in the same area (5) Can mate and produce fertile offspring

29. In the three-domain system introduced by Carl Woese in 1977, domain Eukarya consists of:
(1) One kingdom (2) Two kingdoms (3) Three kingdoms (4) Four kingdoms (5) Five kingdoms

30. All organisms are classified into a total of
(1) One kingdoms (2) Two kingdoms (3) Three kingdoms (4) Six kingdoms (5) Four kingdoms

31. If two organisms are in the same phylum and the same order, then they also belong to the same
(1) class (2) family (3) genus (4) species (5) subspecies

32. In binomial nomenclature, the first part of the name represents:
(1) Species (2) Family (3) Order (4) Genus (5) Specific epithet

33. Though a diverse group, all archaea share certain characteristics which
(1) lack peptidoglycan cell walls (2) possess very unusual lipids
(3) some of their genes contain introns (4) contain characteristic ribosomal RNA sequences
(5) all of the above are true

34. Which one of the following **organisms** is eukaryotic
(1) Autotrophic bacteria (2) Heterotrophic bacteria (3) Fungi (4) Archea (5) Viruses

35. Biogas (methane) is produced by,
(1) Cyanobacteria (2) Bacteria (3) Archea (4) Algae (5) Intestine of mammals

36. Three genera with circular chromosomes, histone associated with DNA and several kinds of RNA polymerase are respectively
(1) *Thermococcus, Amoeba*, and *Methanococcus.*
(2) *Methanococcus, Halobacteria,* and *Nitrosomonas.*
(3) *Amoeba, Salmonella,* and *Obelia* (4) *Halobacteria, Cycas* and *Nostoc*
(5) *Pseudomonas, Anabaena,* and *Cycas.* (AL 2021/8)

37. Which of the following is NOT a characteristic of artificial classification?
(1) Based on few pre-selected characters (2) Easy to use and expand
(3) Used before 18th century (4) Ignores evolutionary relationships
(5) Based on true phylogenetic relationships

38. Which of the following describes a characteristic unique to Archaea? (1) They are prokaryotic (2) They lack peptidoglycan in cell walls (3) They are unicellular (4) They have diverse habitats (5) They reproduce by binary fission

39. The initiator amino acid for protein synthesis in both Archaea and Eukarya is:
(1) Formyl-methionine (2) Methionine (3) Glycine (4) Alanine (5) Leucine

40. Cyanobacteria are characterized by all of the following EXCEPT:
(1) Being prokaryotic (2) Being photosynthetic (3) Having multicellular colonies
(4) Being able to fix nitrogen (5) Having peptidoglycan-free cell walls

15. Which type of bacteria can fix atmospheric nitrogen?
(1) E. coli (2) Salmonella (3) Rhizobium (4) Nostoc (5) Both (3) and (4)

16. The presence of histones associated with DNA is a characteristic of:
(1) Bacteria only (2) Archaea only (3) Some archaea and all eukarya (4) Bacteria and archaea
(5) All three domains

17. Which of these is NOT a characteristic of Domain Eukarya?
(1) Mostly aerobes (2) Circular chromosomes (3) Sexual reproduction (4) Multicellular organization
(5) Diverse habitats

18. Why was the three-domain system introduced?
(1) To simplify classification (2) To replace kingdoms (3) To reflect early evolutionary divergence
(4) To classify viruses (5) To organize bacteria better

19. What type of species concept uses morphological criteria?
(1) Biological species concept (2) Ecological species concept (3) Phylogenetic species concept
(4) Morphological species concept (5) Evolutionary species concept

20. In the name *Cocos nucifera* L., what does 'L.' indicate?
(1) Location (2) Linnaeus (3) Level (4) Latin (5) Lineage

21. Which domain shows growth inhibition with streptomycin and chloramphenicol?
(1) Bacteria only (2) Archaea only (3) Eukarya only (4) Both Bacteria and Archaea (5) All three domains
Answer: (1)

22. What type of membrane lipids are found in Archaea?
(1) Unbranched hydrocarbons (2) Branched hydrocarbons (3) Both branched and unbranched (4) No hydrocarbons (5) Only phospholipids Answer: (2)

23. Which feature is common to both Bacteria and Archaea?
(1) Cell wall composition (2) Response to antibiotics (3) Circular chromosomes (4) Membrane lipid structure (5) Protein synthesis initiation Answer: (3)

24. Which of the following statements is correct regarding naming and classifying organisms?
(1) Scientific name of all organisms is given in English.
(2) The scientific name of an organism consists of its genus and a specific epithet.
(3) Robert Hooke introduced the binomial system of nomenclature.
(4) All the species of plants in the world have now been named.
(5) Whittaker's classification categorizes all organisms into three Kingdoms.

25. The scientific name for the fruit fly is *Drosophila melanogaster*. The word *Drosophila* refers to the classification group known as
(1) Kingdom (2) Genus (3) Phylum (4) Species (5) Domain

26. Plants A and B are classified as members of the same species. Plants C and D are classified in the same genus as A and B, but not the same species as A and B. According to this information, which statement is correct?
(1) Plant A has many characteristics in common with plant B.
(2) Plants A and B belong to a different kingdom than plants C and D.
(3) Plant C cannot be the same species as plant D.
(4) Plants A, B, C, and D must all belong to different phyla.
(5) Plants A, B, C, and D must all belong to different kingdoms.

27. A scientist recently discovered a pond organism that is unicellular, contains chloroplasts and other membrane-bound organelles, and possesses a flagellum. In which kingdom is this organism classified?
(1) Bacteria (2) Fungi (3) Protista (4) Archea (5) Plant

- Ecological species concept–defines species in terms of its ecological niche and the sum of how members of the species interact with the non living and the living components of their environment
- Phylogenetic species concept – defines the species as the smallest group of individuals that share a common ancestor.

Binomial nomenclature

In classification, use of common names for organisms, causes confusion. More over some common names do not actually reflect the kind of organism they signify.

e.g. Jelly fish (a Cnidarian)
Cray fish (a Crustacian)
Silver fish (an insect)
Star fish (an Echinoderm)

Further, a given organism has different names in different languages. Carolous Linnaeus (1707-1778) proposed a binomial system of nomenclature of species, which was accepted worldwide to avoid ambiguity.

According to the binomial nomenclature the name of an organism has two parts:

First is the generic name, to which the species belongs and the second is a specific epithet, the unique for each species within the genus. Generic name is usually a noun and the specific epithet an adjective describing a particular feature.

e.g. *Homo sapiens- Homo* means man, *sapiens* means intelligent

Related species have the same generic name with different specific epithets.

e.g. *Dipterocarpus zeylanicus* and *Dipterocarpus grandiflorus*

Dipterocarpus zeylanicus means fruit with two wings, and endemic to Sri Lanka.

Dipterocarpus grandiflorus means fruit with two wings and having large flowers.

International codes of Binominal nomenclature

Biologists have adopted sets of rules or Codes of nomenclature. These codes are slightly different for plants, animals, bacteria and viruses. Some of the important rules for naming plants, fungi, bacteria and animals are as follows.

- Two species of organisms cannot have the same name.
- Each species has a generic name and a specific epithet, both together forming the species name or scientific name.
- The Name should be made up of Latinized words written in the Roman script.
- It should be underlined when hand written and italicized when printed.
- The first letter of the generic name must be capitalized the and specific epithet must be in simple letters.

In scientific writing, the name of the author who gave the name is indicated by a capital letter, an abbreviation or full word at the end of the name, which is not Latinized.

e.g. *Cocos nucifera* L. (L for Linnaeus).

A third word can be used to represent a subspecies or a variety, example *Panthera pardus kotiya* (Sri Lankan leopard).

- **Use of keys**
  - Used to group organisms and identify them
  - Keys do not show the evolutionary relationships
  - The Commonly used key is the dichotomous key
  - Some examples are given below

Example 1: **Silverfish, Butterfly, House fly, Beetle**

1. Possesses wings …….. (2)
   Do not possess wings …….. Silverfish
2. Possess two pairs of wings …… (3)
   Do not possesses two pairs of wings……Housefly
3. Possesses a proboscis ……..……...Butterfly
   Do not possess a proboscis ……..…….....,.Beetle

Example 2: **Snake, Earthworm, Frog, Sea anemone, Butterfly**

1. Radially symmetrical body ……Sea anemone
   Not having a radially symmetrical body ……..…… … ……..(2)
2. Possess legs……...……(3)
   Do not possesses legs ……...(4)
3. Wings present……..... Butterfly
   Wings absent……..……..... Frog
4 Body covered by scales ..…… Snake
   Body is not covered by scales …… Earthworm

Domains

There are three domains. They are;

a) Domain – Bacteria- consists of one kingdom. Kingdom - Bacteria
b) Domain –Archaea-consists of one kingdom. Kingdom - Archaebacteria
c) Domain –Eukarya-consists of four kingdoms.

MCQ Aid

1. The system of classification developed after understanding evolutionary relationships and based on DNA/RNA sequences is:
   (1) Artificial classification (2) Morphological classification (3) Natural classification
   (4) Linnean classification (5) Traditional classification

2. Who introduced the three-domain system of classification?
   (1) Aristotle (2) Linnaeus (3) Whittaker (4) Carl Woese (5) Ernest Haeckel

3. Which of these is NOT a basis for modern classification systems?
   (1) DNA sequence of important genes (2) Sequence of amino acids in proteins
   (3) Number of legs in animals (4) Base sequence of ribosomal RNA
   (5) Molecular structure of cellular components

4. Which kingdom was introduced by Ernest Haeckel to accommodate organisms that couldn't be classified as either plants or animals?
   (1) Monera (2) Protista (3) Fungi (4) Plantae (5) Animalia

5. The binomial nomenclature system was introduced by:
   (1) Aristotle (2) Theophrastus (3) Carolus Linnaeus (4) Robert Whittaker (5) Carl Woese Answer: (3)

6. Which characteristic is unique to Domain Archaea?
   (1) Prokaryotic organization (2) Presence of peptidoglycan (3) Growth in extreme environments
   (4) Circular chromosomes (5) Binary fission Answer: (3)

7. What is the sequence from highest to lowest taxonomic category?
   (1) Kingdom-Phylum-Class-Order-Family-Genus-Species
   (2) Domain-Kingdom-Order-Class-Family-Genus-Species
   (3) Domain-Kingdom-Phylum-Class-Order-Family-Genus-Species
   (4) Kingdom-Domain-Phylum-Class-Order-Family-Genus-Species
   (5) Domain-Phylum-Kingdom-Class-Order-Family-Genus-Species

8. Which of these statements about Protista is incorrect?
   (1) They are mostly unicellular (2) They are found in freshwater (3) Some are photoautotrophs
   (4) They are a monophyletic group (5) Some are symbionts

9. The initiator amino acid in protein synthesis for both Archaea and Eukarya is:
   (1) Formyl-methionine (2) Methionine (3) Glycine (4) Alanine (5) Valine

10. Which of these is a characteristic of bacteria but not archaea?
    (1) Prokaryotic organization (2) Peptidoglycan in cell wall (3) Circular chromosomes
    (4) Unicellular nature (5) Binary fission

11. What distinguishes cyanobacteria from other bacteria?
    (1) They are prokaryotic (2) They perform photosynthesis (3) They are unicellular
    (4) They reproduce by binary fission (5) They have a cell wall

12. The size range of most bacteria is:
    (1) 0.5-5 µm (2) 1-5 µm (3) 2-10 µm (4) 0.1-1 µm (5) 5-10 µm

13. In binomial nomenclature, which part of the name is written in capital letters?
    (1) Species name (2) First letter of genus name (3) Both genus and species names (4) Author's name
    (5) Complete scientific name

14. What is the main difference between artificial and natural classification?
    (1) Time of origin (2) Number of characteristics used (3) Consideration of evolutionary relationships
    (4) Ease of use (5) Scientific validity

21. Based on the given key find the order of given insect

#1. Does the insect have wings?	
Yes	Go to #2
No	Go to #6
#2. How many pairs of wings does the insect have?	
One	Order *Diptera*
Two	Go to #3
#3. Does the insect have very short antennae?	
Yes	Go to #4
No	Order *Odonata*
#4. Are there two or three long, slender, tail-like appendages at the tip of the abdomen?	
Yes	Order *Ephemeroptera*
No	Go to 5
#5. Does the insect have five segments on each leg?	
Yes	Order *Neuroptera*
No	Order *Isoptera*
#6. Is the insect ant-like with a narrow waist?	
Yes	Order *Hymenoptera*
No	Go to 7
#7. Are the antennae long, and composed of many segments?	
Yes	Order *Psocoptera*
No	Order *Mallophaga*

22. List four key characteristics of Domain Bacteria.

……

……

……

……

23. What distinguishes Cyanobacteria from other bacteria?

……

24. Compare the cell wall composition of Bacteria, Archaea, and Eukarya using the table provided.

……

……

Kingdom - Protista

Kingdom - Fungi

Kingdom - Plantae

Kingdom - Animalia

The diversity of organisms within the Domain Bacteria

Key characteristics of Bacteria

- They are prokaryotic
- They are unicellular, colonial, filamentous
- Most of them are found in size between 1µm -5µm
- Well adapted to most of the 'normal' habitats (both land and water)
- Most of them contain cell walls with peptidoglycan as major component.
- Most of their cell walls are surrounded by a sticky layer of polysaccharides or proteins called capsule
- Most of them have flagella for motility. Bacterial flagellum differs from eukaryotic flagellum as they are not covered by a plasma membrane and absence of 9+2 structure of microtubules.
- Possess diverse nutritional modes-Autotrophs, heterotrophs
- Posses diverse metabolic modes- obligate aerobes, obligate anaerobes, facultative anaerobes, etc.
- Some are capable of performing nitrogen fixation- e.g. *Rhizobium* sp., some cyanobacteria
- Rapid reproduction by binary fission. Some perform conjugation as a sexual method.
- Certain bacteria use bacterial chlorophyll as a photosynthetic pigment.

Key Characteristics of Cyanobacteria

- Prokaryotic organisms
- Photosynthetic
- Most are unicellular and oxygen generating and solitary. But some are linked to form filaments or colonies sheathed in mucous
- Some have the ability of fixing atmospheric nitrogen

Key characteristics of Domain Archaea

- They are prokaryotic and unicellular.
- They lack peptidoglycan in their cell walls which are made up of proteins and polysaccharides
- The size of most of them is between 0.5-5 μm
- They include extreme halophiles and extreme thermophiles
- Some Archaeabacteria live in more moderate environments-Methanogens
- Other species inhabits the anaerobic guts of cattle, termites and other herbivores

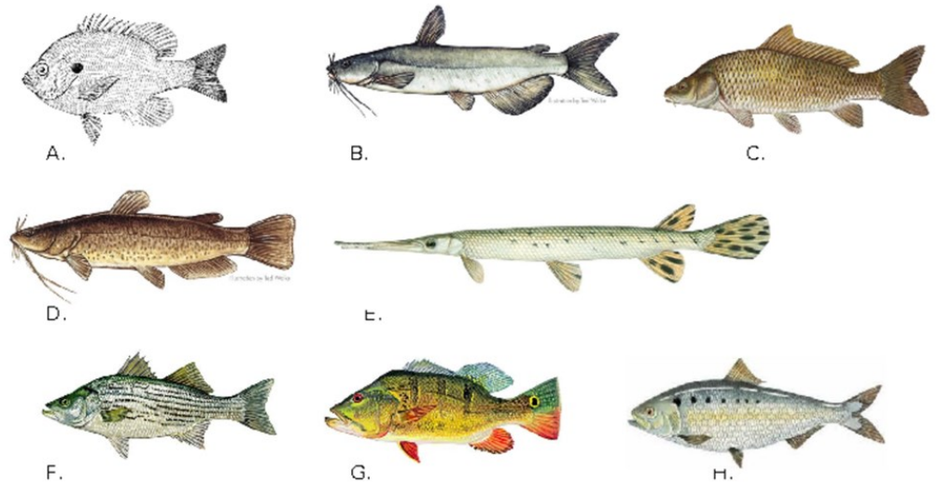
Key characteristics of Domain Eukarya

- They are Eukaryotic
- Vary in size
- Most of them are multicellular
- Habitats are diverse
- Diverse in nutrition
- Mostly aerobes
- Most of them exhibit sexual reproduction (some protists are only known to reproduce asexually)

Table 3.1: A comparison of the three domains of life

	Characteristic	Bacteria	Archea	Eukarya
1	Cellular organization	Prokaryotic	Prokaryotic	Eukaryotic
2	Cell wall composition	Peptidoglycan	Proteins and polysaccharides (lack peptidoglycan)	Cellulose, Hemicellulose, Pectin and Chitin
3	Membrane lipids	Unbranched hydrocarbons	Some branched hydrocarbons	Unbranched hydrocarbons
4	Genetic Composition			
	Histones associated with DNA	Absent	Present in some species	Present
	Circular chromosomes	Present	Present	Absent
	Introns in genes	Very rare	Present in some genes	Present in many genes

21. Find name of A to H fish.



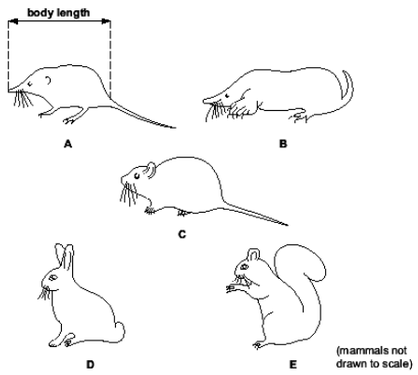
Use the Dichotomous Key to Identify the different species.

1	a. Whisker-like barbel present on head (catfishes)	Go to 2
	b. No whisker-like barbels present on head	Go to 3
2	a. Caudal fin forked	Channel Catfish
	b. Caudal fin not forked	Flathead Catfish
3	a. One dorsal fin	Go to 4
	b. Two dorsal fins	Go to 5
4	a. Elongated snout	Longnose Gar
	b. Regular snout	Go to 6
5	a. Horizontal stripes along its body	Striped Bass
	b. Vertical stripes along its body	Butterfly Peacock Bass
6	a. Body elongate	Go to 7
	b. Body not elongate, but slab-sided	Bluegill
7	a. Dots present along body	American Shad

19. Figure shows five mammals.

(a) Use the key to identify each of these mammals. Write the letter for each mammal in Table 1.1.

1. Tail more than half that of body length — go to 2
   Tail less than half that of body length — go to 4
2. Ears at top of head, with thick tail — *Sciurus caroliniensis*
   Ears at side of head, with thin tail — go to 3
3. Nose pointed, nose length longer than its depth — Sorex araneus
   Nose blunt, nose length shorter than its depth — *Clethrionomys glareolus*
4. Front legs as wide or wider than long — *Talpa europaea*
   Front legs longer than wide — *Oryctolagus cuniculus*



name of mammal	letter
Clethrionomys glareolus	.....
Oryctolagus cuniculus	.....
Sciurus caroliniensis	.....
Sorex araneus	.....
Talpa europaea	.....

20. Identify followings based on given key.

Use the dichotomous key to identify the 5 leaves pictured.

A) _____
B) _____
C) _____
D) _____
E) _____

STEP 1	1A: Leaf is oval shaped	Go to step 2
	1B: Leaf is star shaped	Go to step 3
STEP 2	2A: Leaf is shorter wide	Go to step 4
	2B: Leaf is longer and narrow	Hickory
STEP 3	3A: Leaf has smooth edges	Sweetgum
	3B: Leaf has jagged edges	Sugar Maple
STEP 4	4A: Leaf has 4 veins on each side	Birch
	4B: Leaf has 5 veins on each side	Beech

5	Protein synthesis			
	RNA polymerase	One kind	Several kinds	Several kinds
	Initiator amino acids for protein synthesis	Formyl-methionine	Methionine	Methionine
6	Response to antibiotics Streptomycin and Chloramphenicol	Growth inhibited	Growth not inhibited	Growth not inhibited
7	Growth at temperatures > 100˚C	No	Some species	No
8	Habitats	Diverse habitats	extreme environmental conditions-volcanic pits/ hot springs/ salt marshes etc.	Diverse habitats
9	Examples	Bacteria, cyanobacteria; *Nostoc, Anabaena , Escherichia coli, Salmonella typhi*	Archaebacteria; *Methanococcus Thermococcus., Halobacterium*	Protists fungis plants and animals

PRACTICAL NO. 09

Observing and distinguishing bacteria and cyanobacteria under light microscope

Students should be able to

- observe characteristic features of bacteria and cyanobacteria under the microscope,
- distinguish bacteria and cyanobacteria,
- draw diagrams showing features of bacteria and cyanobacteria

Materials and equipment

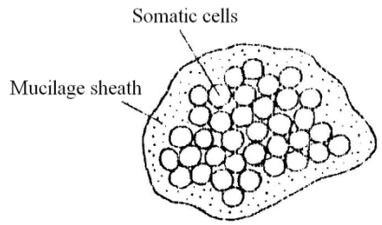
- Permanent slides/ temporary preparations of *Anabaena, Lyngbia* and *Microcystis*
- Light Microscopes

Instructions

- Let students observe and identify the characteristic features of above mentioned bacteria and cyanobacteria using light microscopes.
- Let students to record their observations using appropriate diagrams.

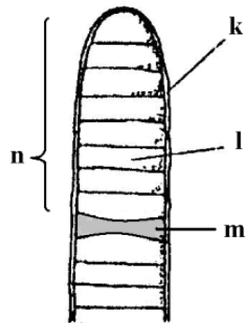
Microcystis

- Irregular shaped colonies
- Mucilage present around cells.
- Cells are spherical shaped
- *Microcystis* do not fix nitrogen.



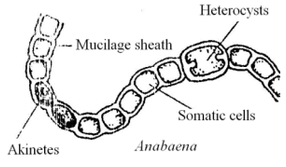
Lyngbia

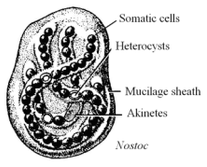
- Filamentous colony.
- No heterocysts or akinetes present.
- Fresh water cyanobacteria.
- Somatic cells are flat disk like.
- Filament can separate from the main filament to form new filaments. This is an asexual reproduction method.
- *Lyngbia* do not fix nitrogen.

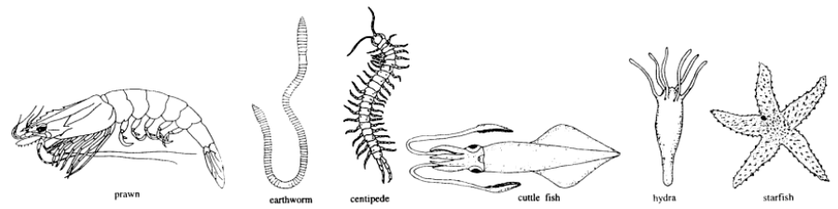


Anabaena

- Filamentous colony
- Live in fresh water
- Fix nitrogen.
- Heterocysts and akinetes present
- *Anabaena* and *Nostoc* show similar properties.
- *Nostoc* filaments are present within one sheath.







1. a. Shows pentamerous symmetry ----------
   b. Does not show pentamerous symmetry ----------
2. a. Shows radial symmetry ----------
   b. Does not show radial symmetry ----------
3. a. Presence of jointed limbs ----------
   b. Absence of jointed limbs ----------
4. a. Presence of two pairs of antennae ----------
   b. Presence of one pair of antennae ----------
5. a. Presence of eyes ----------
   b. Absence of eyes ----------

17. Following dichotomous key is for House fly, Sea anemone, Leech, Tapeworm and Nematode
    1. Body with tentacles ……..
       Body without tentacles ……..
    2. Body with suckers. ……..
       Body without suckers ……
    3. Suckers in both ends ……
       Suckers at one end of the body ……
    4. Wings present ……..
       Wings absent ……..

18. Divide followings using a dichotomous key. *Nephrolepis, Ulva, Cycas, Pogonatum, Mangifera, Selaginella*
    1. Thalloid body present ……..
       Thalloid body absent. ……..
    2. Vascular plants ……..
       Nonvascular plants ……..
    3. Show homospore condition ……..
       Shows heterospore condition ……..
    4. Produce seeds ……..
       Produce only spores ……..
    5. Form fruits ……..
       Do not form fruits ……..

12. Why was binomial nomenclature necessary? What problem did it solve?

……

……

13. State three rules of binomial nomenclature from the text.

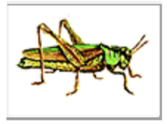
……

……

……

……

14. Following diagram shows four insects lady beetle, grasshopper, house fly and dragonfly. Complete dichotomous key.

1. a. wings covered by an exoskeleton ……..
   b. wings not covered by an exoskeleton ……..
2. a. body has a round shape ……..
   b. body has an elongated shape ……..
3. a. wings point out from the side of the body ……..
4. b. wings point to the posterior of the body ……..

15. Muscle, Earth worm, Leech, Round worm, Shrimp, Garden snail, Sea star, Tape worm.

1. a. Elongate body - ……..... b.
   b. Body is not elongated - ……..
2. a. Tape like body - ……..
   b. Body not tape like - ……..
2. a. Suckers present at both ends - ……..
   b. Sucker absent at both ends - ……..
4. a. Clitellum present - ……..
   b. Clitellum absent - ……..
5. a. Clear external segmentation present - ……..
   b. Clear external segmentation absent - ……..
6. a. Radial symmetry present - ……..
   b. Radial symmetry absent - ……..
7. a. Shell with two halves - ……..
   b. Shell without two halves - ……..

16. Given below is a part of a dichotomous key used to identify animals shown in the diagram. Complete the key by filling the blanks with the name of the correct animal or the number next step to be followed as appropriate.

PRACTICAL NO.10

Use of electron micrographs to study morphological features of bacteria and cyanobacteria

Students should be able to

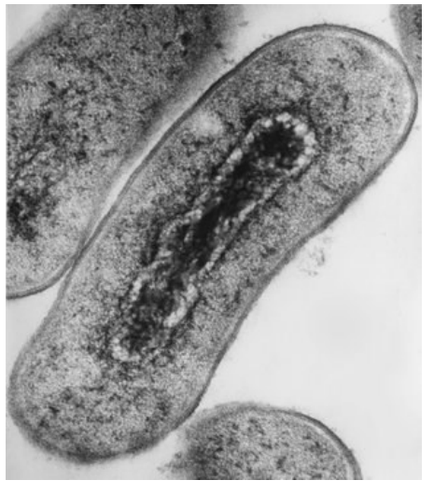
- identify characteristic features of bacteria using an electron micrograph,
- identify characteristic features of cyanobacteria using an electron micrograph,
- distinguish bacteria and cyanobacteria based on their electron micrographs.

Materials and equipment

- Electron micrographs of bacteria.
- Electron micrographs of cyanobacteria.

Instructions

- Allow students to examine the electron micrograph of bacteria.
- Allow students to examine the electron micrograph of cyanobacteria.
- Let students to compare and contrast bacteria and cyanobacteria.




Structured Essay

1. Define classification and taxonomy.

……
……
……
……

2. Compare and contrast artificial and natural classification systems.

Artificial Classification	Natural classification

3. Fill in blanks using most appropriate word.
The early classification systems were all (1) …….. systems and were mostly based on human uses. (2) …… was the first to classify organisms scientifically. He divided organisms into (3) …….. and (4)……... Animals were further classified according to criteria such as mode of (5)……., (6)……... and presence or absence of (7)…….. Aristotle's pupil (8) ……. classified plants according to (9)……., e.g. trees, shrubs and herbs, and according to (10)…… e.g. annuals, biennials and perennials. Up to the time of (11) …….. scientists have used many different methods for naming of organisms. (12)……..…...((13)…….), Swedish botanist, introduced (14) ……... nomenclature and also classified about (15)……... plants into a hierarchical order of taxa, classification level such as: Species, genus, order, and class. His classification of flowering plants was based on the number of (16)…….. and (17) …….. of flower. He identified two kingdoms of organisms: (18)…… and (19)……....With the discovery of the microorganisms the scientists understood that there were organisms which could not be assigned into either plants or animals. To get over this difficulty (20) ……... ((21)……) introduced a third kingdom: (22)……... He also introduced the taxon (23)…….. and classified many organisms. With the discovery of the (24)…….. microscope biologists identified prokaryotic and eukaryotic cellular organization. Robert H Whittaker ((25)……..) introduced the five kingdom system of biological classification: Monera, Protista, Fungi, Plantae and Animalia.

Protista/1969/Phylum/reproduction/electron/Carolus Linnaeus/stamens/red blood cells/artificial/ Ernest Haeckel/1866/habit/6,000/animals/lifespan/Theophrastus/binomial/1753/Aristotle/ locomotion/Linnaeus/plants/styles/plants/animals

4. Why did early classification systems primarily use artificial classification methods?

……
……

5. How did Aristotle contribute to the early development of classification?

……
……

6. What was Theophrastus's approach to plant classification?

……
……

7. Explain how Linnaeus revolutionized the naming system for organisms. What system did he introduce?

……
……
……
……

8. What led biologists to adopt the three-domain system of classification?

……
……

9. List five molecular characteristics used in modern classification systems.

……
……
……
……
……

10. What is a taxon?

……
……

11. Fine suitable explanation for the definition

Phylogenetic species concept	Species is a group of organisms who shares similar characteristics and has the ability to interbreed and produce viable and fertile offspring.
Morphological species concept	defines the species as the smallest group of individuals that share a common ancestor.
Ecological species concept	defines species in terms of its ecological niche and the sum of how members of the species interact with the non living and the living components of their environment
Biological definition of species	use of morphological criteria to distinguish species such as body shape and other structural features