

CHAPTER ONE

CHARACTERISTICS AND CLASSIFICATION OF LIVING ORGANISMS

WHAT ARE THE CHARACTERISTICS OF LIFE?

All organisms are made up of cells. The cells of the organism carry out activities necessary for the organism to stay alive

Living organisms have a list of characteristics including:

- Nutrition: supplies an organism with the food it needs for respiration, growth, repair and reproduction.(plants get food by photosynthesis, animals get food by feeding on other organisms)
- Respiration: is the break down of nutrient molecules in cells to release energy for metabolism

WHAT ARE THE CHARACTERISTICS OF LIFE?

- Excretion: is the removal of metabolic waste products and substances in excess of the body's requirements.
- Growth and Development : is the permanent increase in size and dry mass of an organism by an increase in cell number or cell size or both. Development may make an organism become more complex and change in form.
- Movement:: is an action by an organism or a part of an organism, causing it to change its position or place.

WHAT ARE THE CHARACTERISTICS OF LIFE?

- Reproduction: is the process that makes more of the same kind of the organism
- Sensitivity: is the ability of the organism to detect and respond to changes in the external or internal environment.



CLASSIFICATION

- Classification: sorting organisms into groups according to their similarities and differences.
- Classification systems are useful in providing information on evolutionary relationships among organisms.
- Groups of organisms which share a more recent ancestor (are more closely related) have base sequences in DNA that are more similar than those that share only a distant ancestor
- In the biological system of classification, living organisms are classified according to a graded scale or hierarchy.

Using DNA to help with classification

- Biologists could decide which organisms are closely related to each other by studying the structure of their bodies (**Morphology**);
- Or by studying their internal features (**Anatomy**);
- Or by studying the cells with or without a nucleus;
- Now we have new tools to help work out the evolutionary relationships, one of these is the study of **DNA**.
- **DNA** is the genetic material, passed from one generation to the next.
- Each **DNA** molecule is made up of strings of smaller molecules, containing **four bases**.
- These bases, called **A, T, C, and G**, can be arranged in any order.
- Biologists can compare the sequence of bases in of organisms from two different species.
- The more the similar the base sequence, the more closely related the species are to one another.

Organisms are first divided into **kingdoms**, such as the plant kingdom and the animal kingdom.

► Within each kingdom, organisms are further classified into several phyla (singular: phylum). ◀

► A phylum is made up of several classes. ◀

► Each class is made up of orders. ◀

► Each order is made up of families. Within each family, the organisms resemble one another fairly closely. ◀

Each family consists of a varying number of **genera** (singular: **genus**).

A genus has usually several species. A **species** is a group of organisms that can breed with one another to produce fertile offspring.

The classification system

- **Species:** the smallest natural group of organisms. Organisms of the same species can successfully breed together and produce fertile offspring.
- **Genus:** a group of closely related species. Each genus contains several species with similar characteristics.

THE BINOMIAL NAMING SYSTEM

- It uses two names for each organism:
- The first name refers to the genus. It always starts with capital letter
- The second name refers to the species. It starts with a small letter.
- Both the genus and the species names are either **italicized** or **underlined**.
- For example: domestic cat*Felis domestica*/ Felis domestica

on exactly how to define a species, but usually we say that organisms belong to the same species if they can breed together successfully, and the offspring that they

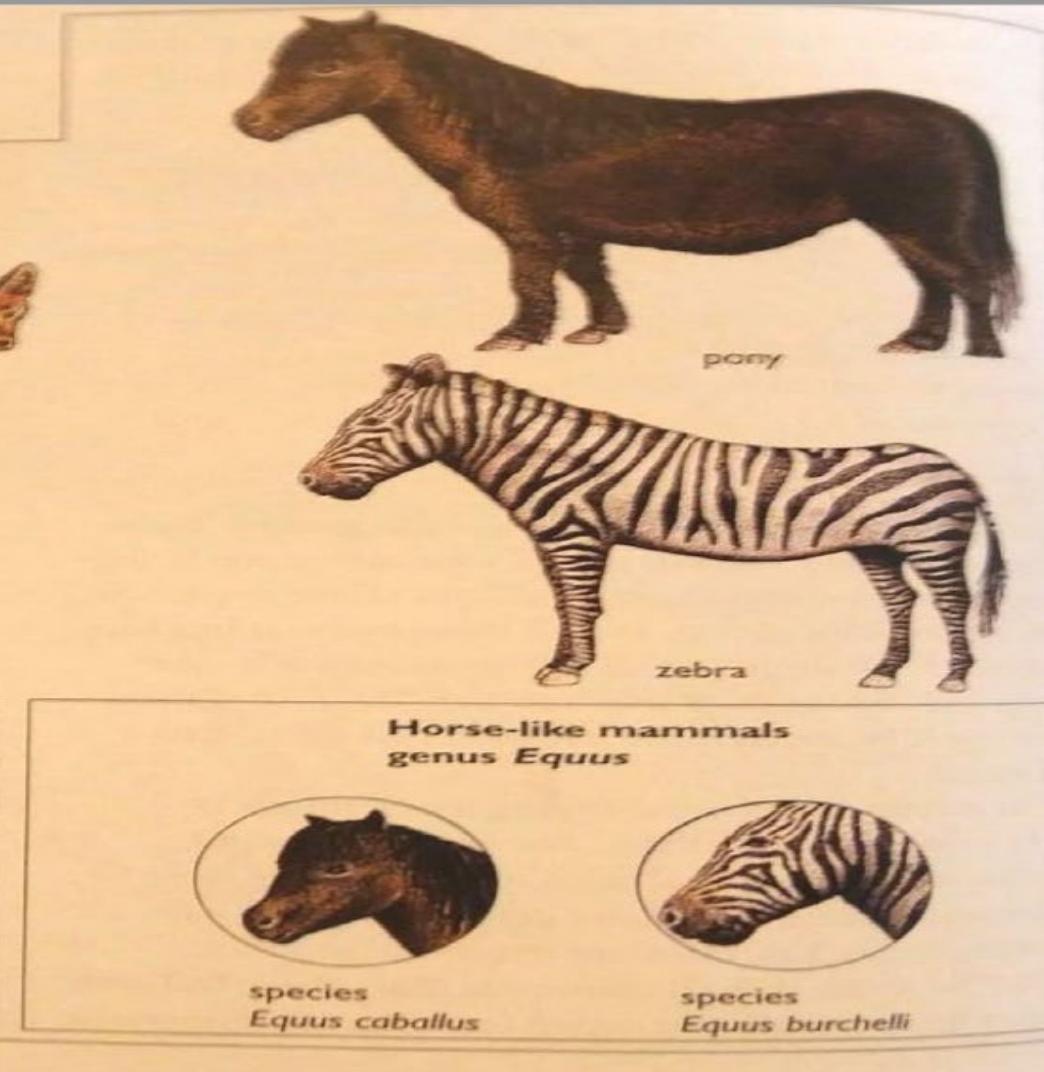
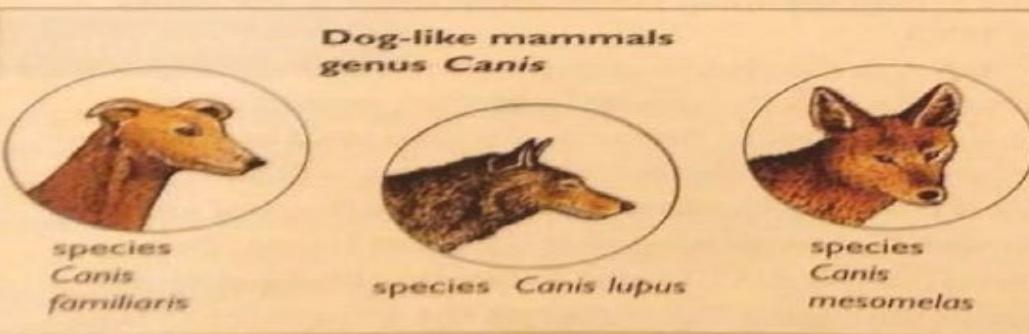
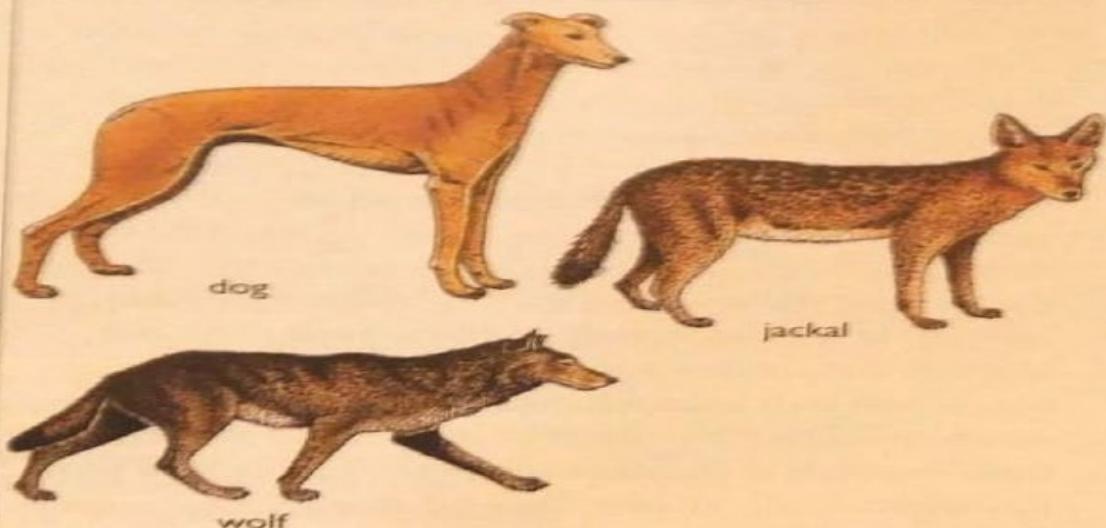


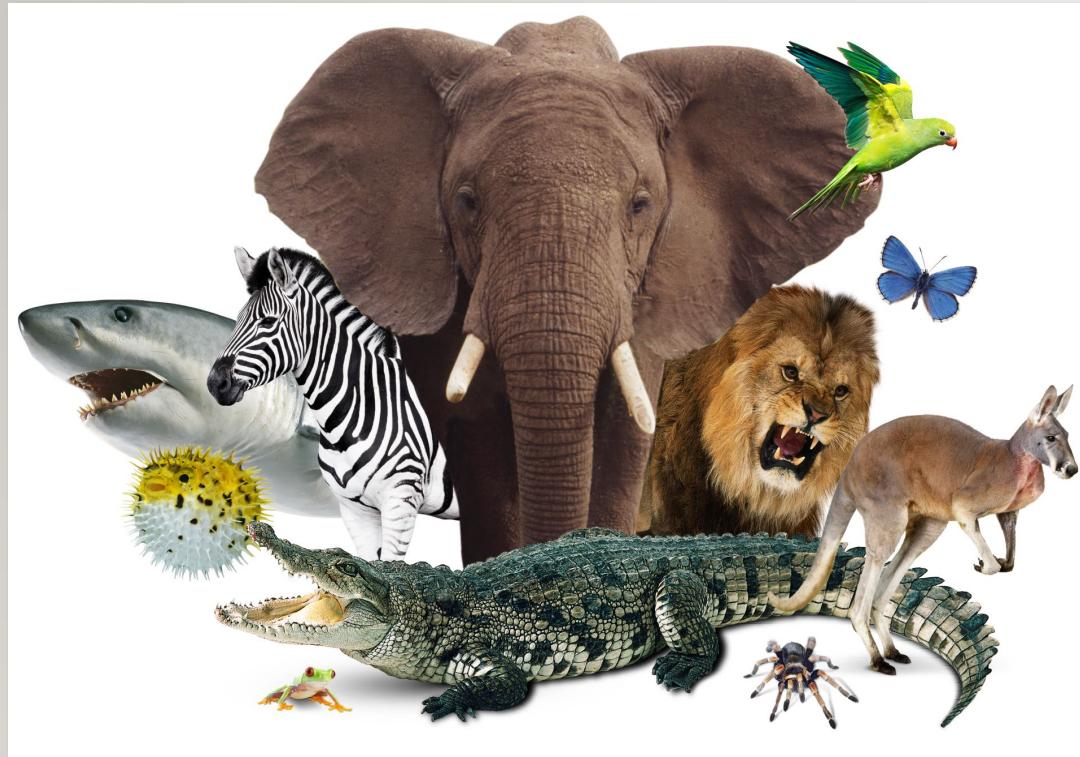
Figure 1.3 The binomial naming system.

The 5 kingdoms classification

Kingdom is the largest group of organisms.

1. *Kingdom prokaryotes*
2. *Kingdom protoctista*
3. *Kingdom fungi*
4. *Kingdom plants*
5. *Kingdom animals*

Animals (kingdom)

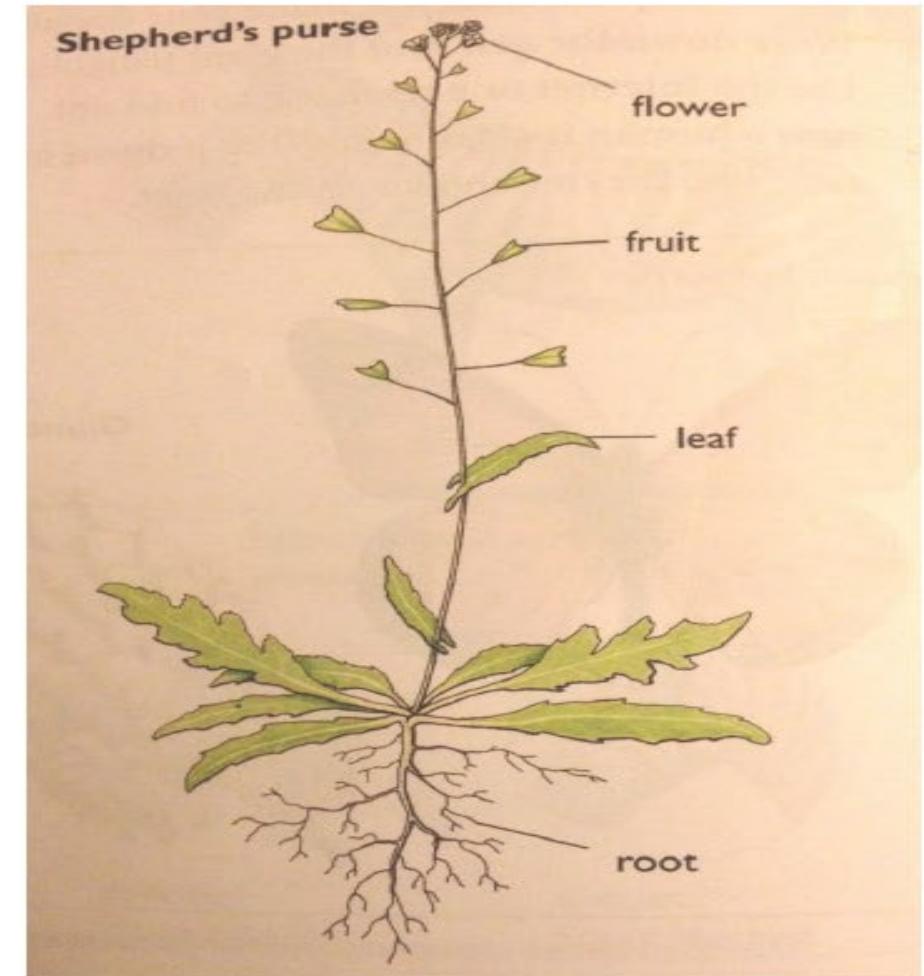


- *Characteristics:*
 - Multicellular (their bodies contain many cells);
 - Cells have a nucleus, but no cell wall or chloroplasts;
 - Feed on organic substances made by other living organisms.

Plants (kingdom)

- **Characteristics:**

- Multicellular;
- Cells have a nucleus, cell walls made of cellulose and often contain chloroplasts;
- Feed by photosynthesis;
- May have roots, stems and leaves.

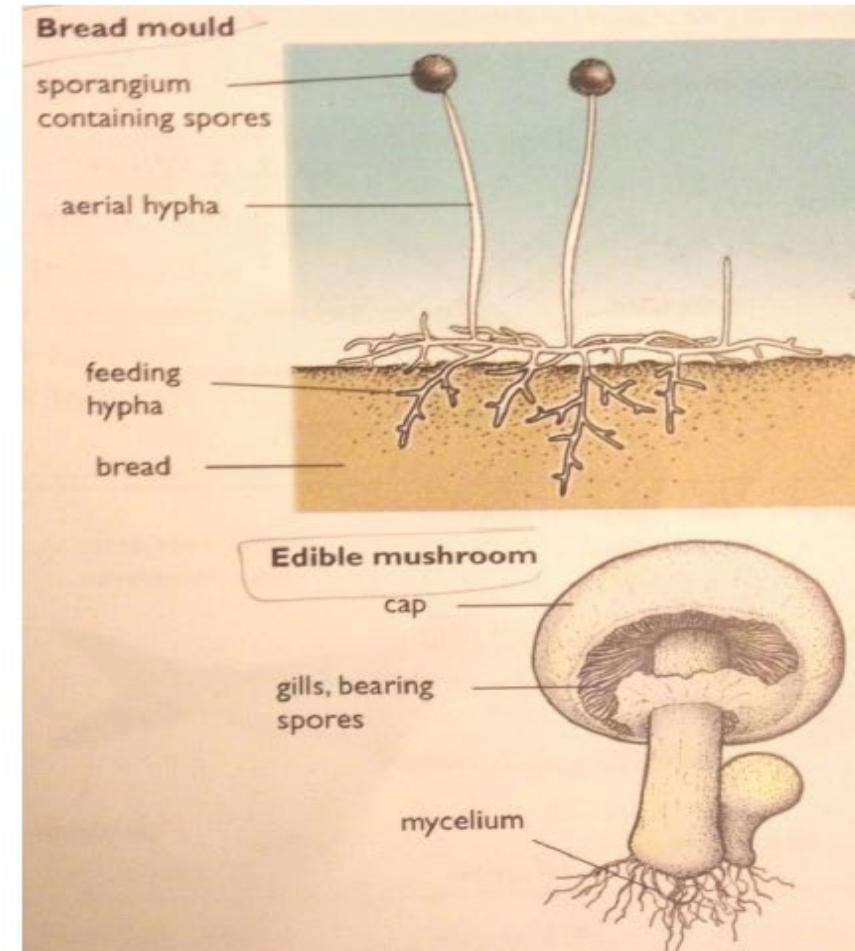


Fungi (kingdom)

Examples: Mushrooms, toadstools, puffballs, bracket fungi, moulds and yeasts are fungi.

Characteristics:

- Usually multicellular, and more precise fungi are made up of microscopic threads called **hyphae**. The network of hyphae is called **mycelium**.
- Have nuclei;
- Have cell walls, not made of cellulose;
- Do not have chlorophyll;
- Feed by saprophytic or parasitic nutrition.



Yeast (unicellular fungi)

- Draw a diagram of a yeast cell as seen by a light microscope.

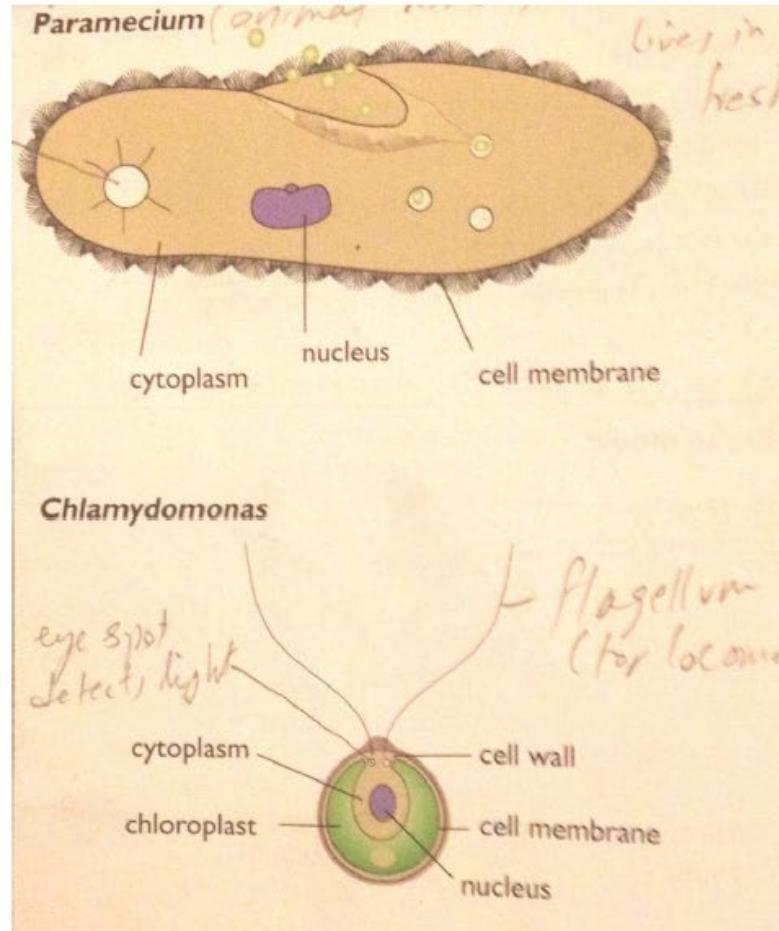
Fungal Nutrition

- Some fungi live as parasites; they derive their food from host cells or digest the cells and their contents.
- Most fungi are saprophytes. They live on dead organic matter. The hyphae secrete enzymes and digest the food outside their bodies. The soluble products are then absorbed back into the hyphae.

Protocista (kingdom)

- **Characteristics:**

- Most protocista are unicellular (made of just a single cell) but some as seaweeds are multicellular;
- Cells have nucleus;
- Cells may or may not have a cell wall and chloroplasts;
- Some feed by photosynthesis and others feed on organic substances made by other organisms.



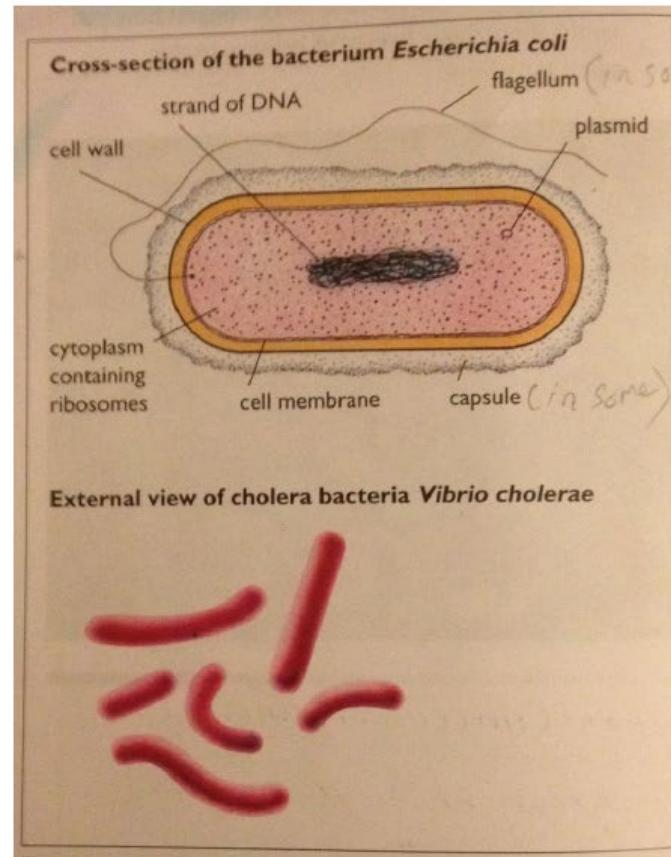
- Draw a diagram of an amoeba (an animal-like Protoctista).
- Draw a diagram of euglena (a plant-like Protoctista).

Kingdom Prokaryotes (Bacteria)

- They are very small unicellular organisms and can be seen only with the higher powers of the light microscope.

Bacterial shapes

- The round shape;
- The rod shape;
- The spiral shape;
- The comma shape;



Bacterial structure (Characteristics)

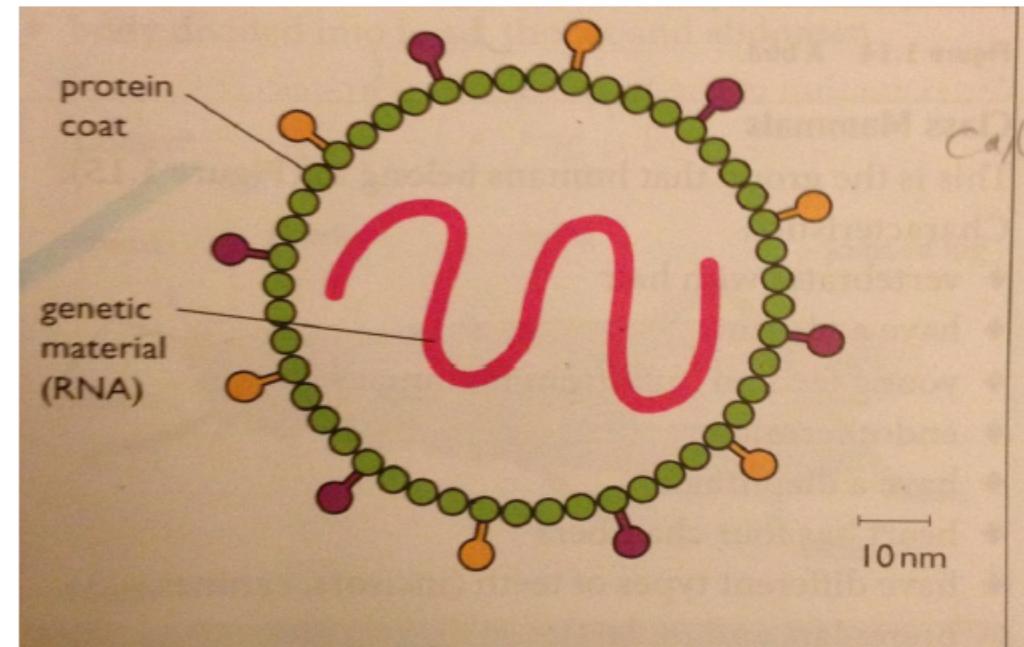
- Bacteria have cell walls not made of cellulose;
- Some bacteria have a slime capsule outside their cell wall.
- Their cytoplasm contains granules of glycogen, lipids and other food reserves.
- Have no nucleus, their genetic material consists of a circular strand of DNA not enclosed in a nuclear membrane.
- Some bacteria have flagella as filaments for locomotion;
- Have no mitochondria.

Bacterial Nutrition

- A few species of bacteria contain a photosynthetic pigment like chlorophyll, and can make their food by photosynthesis.
- Most bacteria live in or on their food as Saprobes, they release enzymes, which digest the food outside the cell. The soluble products are then absorbed back into the bacterial cell.
- Some bacteria live as parasites and cause diseases.

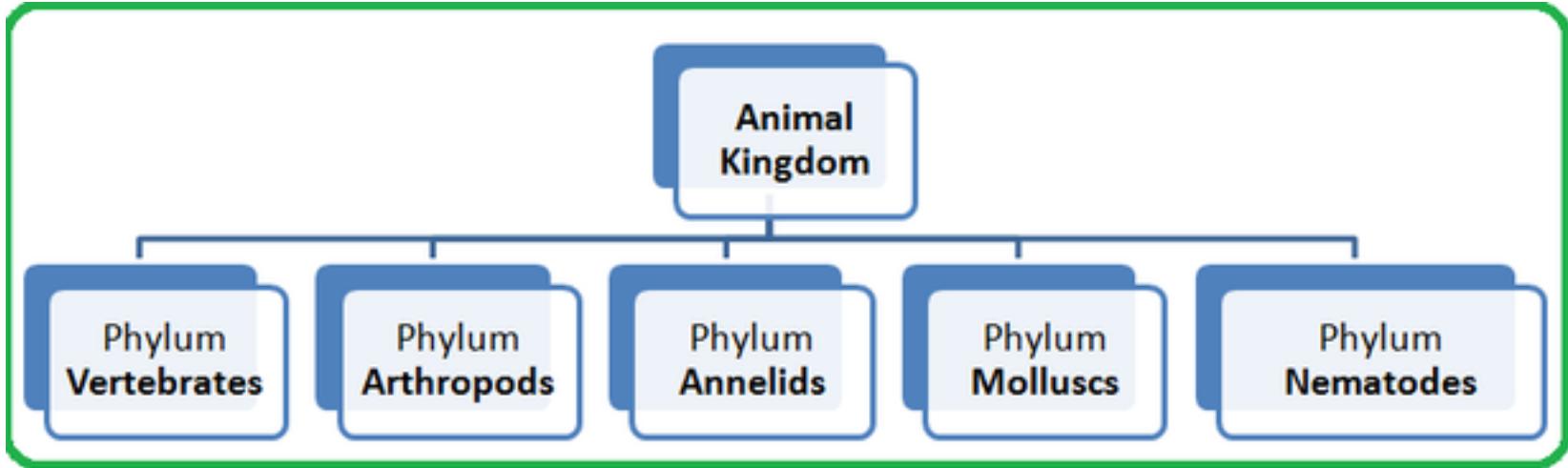
Viruses

- They are small and can be seen only with the electron microscope.
- Viruses are not normally considered to be alive;
- On their own viruses cannot move, feed, excrete, show sensitivity, grow or reproduce;
- Viruses cause common disease such as colds, influenza, and serious ones such as AIDS;



Viral structure

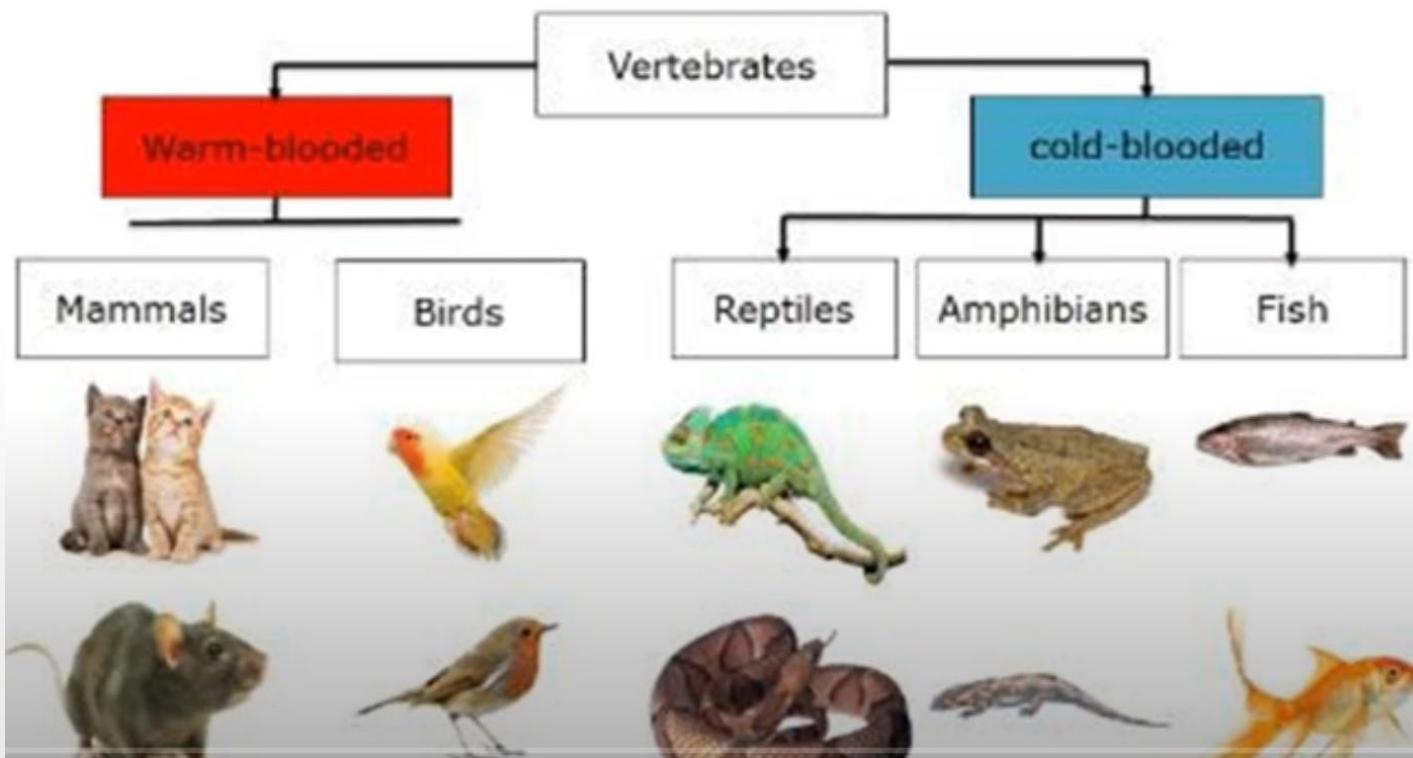
- All viruses have a central core of **RNA** or **DNA** surrounded by a protein coat.
- The protein coat is called a ***capsid*** and it is made up of well packed protein units called ***capsomeres***.
- Viruses have no nucleus, cytoplasm, cell organelles, or cell membrane.



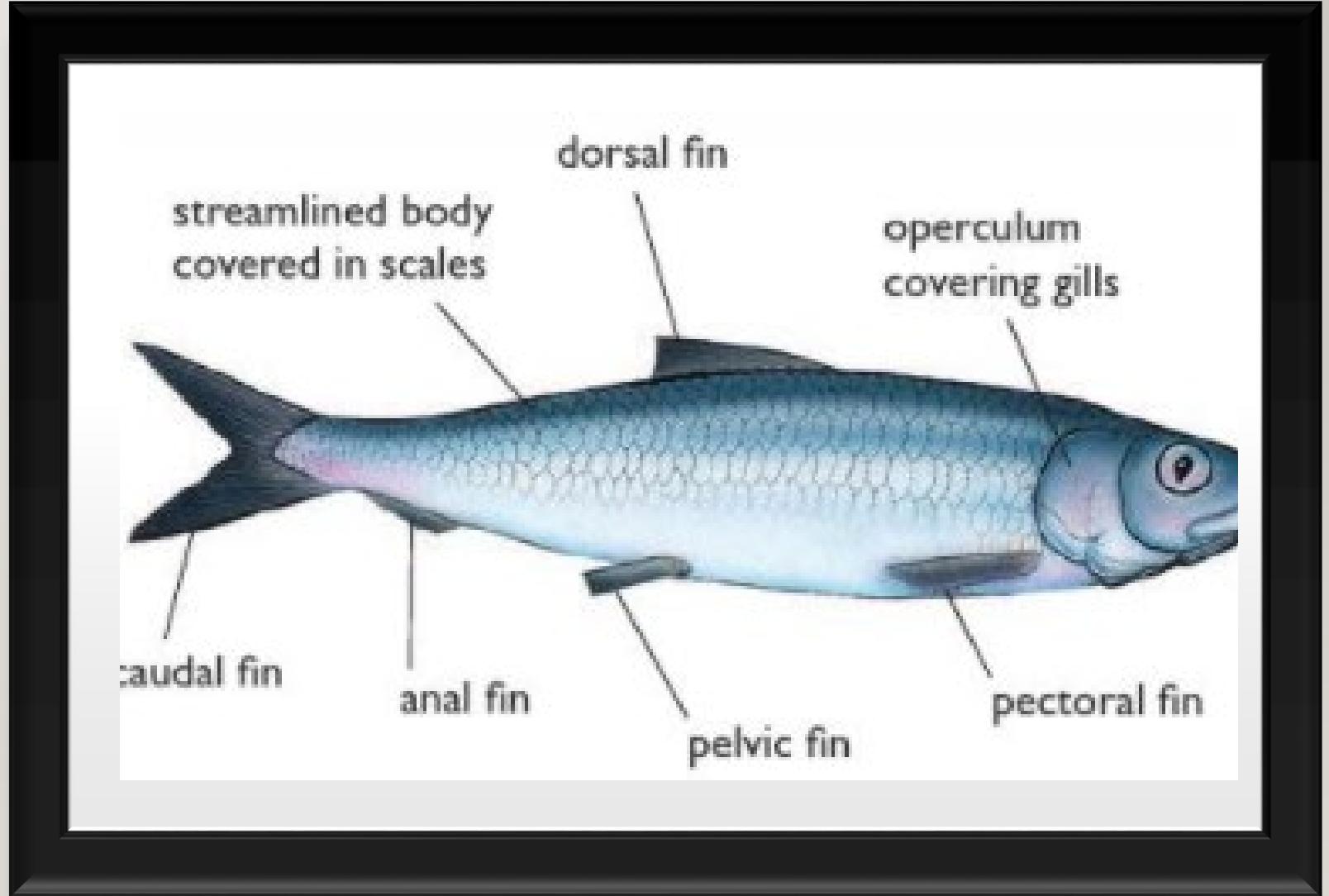
CLASSIFYING ANIMALS

Phylum Vertebrates

- Vertebrates are animals, which have a vertebral column.
- The vertebral column protects the spinal cord.
- The front end of the spinal cord is enlarged to form a brain, which is enclosed and protected by the skull.



CLASS FISH



- They have stream lined shape, which reduces water resistance and allows easier movement.
- Their bodies are covered with wet scales.
- They have fins for swimming.
- They breathe by means of gills, which are protected by an operculum (=a bony plate)
- Cartilaginous fish (e.g. shark) have gill openings;
- Exothermic (cold blooded).

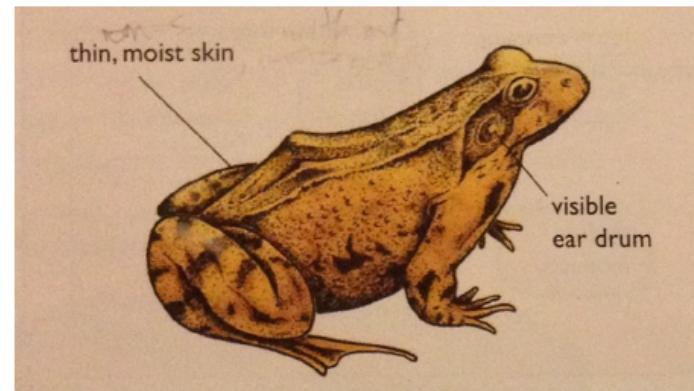
How do fish swim ?

- The spine is extremely flexible and is moved from side to side by contraction and relaxation of muscles.
- The caudal fin increases the surface area of the tail. This increases the propulsion gained when the tail is pushed against the water.
- The additional fins prevent unwanted movement.

Class Amphibians

e.g. frogs, toads, Salamanders and newts

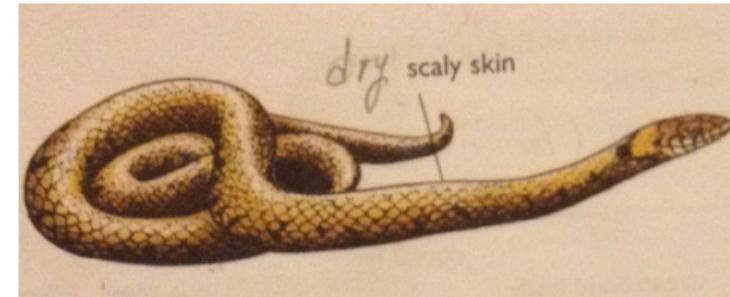
- They are vertebrates with moist, scale-less skin;
- Eggs laid in water, larva (tadpole) lives in water;
- Adults often live on land;
- Larva has gills, adults has lungs;
- Adults have 4 limbs.
- Frog hind limbs are muscular and strong for jumping, their
- hind feet are webbed for swimming.
- Newts have a tail, and swim by wriggling their bodies.
- Exothermic.



Class Reptiles

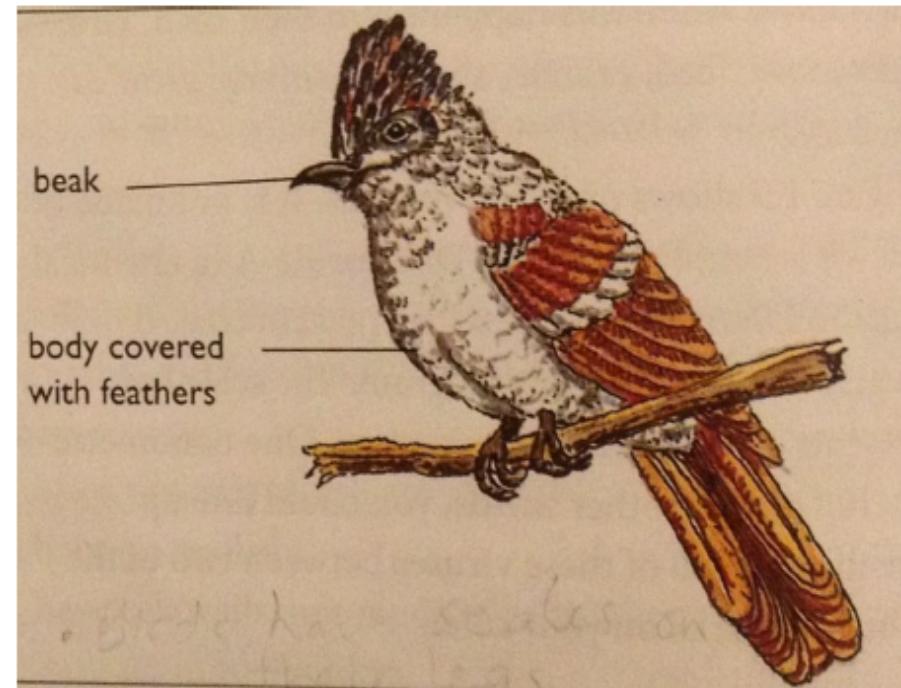
*e.g. lizards snakes,
turtles....and crocodiles.*

- They have dry scaly skin;
- Lay eggs with rubbery shells;
- Apart from the snakes, reptiles have 4 limbs, each with 5 toes.
- Exothermic.



Class Birds

- Their skins are covered by feathers, but on the legs and toes, the skin forms scales.
- Birds have 4 limbs, but the forelimbs form wings.
- They have beaks, which are used for feeding in various ways.
- Lay eggs with hard shell;
- Their heart has four chambers;
- Endothermic (warm blooded vertebrates).



- Draw the four different types of beaks.

Feathers are of 3 types:

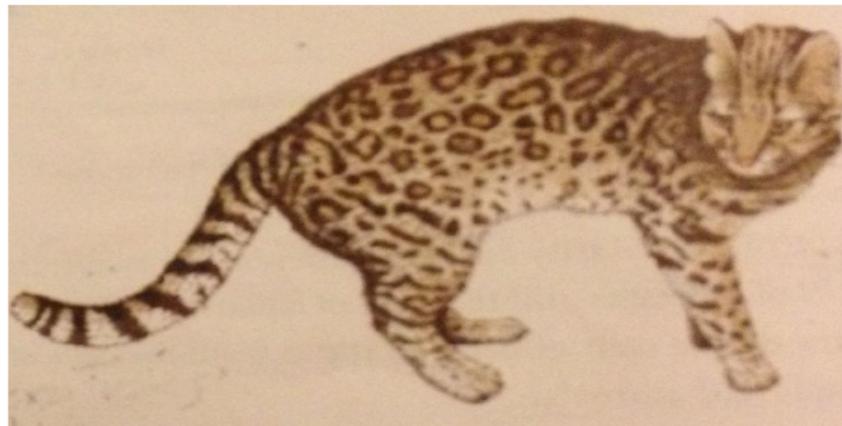
- The fluffy down feathers form an insulating layer close to the skin, by trapping air and reducing heat loss.
- The contour feathers give shape and colour.
- The large quill feathers on wings are essential for flight.

How do birds fly?

Feathers and wings are adapted for flight. The wing provides an enormous surface area to lift the bird against the force of gravity pulling it down towards the ground.

Class Mammals

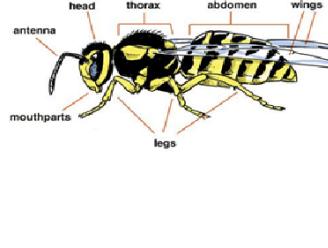
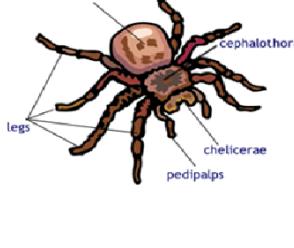
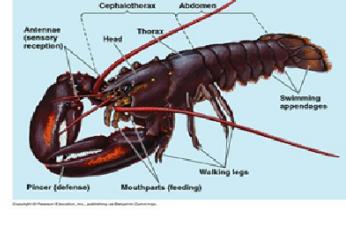
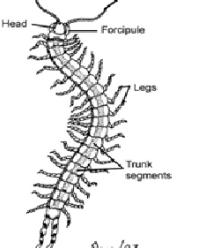
- Their bodies are covered by hair or fur.
- They have lungs and diaphragm for breathing.
- Young feed on milk from mammary glands;
- They have external ear called pinna;
- Their heart has four chambers;
- They have placenta;
- Endothermic (warm blooded);
- They have different types of teeth (incisors, canines, premolars and molars).



ARTHROPODS

Arthropods

Are animals without vertebral column. The main features include: segmented bodies, jointed limbs and bodies covered by exoskeleton(outer skeleton made up of chitin)

| INSECTS | ARACHNIDS | CRUSTACEANS | MYRIAPODS |
|--|---|---|--|
| <ul style="list-style-type: none"> • 6 legs. • Exoskeleton • 3 body parts (head, thorax and abdomen). • Two antennae. • Many have wings. • Examples are wasps, ants, butterflies...  | <ul style="list-style-type: none"> • 8 legs. • Exoskeleton. • 2 body parts (cephalothorax and abdomen). • they have simple eyes • Don't have antennae or wings • Examples are spiders, scorpions...  | <p>They are mainly aquatic and often have gills they have two pairs of feelers (also known as antennae) Most have compound eyes Ex. shrimp, lobster, crab</p>  | <ul style="list-style-type: none"> • Lots of legs. • Exoskeleton. • Two antennae. • Body has lots of segments. <p>They have simple eyes Ex. centipede, millipede</p>  |

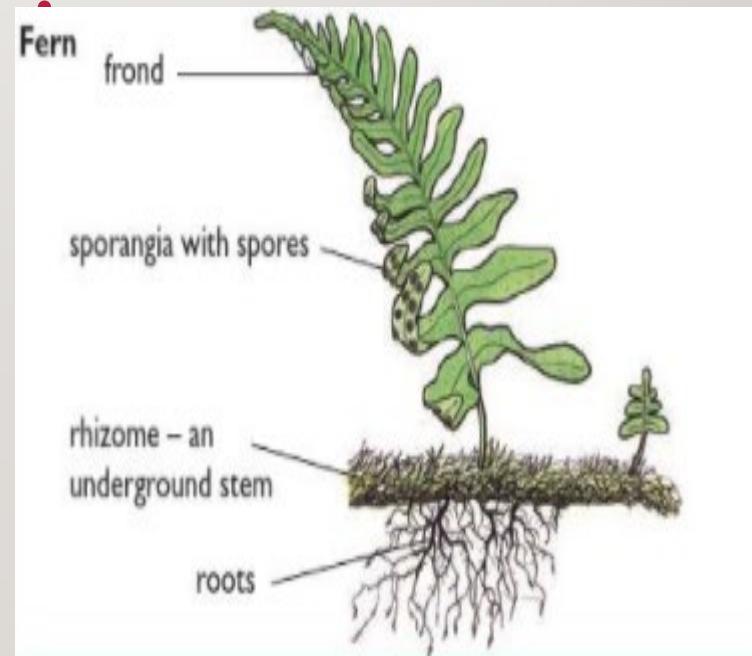
HOW DO WE CLASSIFY PLANTS?

- Plants include small organism as mosses, as well as ferns and flowering plants.
- **Flowering plants** have roots, stems and seeds. They produce flowers and seeds. They reproduce by seeds.
- **Ferns** have roots, stems and leaves. They do not produce flowers or seeds. They reproduce by spores.

HOW DO WE CLASSIFY PLANTS?

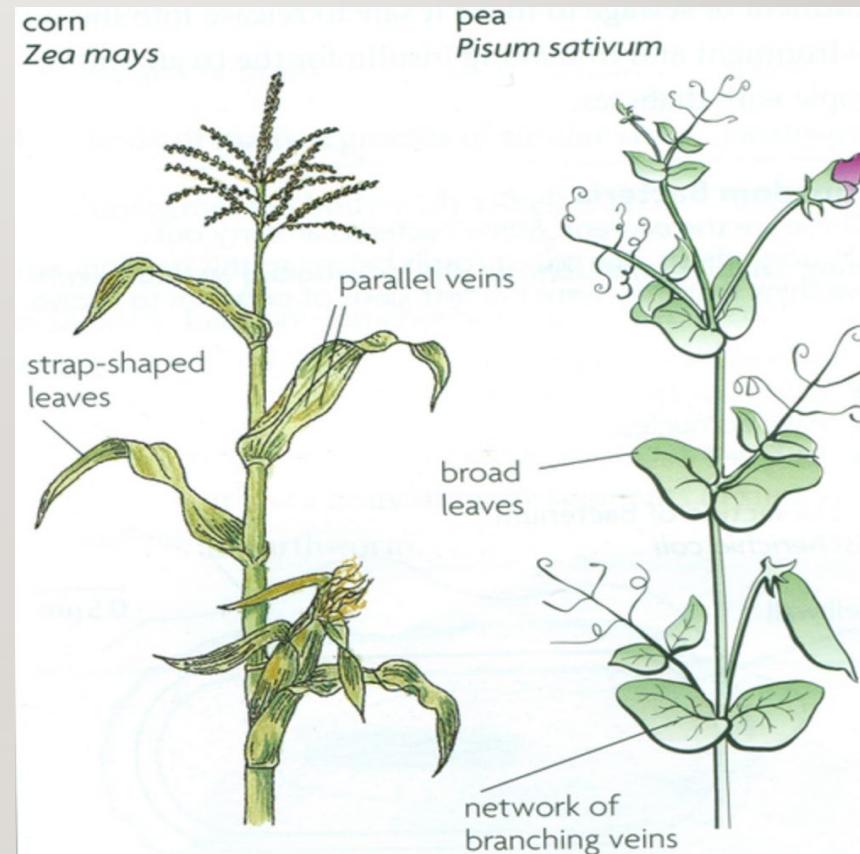
PLANTS INCLUDE SMALL ORGANISM AS MOSSES, AS WELL AS FERNS AND FLOWERING PLANTS.

- **Ferns:** have roots, stems and leaves.
- They do not produce flowers or seeds.
- They reproduce by spores.
- Fern leaves are called fronds

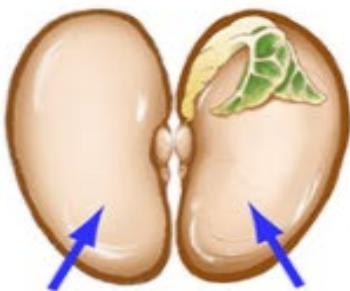


PLANTS

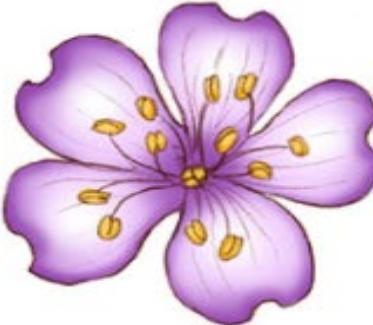
- Flowering plants
- Have roots, stems and seeds.
- They produce flowers and seeds.
- They reproduce by seeds.
- Flowering plants are further divided into 2 classes: monocotyledons and dicotyledons



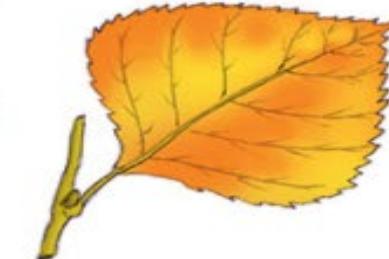
Dicot (two cotyledons)



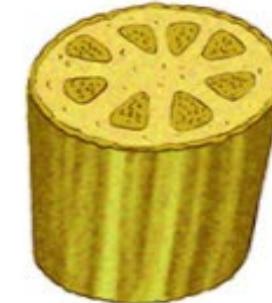
Seeds have
two cotyledons



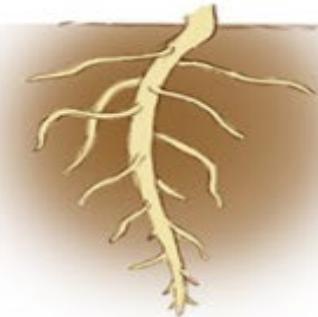
Flowers have
four or five floral
parts (or multiples
thereof)



Leaves are oval
or palmate, with
net-like veins

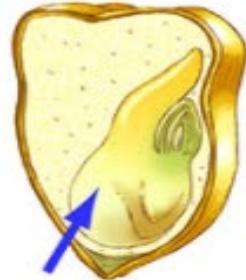


Vascular bundles
arranged in a ring
around stem

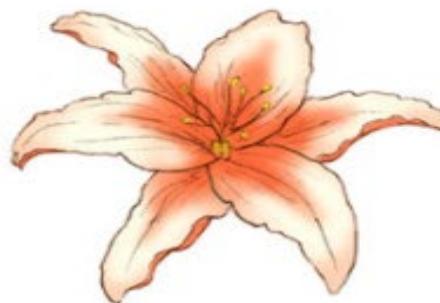


Tap roots

Monocot (one cotyledon)



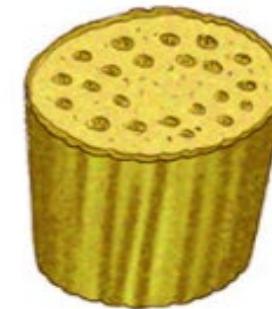
Seeds have
one cotyledon



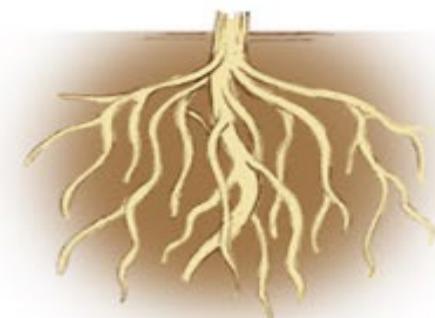
Flowers have
three floral parts
(or multiples
thereof)



Leaves are
narrow, with
parallel veins



Vascular bundles
small, and spread
throughout stem

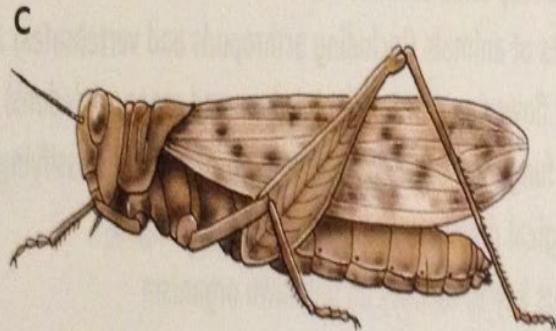
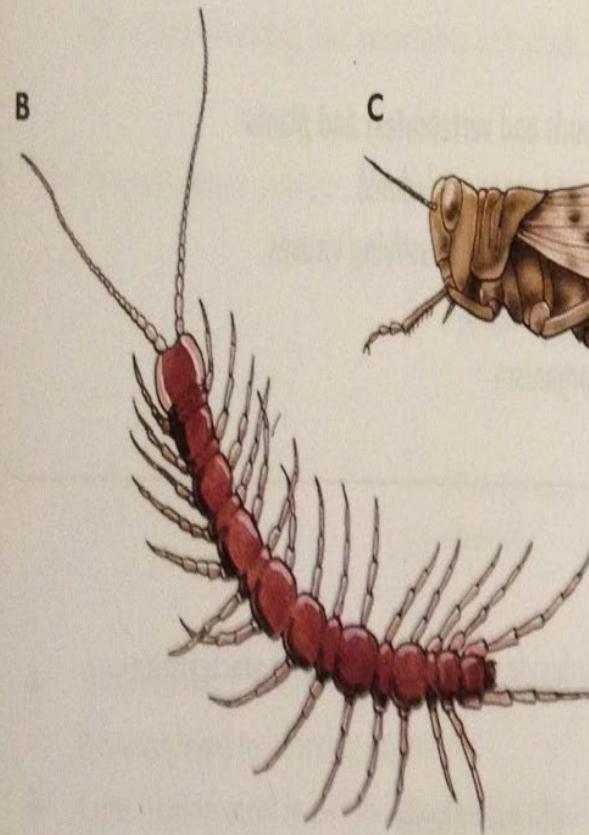
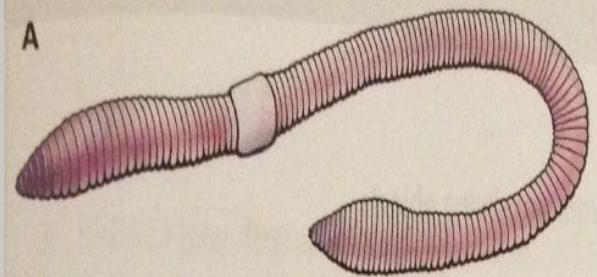


Fibrous roots

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HOW DO WE CONSTRUCT AND USE A DICHOTOMOUS KEY TO IDENTIFY ORGANISMS

- Dichotomous key: is used to identify and classify organisms. A dichotomous key has a series of paired statements called **couplets**. Each couplet consists of two contrasting statements.
- Dichotomous key can also be presented in a chart.



- 1 jointed limbs 2
- no jointed limbs earthworm
- 2 more than 5 pairs of jointed limbs centipede
- 5 or fewer pairs of jointed limbs 3
- 3 first pair of limbs form large claws crab
- no large claws 4
- 4 3 pairs of limbs locust
- 4 pairs of limbs spider