

Characteristics of organisms

Recall all the information and experiences you have , about organisms. Using that knowledge carry out the below mentioned assignment.

Assignment 8.1

Express your idea about below instances whether they are living or non living.

1. Hen egg
2. A tissue stored in a deep freezer which is obtained from an organism
3. A fossil about thousands of years old

How far the living characteristics already known to you could be applied to describe a hen egg? Even after few weeks, if the egg is incubated, a chick with living features will be born.

A tissue removed from an organism can be stored in a deep freezer for a longer time. Once it is bud into another organism using appropriate techniques, it will show living characteristics.

The DNA isolated from a thousand year old fossil can be bud to obtain new organisms with old characteristics using gene technology.

By considering above facts, you can understand that only by observing the external features, one cannot get a confirmation about life.

Assignment 8.2

List out the features that can be used to identify living from non living.

The features that you have listed are not always found in all living units. But all living units show one or few living characteristics. You can study in future lessons that living and non living cannot be separated by a clear line in some instances.

The common characteristics of living organisms can be listed out as below.

- Cellular organization
- Nutrition
- Respiration
- Irritability & Co-ordination
- Excretion
- Movement
- Reproduction
- Growth & Development

8.1 Cellular organization

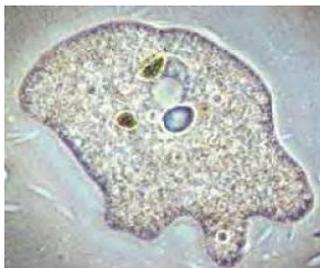
When considering the structure of a unicellular organism, it is made up of the cytoplasm and organelles enclosed by a plasma membrane. This unicellular unit is an organism which shows living characteristics. When a water sample of a pond or hay extraction is observed using a microscope, unicellular organisms can be observed easily.



Chlamydomonas



Euglena



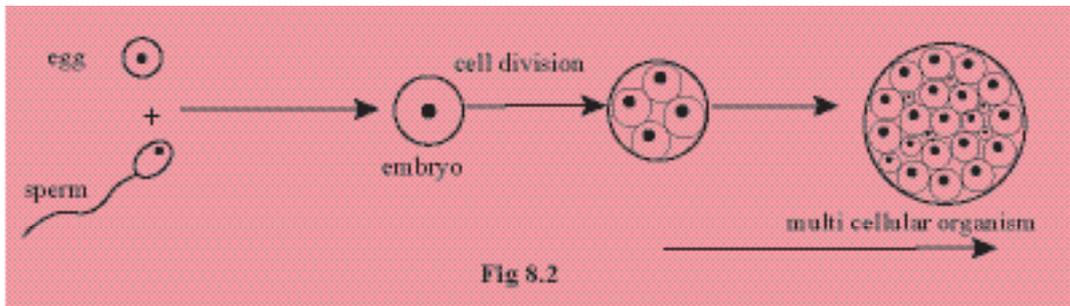
Amoeba



Paramecium

Fig 8.1 - Appearance of uni-cellular organisms through light microscope

In a unicellular organism, organelle level organization can be seen. The origin of a multicellular organism is from a single cell, the zygote which is the product of the fertilization of an egg with a sperm. The below mentioned sketch (Fig 8.2) is just to show the development of embryo of human.



The bodies of the multicellular organisms are composed of different types of cells. Those cells are important in different functions. Diagram 8.3 shows the arrangement of different cells in the plant body and diagram 8.4 shows the arrangement of different cells in the human body.

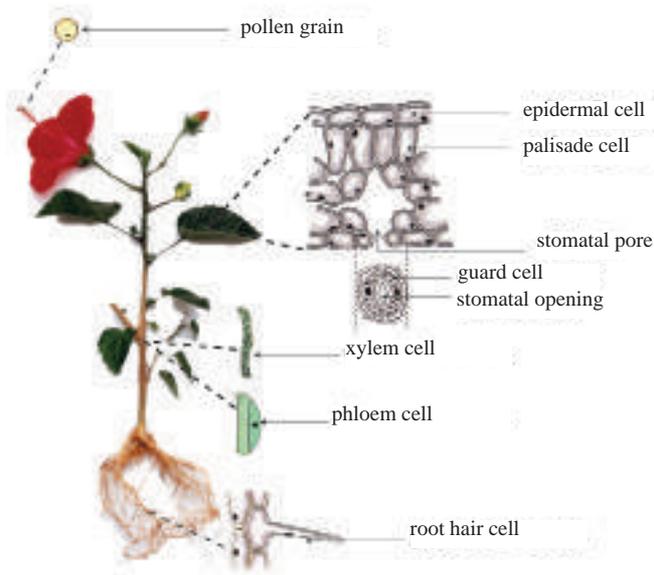


Fig 8.3 - Organization of different cells in plant body

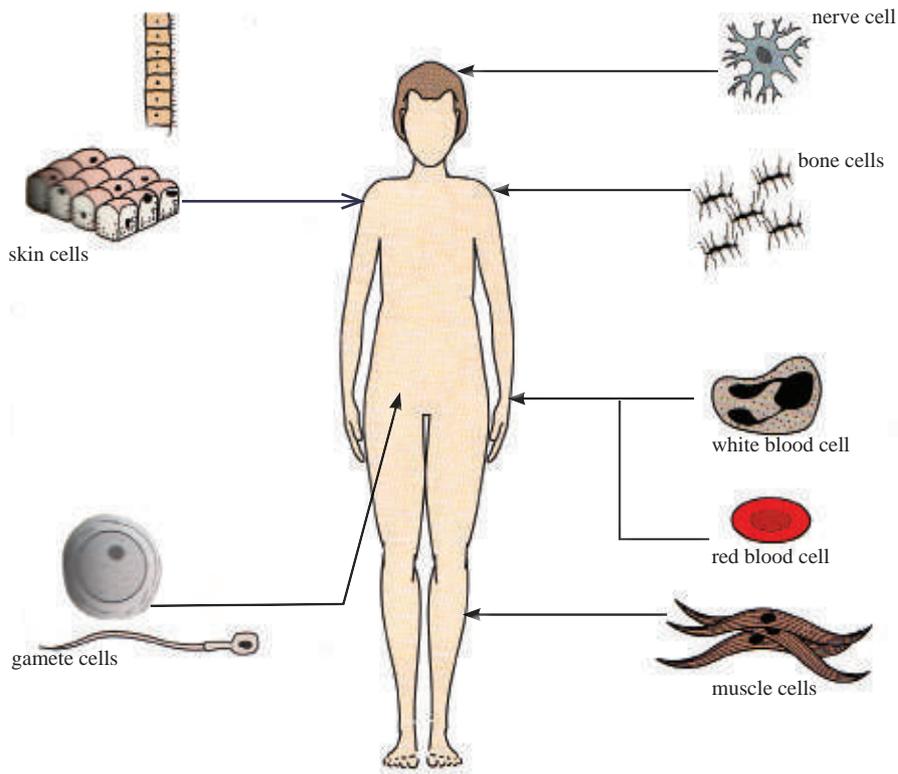


Fig 8.4 - Organization of different cells in the human body

A multicellular organism possesses a tissue and a system level organization. The organs of the organism are well developed & designed to carry out relevant functions.

e.g. Tongue, Eye, Heart

Activity 01

- Observe a water sample obtained from a pond or a hay extraction under light microscope. Identify micro organisms and illustrate them.
- Observe the prepared slides of different cells in the laboratory and identify them.

The smallest structural & functional unit at living condition is the cell. A group of cells modified to perform a specific function is called a tissue. A collection of tissues form an organ, a collection of organs forms a system, and systems collectively form an organism.

Below chart shows the organisational levels of an organism considering the blood circulatory system.

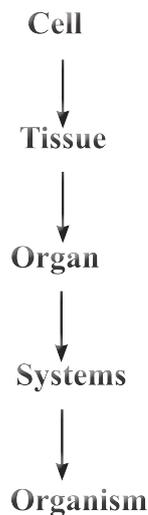
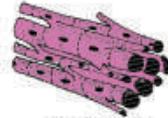


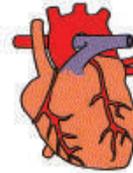
Fig 8.5 - Organisational levels that can be identified in a living being



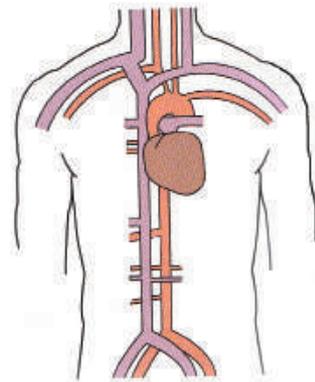
heart muscle cell



heart muscle tissue



heart (organ)



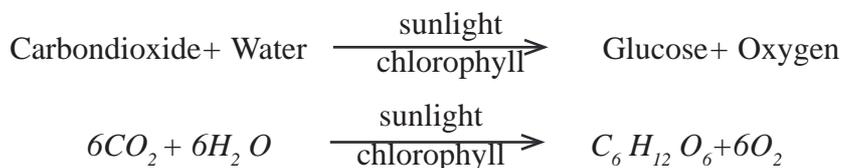
blood circulatory system

Fig 8.6 - Blood circulatory system and how it becomes complex from cellular level to system level

8.2 Nutrition

The process by which the energy & the materials are obtained for the maintenance of life is known as nutrition. Energy is needed for the cell growth and to repair the worn out structures. This energy is obtained by nutrients. The Organisms that produce their own food or the nutrients by themselves are known as autotrophic organisms.

Autotrophism can be divided into two categories according to the type of energy they use for food production. If solar energy is used they are known as photoautotrophs and if energy is obtained by a chemical reaction they are known as chemoautotrophs. Most of the plants are photoautotrophic. Most bacteria are chemoautotrophic. Production of food inside the chloroplast of plant cells using chlorophyll, which is a specific organic compound, is called photosynthesis. The photosynthesis can be expressed by the below equation.



The food produced in the leaves get stored in stems, roots & fruits. Animals are heterotrophic as they utilize food produced by plants or organic compounds with other living origins.

Below food web shows the connection between these modes of nutrition.

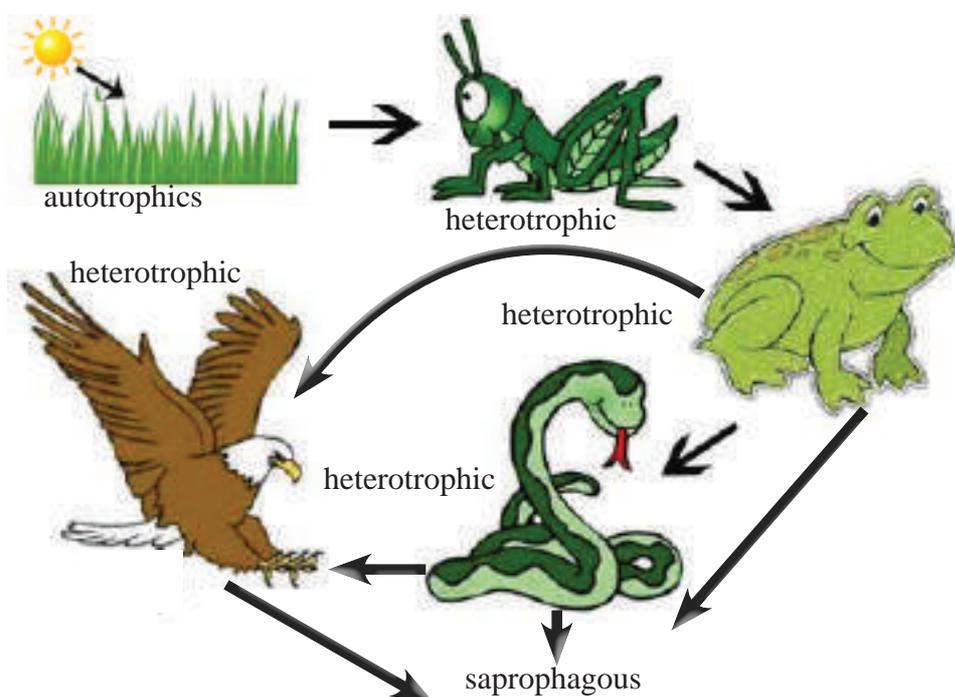


Fig 8.7 - A Food web

8.3 Respiration

All Organisms need energy for their metabolism. They obtain this energy by breaking down of food inside the cell that they have produced or obtained by other means. The process by which the stored food is transformed into energy inside the cells is known as cellular respiration.

Cellular respiration is a series of biochemical reactions. The respiration, which is an important characteristic of life, cannot be observed directly. But it can be observed using respiratory movements of some organisms. That is by inspiration, intake of oxygen for respiration and removal of carbondioxide, the expiration.

Using the below experiment it can be shown that CO_2 is released while O_2 is absorbed during respiration.

Activity 02

Experiment to show the release of CO_2 during respiration

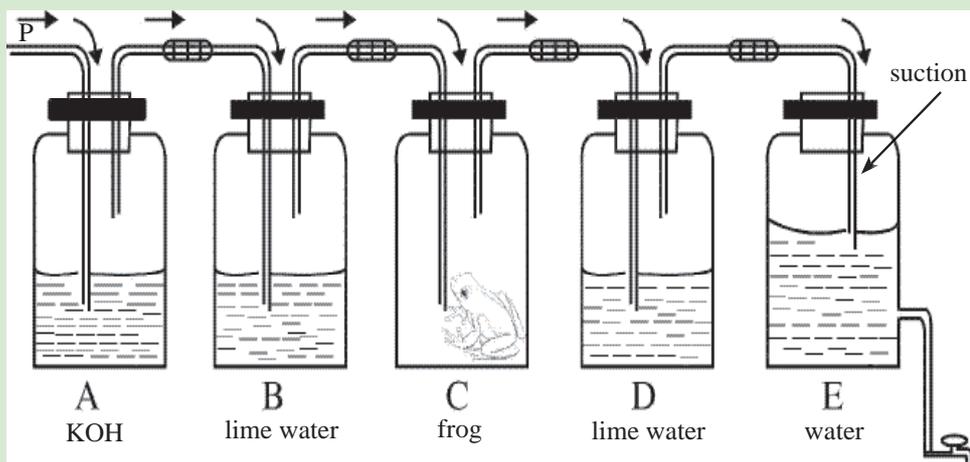


Fig 8.8- Demonstration of the products of respiration

Arrange the apparatus as shown above & remove water in bottle E. Then an air flow occurs from A to E.

The colour of lime water in B does not change as CO_2 in air that enters through P dissolves in KOH of vessel A. But after some time the lime water in vessel D turn to milky. It is because of the released CO_2 by the frog during respiration. A control experiment can be used without a frog in C. Accordingly it is confirmed that CO_2 is released as a byproduct of respiration. This experiment can be conducted again using germinating green gram / paddy/ maize/ bean seeds in vessel C instead of a frog.

Now we will carry out the experiment below to show the absorption of O_2 during respiration.

Activity 03

Experiment to show absorption of oxygen in respiration

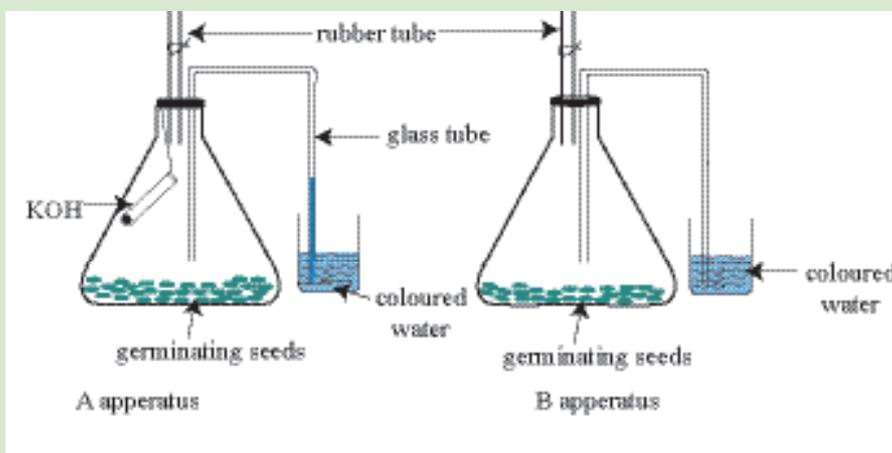


Fig 8.9- A practical demonstration to show absorption of oxygen in respiration

Close the flask with the cork lid connected to a rubber tube and a U tube as shown in the diagram and observe the water level in the U tube.

CO_2 present in the flask & released CO_2 during respiration of seeds dissolves in tube with KOH. The O_2 in the flask is absorbed by the seeds for respiration. To fill that gap, (reduction in volume of air) air in the tube flows into the flask. The water column in the glass tube is drawn up. So it is clear that O_2 is absorbed for respiration of organisms. No such change in B setup as absorbed volume of O_2 is equal to the released volume of CO_2 .

Assignment 8.4

What are the respiratory movements & associated movements of below organisms?

- | | |
|-----------|-------------|
| 01. Frog | 02. Tilapia |
| 03. Human | 04. Whale |
| 05. Dog | 06. Locust |

8.4 Irritability & Co-ordination



Fig 8.10- Responding towards stimuli

Organisms react according to the changes in the environment. When there is a change in the internal and external environment or a stimulus with a particular strength, organisms respond accordingly. A change which is strong enough to bring about a response is known as a stimulus. The stimuli are detected by organs such as eye, ear, nose, tongue & skin. The stimuli are light, sound, chemicals & mechanical or physical vibrations.

The reactions according to the changes in the environment are known as responses. Eg: The stimulus is the sound & the response is closing of ears with hands as in the above diagram 8.10. below.

The ability to respond to stimuli receives from internal or an external environment is known as irritability. The communication between different organs during responding to a stimulus is known as coordination. Nerves, muscles and hormones are important in coordination. Some insects fly towards light, some fly towards dark. Not only animals but also plants respond to stimuli.

Example : Leaves of *Mimosa* fold when touched. That means those plant leaves are sensitive to touch. Leaves of *Thora*, *Tamarind* & *Sesbania* fold at night. That means these plant leaves are sensitive to light.

8.5 Excretion

All organisms obtain materials from the environment and transform them to a beneficial form of energy. At the same time the materials which are not used and the waste materials that are produced during the processes in the body are released to the environment.

The sum of chemical & physiological activities or building up and breaking down of materials within the cell are known as metabolic activities. **Removal of the byproducts from the body that are produced during metabolism is known as excretion.**

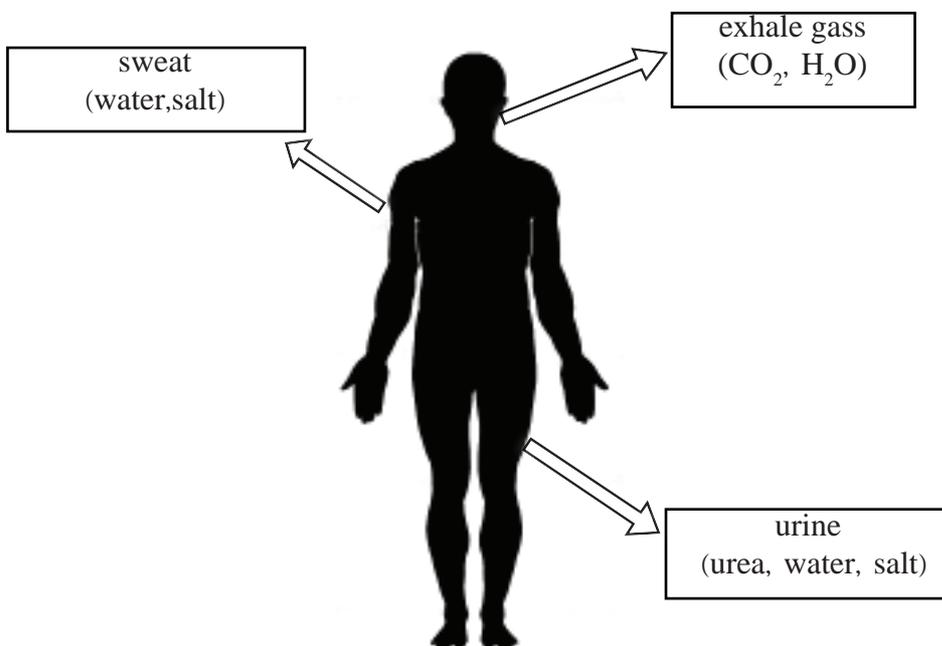


Fig 8.11- Different ways of excretion of a living being

The main excretory materials of organisms are urea, salts, CO₂ and water. There are organ systems present in the organism body for excretion. Nitrogenous excretion of human mainly takes place by the kidney.

Plants remove CO₂ during respiration, O₂ during photosynthesis through lenticels and stomata of the leaves. That can be referred to as excretion too.

For extra knowledge.

- **Anabolism**

The process of synthesis of complex compounds from simple compounds within the living body. Energy is stored during this process.

- **Catabolism**

The process of breaking down complex compounds into simple compounds in the body releasing energy is known as Catabolism.

- **Metabolism**

Summation of bio chemical reactions taking place in the living body or the total of anabolism & catabolism. is known as Metabolism.

8.6 Movement

Organisms fulfil their requirements (food, protection, reproduction) with the help of movement. During this, the whole organism or a part of the organism is moved. Unicellular organisms use cilia, flagella or pseudopodia for movement. Multicellular organisms move the whole body or a part of the body with the help of muscles.

Similarly the organelles within the cell have the ability to move. Movement is a living characteristic of organisms and it is essential for their existence.

Hope that you have observed the growth of a shoot tip of a potted plant towards light which is placed closer to a window. The shoot apex of a plant grows towards light and the root apex towards the gravity. Accordingly the shoot of the plant shows positive phototropic and root, positive geotropic movements. Organisms move as a response to stimuli. The stimuli may vary.

Example : Light/darkness, Chemical substances, Gravitational force
 Heat/temperature, Vibrations/touch

Assignment 8.5

1. State different modes of locomotion of mammals & give two examples for each.
2. For what purposes do organisms locomote?
3. Give examples for different growth movements of plants.

8.7 Reproduction

What happens to the existence of the earth, if all the organisms die without producing their own offsprings? If so, the populations become extinct with time, one by one. Therefore before one generation dies, they have to produce their next generation. Production of a new generation by a unicellular or a multicellular organism for the continuation of their species is known as reproduction.

Reproduction is of two types. They are sexual & asexual reproduction. During sexual reproduction, gametes of two individuals of the same species unite to form a zygote. The first cell of the process of producing a new organism is the zygote.

During asexual reproduction, a single organism can produce an identical new offspring without the contribution of another organism.

Example : Propagation of new plants by vegetative structures of plants

8.8 Growth and Development

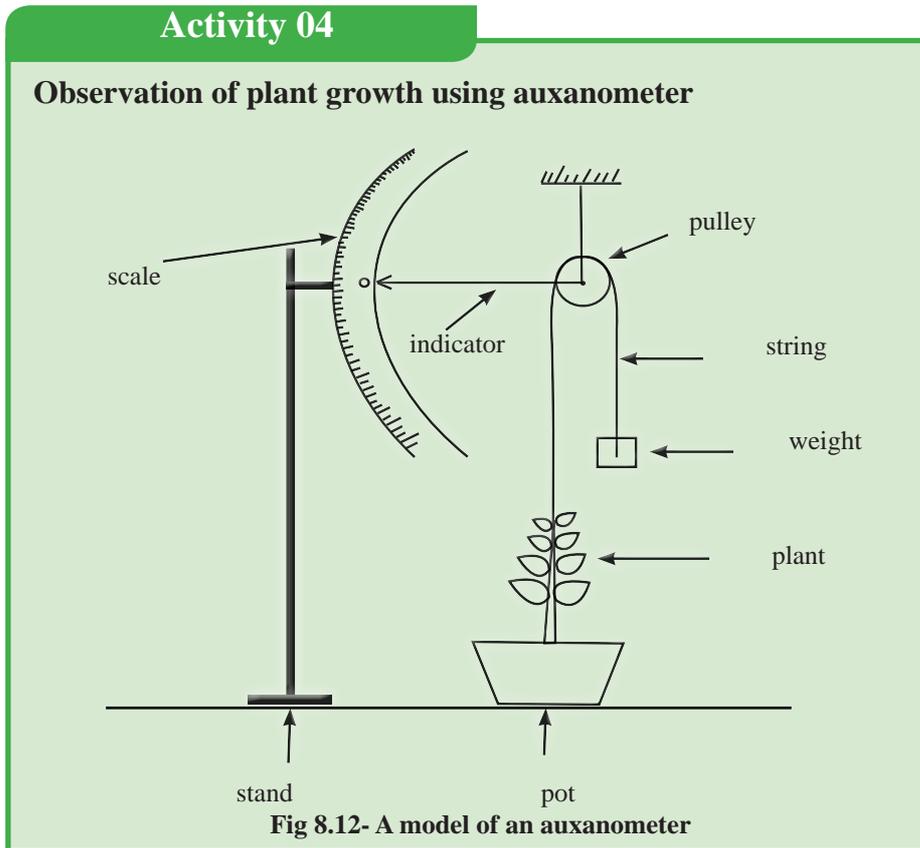
The life of multicellular plants or animals starts from a single cell. Tissues which are modified to perform a specific function arise by the division of the above single cell, zygote.

The zygote which is the result of the sexual reproduction of human develops into an embryo within the uterus and later transforms into an offspring. It is useful to study about the above process to understand the growth & development.

Mainly the increase in number of cells by the cell division contributes towards the growth of a multicellular organism. The growth of a unicellular organism is considered as the increase of the size & the volume of the cell. (*Paramecium*, Yeast, *Chlamydomonas*) The cell growth means the irreversible increase of dry mass of the cell. Development means, the increase in the complexity of the cell. Accordingly, growth & development can be expressed in three steps.

1. Irreversible increase in size of the cell
2. Increase in number of cells by cell division
3. Cell differentiation

Auxanometer can be used to show the growth of a plant.



According to the Figure 8.12 a thread is connected to the shoot apex of a potted plant & it is sent through a pulley and a weight is hung onto it. The plant grows very slowly, but the indicator shows it in a greater scale.

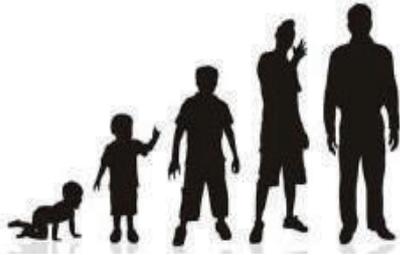


Fig 8.13 - Human growth and development



Fig 8.14 - Plant growth and development

According to the above mentioned features, now you can identify living or non living things in the environment.

Observe a white thread like mass on a pile of decomposing garbage. It is the somatic part (growth part) of a fungus. Later it transforms into mushrooms which are structures of sexual reproduction.

You can observe Lichen grows on a coconut trunk, ferns & orchids grow on a wall, mealy bugs on chili or papaw plants, small, fragile white eggs on leaflets of *Sesbania* & identify their living or non living nature.

Sometimes, living or non living nature of some substances cannot be identified easily. Bacteria cells can be dried into a powder. Yeast which is a fungus that is used to make bread is available in the market as a dried powder.

Assignment 8.6

Some non living things show, living features in the environment. Formations of rocks by aggregation of soil, growth of crystals are some examples. Waves appear in reservoirs show a movement. Discuss how this movement & growth is different from that of living organisms.

Some living entities cannot be easily identified whether they are living or nonliving.

Eg : Virus

Virus

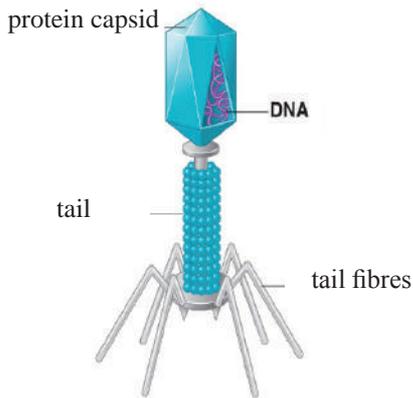


Fig 8.16- Structure of a virus as a model observed through electron microscope

They are very small and can be observed only through the electron microscope & are about $1/1000^{\text{th}}$ of the size of a bacteria. They show living or non living features according to their status. A virus is not considered as a cell. They are composed of a nucleic acid enclosed by a protein capsid. The nucleic acid may be DNA or RNA. Viruses with different shapes and sizes have been identified.

No metabolism takes place within viruses, because they do not possess any organelles for those reactions. A virus becomes active only inside the host cells.



Fig 8.17- A virus infected cell observed through electron microscope

For extra knowledge.

The only living feature of virus is the reproduction. When a virus reaches an appropriate host it hydrolyzes the cell membrane of the host cell & releases its RNA or DNA into it. The nucleic acid then multiplies within the host cell or produces thousands of viral particles. A virus activity like an organism in this manner can only be seen inside a host cell.

Common plant viral diseases are banana bunchy top disease & curly leaf of chilies. Animal viral diseases are influenza, common cold, Dengue & AIDS. It is important to prevent those diseases by knowing about them.

Organisms live in environments in which they can maintain their life. Therefore we can protect them by conserving those environments.

For your attention

You should have the ability to differentiate living from non living after studying the above lesson. You should respect every organism in the environment as they are part of the environment. Spend small time daily to study about the environment. Try to keep a daily record about them. If possible try to keep a environmental diary. Collect relevant information from your teacher.

Summary

- Cellular organization, Nutrition, Respiration, Irritability & coordination, Excretion, Movement, Reproduction, Growth & Development are characteristics of organisms.
- The basic organizational level of an organism is the cell. Multi cellular organisms possess tissues, organs and system level complex organization.
- The process of obtaining energy & material to maintain the life is known as nutrition.
- The cellular respiration is the process by which the end products of digestion combine with oxygen to produce energy inside the cell.
- The ability to respond to the changes in the external or internal environment is known as irritability. The adaptation of the body functions according to those changes is the coordination.
- Removal of waste products of metabolism out of the body is termed excretion.
- Organisms move as a result of coordination.
- Production of new generation for the continuation of their species is termed reproduction.
- The growth is the irreversible increase of dry mass of a cell. During development, cells differentiate to perform a particular function.
- Virus is an acellular form which cannot be differentiated into living or non living.
- All organisms contribute to maintenance and the existence of the environmental balance.

Exercises

Select the correct answer

- (01) Select the correct term for the gap.
Cell → Tissue → → System
1. Organism 2. Organ 3. Organelle 4. Structure
- (02) What is the process that produces energy for cells?
1. Nutrition 2. Reproduction 3. Excretion 4. Respiration
- (03) Select the plant that is not photoautotrophic
1. *Acalypha* (Kuppamenia) 2. *Asparagus*
3. *Loranthus* 4. *Cuscuta*
- (04) Which organ does not act as an excretory organ ?
1. Kidney 2. Skin 3. Stomach 4. Lungs
- (05) Few statements about viruses are given below
A - Virus is a species of organism
B - Virus possess DNA or RNA
C - Virus multiply only within living cells
Correct statements are,
1. A & B 2. B & C 3. C & A 4. All above
- (06) What is the term used to explain all the bio chemical reactions take place in living body?
1. Metabolism 2. Coordination 3. Respiration 4. Growth
- (07) To which group of organisms does Yeast belong?
1. Bacteria 2. Fungi 3. Algae 4. Protozoa
- (08) Select the most appropriate term to define a stimulus.
1. Maintenance of a constant internal environment
2. A change takes place in internal & external environment
3. A change in the external or internal environment that is strong enough to bring about a response
4. Co-ordination between different organs during responding

Technical terms

Cellular organization	- செசுலீசு சுவீடாசு	- கலவொழுங்கமைப்பு
Nutrition	- ஷீசுசு	- ஷோசணை
Respiration	- ஷீசுசு	- சுவாசம்
Reproduction	- ஷீசுசு	- இனப்பெருக்கம்
Movemen	- ஷீசுசு	- அசைவு
Excretion	- ஷீசுசு	- கழிவகற்றல்
Sensitivity	- சுவீசுசு	- உணர்ச்சி
Irritability	- சுவீசுசு	- உறுத்துணர்ச்சி
Co-ordination	- சுவீசுசு	- இயைபாக்கம்
Growth & Development	- ஷீசுசு சுவீசுசு	- வளர்ச்சியும் விருத்தியும்