
UNIT 12 THE LIVING WORLD

Structure

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12.1 INTRODUCTION

This unit is continuation of previous units in which main focus is on various concepts under the theme “The Living World”. This unit will facilitate you in appropriate methods, techniques and strategies to be used while dealing with concepts and sub-concepts under this theme in your classroom. The basic theme of this unit includes the diversity seen in the organic world and how each variety is named. The basic unit of any organism ‘cell’ and their functioning importance will be discussed. Besides various examples of living processes like respiration, circulation, transportation etc., shall also be taken into consideration. The unit also discusses how various organisms give rise to their own kind and during this course what sort of evolutionary changes take place.

12.2 OBJECTIVES

After going through this unit, you will be able to:

- introduce your learners to the living world of our environment,
- enable learners to understand the diversity found in this living world,
- help learners in understanding the concept of nomenclature and naming of organisms scientifically,
- make your learners aware of the basic unit of life ‘cell’
- explain various life processes like transportation, respiration, circulation, etc.

- elucidate the importance of heredity in organism's life, and
- familiarize learners with the evolution of different species.

12.3 DIVERSITY IN PLANTS AND ANIMALS

Learners in your class often ask some questions like, Are we human beings similar to each other? Do we differ from each other in any way? Human beings differ in height, colour, features, etc. Let us take the example of dogs of different breeds like pomeranian, Labrador, Alsatian, etc. Though all are dogs but have distinctive features. When we look at the plants we can see the diversity there too; say for example, the leaves of hilly plants are of small size as compared to the plants found in plains. Aquatic plants have totally different features.

As a science teacher, how will you introduce this concept in your class? Traditional teacher may use a chart of different types of animals and plants and explain the differences but a constructivist teacher requires a different approach. You have to think of an activity which will facilitate learners in developing their own concept of diversity and examine various aspects of diversity among animals and plants.

In order to help learners in understanding this diversity, Mr. Venkat, a science teacher Chennai, used the following activity.

Mr. Venkat asked learners to collect the information and complete the chart given below:

Sl. No.	Characteristics	Smallest/ Shortest	Longest/ Largest
1.	Life span		
2.	Size (naked eye)		
3.	Period of existence on earth		
4.	Aquatic animal		
5.	Land animal		
6.	Plant		

When learners completed the chart, he further added some more dimensions like some plants and animals have life span of days while some have of many years. Variety of plants and animals with different texture, weight, height, size, reproduction etc. can be seen around us. He explained in his class that more than ten million species of plants and animals are present on the planet Earth. The climatic and geographical condition of our planet has made house for diverse variety of living organisms.

You can also plan various activities to introduce the concept of diversity which will help you to lead your learners towards the concept of classification.

Activity 1

Ask your learners to make a project file where they can assemble information and pictures of at least five different:

Insects Birds Trees Climbers Aquatic plants

12.4 NOMENCLATURE, SCIENTIFIC NAMES AND HIERARCHY

When your learners develop an understanding of the vast diversity seen in animals as well as in plants, you can easily visualize the condition when you can help them in understanding the terms like classification, nomenclature, hierarchy, etc.

12.4.1 Classification

You can start with an activity in which you can ask few questions to your learners like:

- How have the learners been grouped in your school to make teaching proper and suitable according to the learners?
- If the groups made in the school are large, are they divided into smaller sub-groups?
- If you are asked to make groups of the learner of your class, how will you do it?

As a teacher, you can explain how so many learners are taught by few teachers only. The learners are divided into different class levels and each level is divided into sections if the numbers of learners at a class level is a lot. The learners in a class can be divided according to their achievement (High, Mediocre and low achievers). Similarly they can be classified into boys and girls.

Aristotle was the first who classified animals according to their habitat — land, water and air. But this classification was not found appropriate as the land, water or air harbored variety of animals and the difficulty was not resolved. So, a need for the better classification aroused where animals/ plants with maximum number of similar characteristics could be grouped together.

Thus, you can introduce that that **“classification is an arrangement of organisms into various groups on the basis of similarities and differences.”**

12.4.2 Hierarchical Classification

Hierarchy means classifying according to the various criteria into successive levels. Here, it means, based on similar characteristics the living organisms have to be broadly divided and in the next level making it more specific regarding similarities. Linnaeus originally placed all living things under plant or animal kingdom but later on the criteria changed.

As discussed earlier, in a classroom, to make certain groups we need some criteria like academic achievement or gender, etc. Similarly for an organism main characteristics used for classification are:

Cell structure: Cells which have well defined nucleus (Eukaryotes) and those not having well defined nucleus (prokaryotes). Besides this, prokaryotes do not have cell organelles which are present in eukaryotes.

Cellular organization: Single celled organisms (Unicellular) and many celled organisms (multicellular). All functions in unicellular are performed by single cell whereas in multicellular, the functions are distributed among specific group of cells.

Nutrition: Whether food is manufactured by the organism (Autotroph) or whether it is derived from some other source (Heterotroph).

Reproduction: whether reproduce asexually or sexually

Evolution: With the passage of time some organisms have undergone little change whereas some have seen drastic change so much so that they may have developed into a new group and thus get a separate place in the classification.

12.4.3 Basic Concepts : Classification

A five kingdom classification was proposed by Robert Whittaker and later on modified by Woese. The bases of the classification are cell structure, organization, nutrition, reproduction etc. The five kingdom system may be depicted as follows:

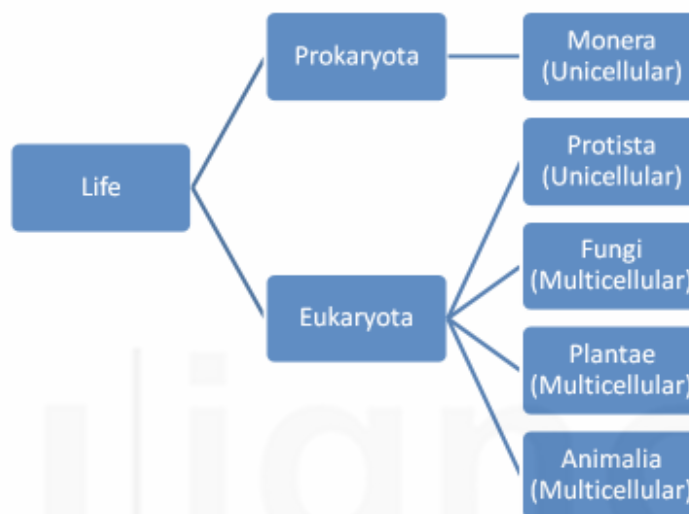


Fig. 12.1: Classification

The basic thing which learners have to understand that any living being (be it plant or animal) is classified in any group on the basis of certain distinctive characteristics.

As a teacher, you should not focus on classification rather you should give your learners exposure to identify the characteristics which are the basis of classification.

Can you plan any such activity which will help your learners in understanding the classification of plants? Try few of the following activities in your class:

Activity 2

In order to explain the classification of plants into monocot and Dicot, bring some plants of both categories and give to learners to feel and note down the differences. You note down the observation of learners in a two column chart and later introduce the concepts like monocot and Dicot.

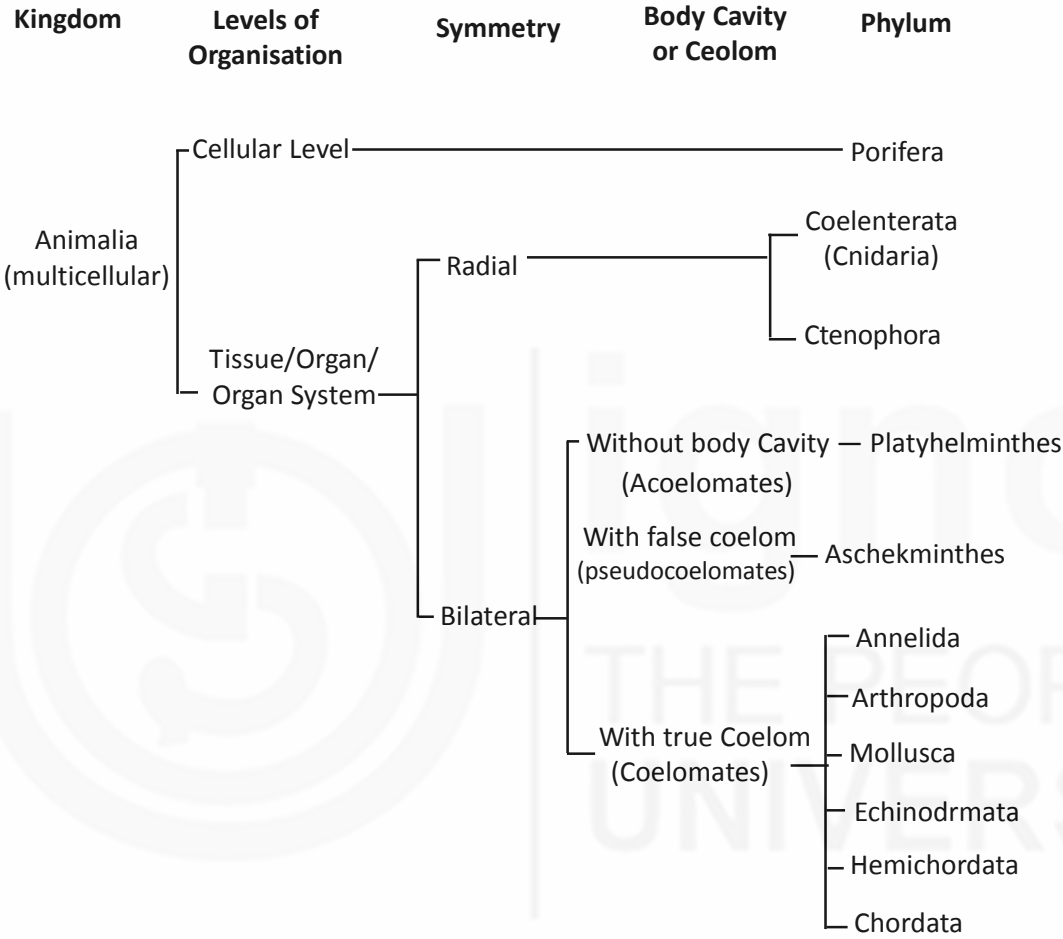
You can ask them to carry out one more activity at their home.

Soak different kinds of seeds available at your home like gram, wheat, maize, peas etc. After they are soaked overnight try to split the seeds. The seeds which split into two are dicots like pea, gram etc. Maize seeds do not split so they are monocot.

If you observe the plant of maize and its leaves you will see parallel venation in it. Uproot a small maize plant and see that all the roots come out of same node or point (fibrous root system). Uproot a pea plant and you will see a main root and branches of small roots (tap root system). Also its leaves have network of veins called as reticulate venation.

Ask learners to list the plants which are examples of monocot and dicot. They can do on the basis of root system, leaf venation or seed cotyledon.

Similarly you can introduce the classification of Kingdom: **Animalia**, if you are able to make them understand the criteria of classification like their level of organization, symmetry, presence of body cavity (Coelom) and finally Phylum. See the following chart:



In order to introduce various phylums, if you use few specimens and allow your learners to examine and note down the distinctive characteristics, it will help them to understand better.

For example, in a class to introduce the Phylum: Porifera, Ms. Suniti, the science teacher, used the sponge available at home, along with specimens of Sycon, Spongilla. She gave it to group of learners and asked them to write similarities among all three. She letter explained that all the animals under this phylum have pores all over body that’s why this phylum is named as **Porifera**.

You can use similar method for introducing other phylum to your learners.

12.4.4 Nomenclature and Scientific Names

Ms. Sayma, Science teacher in a secondary school in Lucknow, called one boy in front of the learners. She asked other learners, what they call a boy in different languages. She got different answers. Few called him 'ladka' in Hindi, 'balakah' in Sanskrit, 'munda' in Punjabi and so on. Then she asked, how do we know that we are talking about the boy if we do not know the language? Is there any one common word across the languages which can be use for a boy? Class said no. The Sayma told to class that similarly it is difficult for scientific world to recognize a particular animal or plant by its common name as it is different in different languages. Therefore scientific community decided that each organism should be given a scientific name which should be same across the world. Thus she introduced the concept of nomenclature and scientific names.

You know that Carolus Linnaeus introduced this system of scientific naming or nomenclature in the 18th century. The hierarchical classification helped in giving scientific names to an organism. Linnaeus hierarchical classification was based on arranging the organisms into groups according to the characteristics becoming more and more specific till we reach 'species' which is the smallest unit of classification. Organisms that are similar in characteristics at all level i.e. from kingdom to the genus and whose members can interbreed are called 'Species'.



Figure 12.2: Levels of Classification of Animals

You should clarify to your learners that there are various levels undertaken during classification and all cannot be mentioned while naming any organism. Therefore, its name is limited to writing the genus and the species to which it belongs. All over the world this system of giving scientific names in Latin forms is accepted. The naming of species and other taxa follows certain rules and conventions; The International Code of Botanical Nomenclature (ICBN) for plants and the International Code of Zoological Nomenclature (ICZN) for animals. The basic rules followed for scientific naming are:

- ‘Genus’ starting with capital letter
- Followed by ‘species’ beginning with small letter
- Hand written scientific name must be underlined
- Printed one should be in italics

For eg: Human being/ Man = *Homo sapiens*

Frog = *RanaTigrina*

China rose (Gurhal in hindi) = *Hibiscus rosa-sinensis*

Betel palm (Supari in hindi) = *Areca catechu*

This type of nomenclature is known as binomial nomenclature.

Activity 3

Ask learners in your class to enlist the animals and plants they observe around them in their surrounding. They should be asked to develop a chart showing common name and scientific names of these animals and plants. Display the charts prepared by your learners on your bulletin board.

Check Your Progress

Note : a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

1) What is “binomial nomenclature”?

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2) a) Name the kingdom of organisms which is unicellular, eukaryotic and prepares its own food

b) Name the group of organisms with no defined nucleus or organelles and is unicellular

3) What does “species” mean?

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12.5 CELL AND CELL ORGANELLES

Whenever a teacher introduces the concept of cell, generally he starts with an example of constructing a building, where the basic unit required is 'brick'. Similarly, the organism body has a basic unit. You can ask your learners if they have seen a wooden cork. If you allow them to observe it under a lens, they will see small box like structures.

Here, you can introduce that these small box like structures are cells. Robert Hook called these as 'cells' which means 'little room'.

Let us see an example of how a teacher has introduced the concept in his class.

Mr. Bhuwan, a Science teacher in a secondary school of Dehradun (Uttarakhand) asked his learners to bring onion with them. He went to laboratory with all learners and asked them to take a peel from an onion with the help of forceps. He carefully placed it on a slide and stained it with a drop of saffranine solution. He mounted a cover slip over the stained piece avoiding any air bubble. He placed the slide under a microscope and asked learners to observe one by one. Learners informed him that small blocks with dot in the centre can be seen. Mr. Bhuwan informed the class that these structures are called cells. Similar group of cells can be seen in leaf peels, root tip, etc. with the help of microscope.

He further explained that there are various organisms comprising of single cell only like amoeba, paramecium, chlamydomonas, bacteria, etc. These are called unicellular organisms where 'uni' means one. Organisms comprising of group of cells are called multicellular organisms. In unicellular organisms all functions are performed by one cell. The work is divided amongst the organelles present inside that cell. In multicellular organisms the functions are divided amongst specialized group of cell. Schleiden & Schwann gave the cell theory which states that all plants and animals are composed of cells and that the cell is the **basic unit of life**.

12.5.1 Structure of Cell

When learners observe the slide of onion peel, they must have seen that each box (cell) has an outer covering and inside it was a dark dot like structure surrounded by many small dots.

Various parts of a cell can be explained with the help of a chart. Case you can take that the structure of a cell should be well labeled and preferably it should be a colored chart.

As teacher you can introduce following parts of a cell with the help of a chart and later ask your learners to draw a cell and label all its parts.

If possible, you can prepare/use models of plant and animal cell also, through which you can ask the learner to differentiate between plant and animal cell.

Here is one activity, which you can use in your class to introduce the concepts like osmosis.

Put some dried raisins in water and soak them for some hours. What do you observe? The raisins are no more shriveled but are swollen and soft as the water has gone inside it by osmosis. Now add some salt in water and put these swollen raisins in it. They will shrink again after some time because the water concentration has lessened and dissolved salt concentration has increased as a result absorbed water is passed out. Similar activity can be tried by using dried apricot.

You can also introduce the concept of nucleus with one more activity, which could be performed along with the previous activity of observing an onion peel slide.

With the help of a toothpick try to scrape the inside lining of your cheeks gently, without hurting yourself. Now place whatever has been scraped on to the slide. Put a drop of methylene blue stain on it. Cover it carefully with a cover slip exactly as you did while preparing onion peel slide. Now ask learners to observe it under the microscope. Ask them questions, like, what do you see? Can you see any similarity between onion and cheek cells? Did you see any dark dot like structure in each cell?

This is almost centrally located dot like structure is nucleus. It has double layered membrane with pores for transfer of material in and out of it to the cytoplasm. Eukaryotic nucleus contains chromosomes about which we shall discuss in latter part of the unit. Nucleus has important role in cellular reproduction where cell divides into two new cells. Some organisms have undefined nuclear region called as nucleoid. This is usually found in prokaryotes.

Activity 4

Plan some activities to introduce the cell organelles like mitochondria, Golgi apparatus and plastids, vacuoles, endoplasmic reticulum, etc.

While planning the activity, learners’ participation should be ensured to make them understand the roles of these organelles.

Check Your Progress

Note : a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

4) Write down difference between prokaryotes and eukaryotes.

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5) Why is mitochondria called as “Power house” of the cell?
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12.6 LIFE PROCESSES

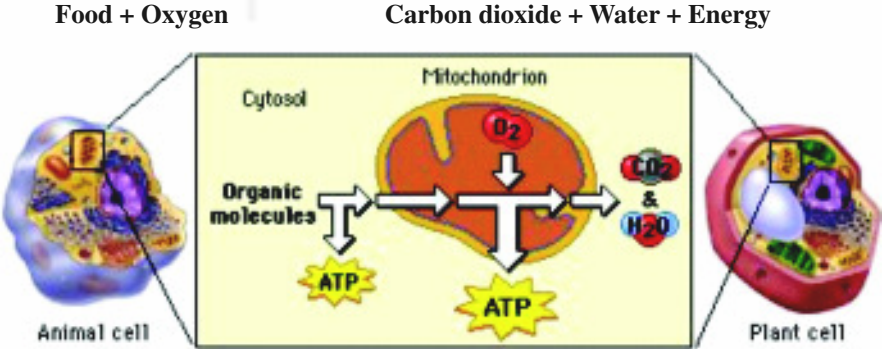
As a science teacher, at secondary level, you have to explain various life processes in animals and plants. In this section, few examples have been discussed, like respiration and transportation. You can use many similar approaches or devise your own method to deal with such topics.

12.6.1 Respiration

We have discussed in Unit 10 that all organisms need food in order to get energy and also for the growth of the body. Children often ask how organisms get energy by taking food. Similarly, they may be aware that all living organisms take in Oxygen and give out Carbon dioxide but many a times they ask if plants also require oxygen for respiration as human beings do. Children may not be aware about the role of oxygen in combustion of food in the cell and for generating energy. All these are part of the process of respiration but for children respiration means simply inhaling air and exhaling carbon dioxide. Let us discuss these processes.

Respiration and Breathing

As Science teachers, we know that the food taken into the body is digested when molecules are burnt in the cells using oxygen with the release of energy, producing carbon dioxide. This energy is stored in the cells in some special molecules. In the cell, the food (glucose) is broken down into carbon dioxide and water using oxygen. In most of the living beings, breakdown of glucose occurs with the use of oxygen this is called **aerobic respiration**.



Source: http://www.phschool.com/science/biology_place/biocoach/cellresp/intro.html

The process of respiration takes place in smallest unit of body i.e. the cells, hence it is also known as **cellular respiration**. This process is common to all living organisms.

Food can also be broken down without using oxygen. This is called **anaerobic respiration**. Breakdown of food releases energy. e.g. yeast. Sometimes, anaerobic respiration takes place in our muscles also. It produces lactic acid and carbon dioxide.

Many a times children get cramps after heavy physical exercise, race or participation in games. You may have also observed players getting retired hurt in cricket due to muscle cramps in hot and humid weather. This occurs due to the excess need of energy, anaerobic respirations takes place in muscles and excess of lactic acid causes cramps.

The process of cellular respiration is a bit complex for children at elementary level because in cellular respiration, chemical reaction takes place in the cell. Children at this stage are not introduced to cell organelles such as ribosome, mitochondria, etc. and are also not able to understand complex cycles at Adenosine Triphosphate (ATP) formation. You can think of organising a role play on cellular respiration. An example is given in the box.

Banas proposed a role play in a blog entitled “How to Teach Cellular Respiration to Kids”. Here are the steps proposed by him, which you can also repeat in your class.

- 1) Explain to the students that the classroom is a plant cell, the tennis balls represent molecules of oxygen, the textbooks represent food molecules and the racquet balls represent molecules of ATP.
- 2) Assign five students to be Mitochondria, five students to be Chloroplasts and five students to be Oxygen carriers. Have them make signs that reflect their roles and tape them to their backs.
- 3) Give each Mitochondrion student a racquet ball and ask him to put it in his pocket. Give each Chloroplast student a textbook, and each Oxygen carrier a tennis ball. Send the Oxygen carriers into the hall and tell them that you will let them know when to come in and give their Oxygen molecules (tennis balls) to the Mitochondria students.
- 4) Explain that in a plant cell, Chloroplasts make food through Photosynthesis and Oxygen enters the cell from the air surrounding it. Both the Oxygen and the food molecules go to the Mitochondria, where they are both used in a series of chemical reactions—called cellular respiration—to create ATP molecules.
- 5) Turn off the classroom light. Then turn it back on and explain that Photosynthesis has begun. Instruct the Chloroplast students to hand off their food molecules (textbooks) to the Mitochondria students.
- 6) Instruct the oxygen carriers to bring their Oxygen molecules (tennis balls) into the plant cell (classroom) and hand them to the Mitochondria students.
- 7) Instruct the Mitochondria students to throw their ATP molecules (racquet balls) around the room as soon as they receive an Oxygen molecule and piece of food. They should store the textbooks and tennis balls under their desks. The loose racquet balls symbolize the energy molecules that Mitochondria release into the cell for use in metabolic processes.
- 8) Let the students perform this process on their own a couple of times. Once they see this simple and hands-on illustration of how Mitochondria use the raw materials of oxygen and food to produce ATP molecules, they are not likely to forget it.

Retrieved from: http://www.ehow.com/how_6345587_teach-cellular-respiration-kids.html#ixzz2fDZsya1W

Cellular respiration is the process of energy generation by using Oxygen but getting oxygen for this is called the process of breathing.

You can explain children about breathing very easily. **Breathing** means taking air with Oxygen in and giving our air with Carbon dioxide. You should introduce the two associated terms i.e. **inhalation and exhalation** along with breathing.

You can ask children to inhale air, hold it for a few seconds and then release it. You should correlate the concept of inhalation and exhalation with these activities to give them real time experience of these two processes of breathing. You should also explain to them about the breathing rate.

Activity 5

- Ask children to count the number of times they breathe in and breathe out in one minute. You can give them a table to fill under different conditions as follows:

Breathing situation	Breaths in a minute
Normal sitting in classroom	
After playing football or badminton for 20 minutes	
After running 100 meters sprint	
On taking rest for 10 minutes after running	

From above table you can explain not only the concept of breathing but also explain that when we need extra energy at fast rate, we breathe more. Fast breathing supplies extra Oxygen for faster energy production in our cells. On an average, we breathe about 15-18 times in a minute.

We should clearly explain the difference between cellular respiration and breathing also. You can use following table for differentiation.

Breathing	Cellular Respiration
1. It is physical process wherein exchange of gases (O_2 and CO_2) occurs.	1. It is chemical process wherein the food molecules get oxidised to Carbon Dioxide and water.
2. It takes place outside the cells.	2. It takes place inside the cells.
3. Enzymes are not involved.	3. Enzymes are involved.
4. No energy is released.	4. Energy is released.
5. It generally takes place in higher animals.	5. It takes place in all plants.

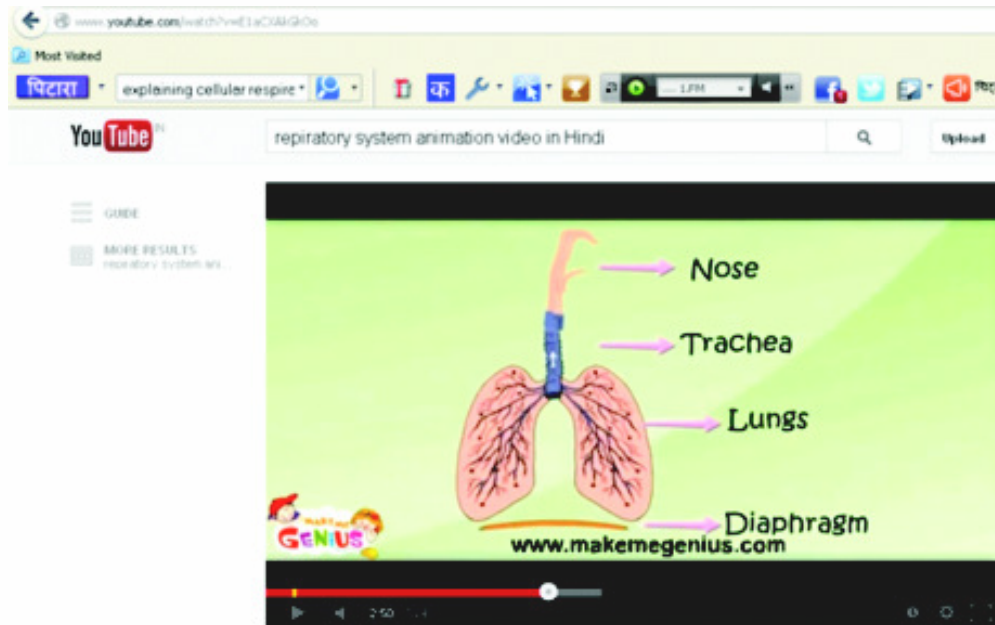
The process of breathing needs to be explained along with the human respiratory system. But, first you will have to introduce organs of human respiratory system. To do this, it will be better to use a working model of human respiratory system or an animation video, because children have no concrete idea about the structure and functioning of lungs, trachea or pharynx.

Children can experience breathing in and breathing out as well as change in the diameter of chest cavity during breathing.

Here are a few video links, which you can use to explain the structure and functioning of human respiratory system.

<http://www.youtube.com/watch?v=E1aCXAkGkOo>, http://www.youtube.com/watch?v=RPdGQ-A_yM4

One screenshot of a video available in given below.



Human Respiratory (Breathing) System -Hindi (हिंदी) for Children

Fig. 12.2

In the absence of video or no access to internet facility, you can use a chart or a working model. If these are not available, you can perform some simple demonstrations. One such demonstration has been explained in NCERT Science textbook of Class VII. Here it is being reproduced.

Take a wide plastic bottle. Remove the bottom. Get a Y-shaped glass or a plastic tube. Make a hole in the lid so that the tube may pass through it. To the forked end of the tube fix two deflated balloons. Introduce the tube into the bottle as shown in the figure below. Now you can seal the bottle to make it airtight. To the open base of the bottle tie a thin rubber or a plastic sheet using a large rubber band.

To understand the expansion of the lungs, pull the rubber sheet from the base downwards and ask children to watch the balloons. Next, push the rubber/plastic sheet up and ask children to observe the balloons.

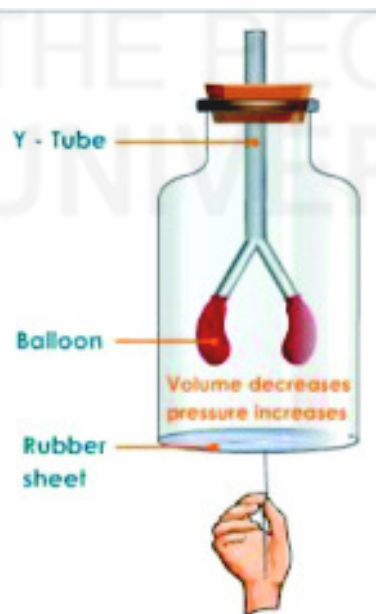


Fig. 12.3

Draw a simple representative diagram on the board and relate the process with your demonstration. It will help children to visualize the actual working of respiratory system in human beings.

Breathing in Other Animals

When you explain about breathing in human beings, children may ask you about how breathing takes place in other animals. As we said earlier, respiration takes place in all living beings but the ways of respiration are different. Some animals have similar systems as in human beings like elephant, lion, cow and some have some special adaptation due to their habitats and body structures.

For example, **Sponges and jellyfish** lack specialized organs for gas exchange and **take in gases directly from the surrounding water**. **Flatworms and annelids** use their **outer surfaces** (skin) as gas exchange surfaces. **Amphibians** use their **skin** as a respiratory surface. **Fishes** use **gills**.

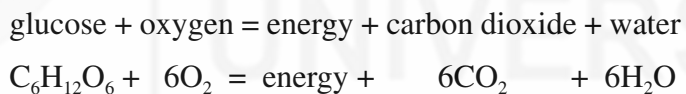
Activity 6

- Plan a pictorial puzzle on the basis of animals and their breathing organs. Give it to children for practice.
- You can organize a small quiz with some statements hinting about adaptation and habitat of animals and ask children to reflect the organs involved in breathing, based on your hints.

Respiration in Plants

We have already discussed that all living beings respire and plants are not an exception. They also respire by taking Oxygen in and giving out Carbon Dioxide. Like all other living beings, plants also need Oxygen to generate energy. Plants get Oxygen through root hairs from the gap between the soil particles. This Oxygen is used by plant cells.

During **respiration**, plants convert the sugars produced through Photosynthesis back into energy for growth and other life processes (metabolic processes). The chemical equation for respiration shows that glucose is combined with Oxygen releasing energy, Carbon Dioxide, and water. A simple chemical equation for respiration is given below. You can also notice that the equation for respiration is the opposite of that for photosynthesis.



Check Your Progress

Note : a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

6) Differentiate between aerobic and anaerobic respiration with an example.

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12.6.2 Transportation

Like respiration, transportation of food, water and Oxygen is an essential process in all living beings. In every animal and plant food, water and oxygen is transported to the basic unit of body i.e. the Cell. Processes of transportation are different in animals and plants. Give children an opportunity to explore the functions of various systems of transportation in human beings as well as in plants. In human beings, the main transportation systems are the circulatory system and the excretion system while in plants food and water is transported through the Xylem and the Phloem. Let us discuss in detail about these systems one by one.

Human Circulatory System

While discussing about the human circulatory system, new concepts like blood and its structure, blood circulation through arteries and veins, structure and function of heart, functions of blood, etc.

Children at the elementary level are not able to understand many complex phenomenon of the circulatory system but they are aware of the presence of the heart, its major function of blood circulation, heart beats and pulse rate, etc. We can use the basic knowledge of children for linking with major concepts of the circulatory system.

Ms. Barkha, a Science teacher wants to introduce the circulatory system in her class. She took some used drip transfusion tubes and balloons and prepared a model of the circulatory system. She used a big balloon filled with red colour as heart and a few smallest balloons of different colours as different organs. She attached all the organs with the central balloon and pushed it so that the red colour was pushed to all the other balloons.

She also drew a diagram of the human circulatory system on the board and explained that the heart pumps blood to different body parts, which reaches there through vessels and also comes back to the heart through separate vessels.

To explain all this more effectively, she used a video animation available in her library. Children concentrated more on that video and the teacher was able to introduce many related concepts with ease.

As a teacher, you can also use a variety of resources as per their accessibility and availability in your school. You can use charts, working models, role play, animation video, invited talk by scientist/doctor, etc. to provide the right kind of learning opportunity to children. Let us discuss about a few basic concepts related to the system.

Blood: Children are familiar with blood, its colour and its existence in the human body. They also know that it is in liquid state and is pumped by the heart through vessels to different parts of the body. Though children know about the existence of blood in the human body, they may not be aware about its importance in transportation as well as its constituents.

You have to explain to children that digested food components from small intestine to cells, Oxygen from the lungs to the cells and waste material from the cells to the kidney are being transported by blood. Children may ask you how blood carries all these materials. For this, you can explain the structure of blood. The following table explains about the components of blood in brief.

Table 12.1: Components of Blood and their functions

Component	Characteristics	Functions
Plasma	Fluid part of blood	Flowing through vessels, medium for blood cells, transport food to cells
Red Blood Cells (RBC)	Contains red pigment called hemoglobin	Binds oxygen and transport it to cells
White Blood Cells (WBC)	White coloured cells of many types, also known as leukocytes	Fight with germs and maintain immunity in body
Platelets	Highest numbered cells	Help in clotting of blood

Blood Vessels: In the previous demonstration, we have discussed that blood moves through the blood vessels from the heart to different body organs and vice-versa. Blood performs two major roles, one to supply Oxygen and food material to different cells and second, to collect Carbon Dioxide and waste from the cells. For this role, there are two types of vessels in our Circulatory System, commonly known as the **arteries** and the **veins**.

How can the experience of blood vessels be given to children? See the following example:

Mohsin the Science teacher in an elementary school, held tightly his upper arm and closed his palm tightly. Soon some bluish blood vessels were visible on the inner side of his elbow. He showed them to the children and asked them to reflect and find out the reason. Children observed that there were some thick and thin vessels of bluish colour, these were the **veins**.

Mohsin also asked children what does a doctor count by holding the patients' wrist?

Ramya replied that the doctor counts the pulse. Mohsin further asked, what she meant by pulse?

Children were not able to answer, Mohsin told them that pulse is the throbbing in the **arteries** due to the flow of the blood.

He also told the class that the number of times of the pulse throbs per minute is called the **pulse rate**, which is around 72-80 for a normal healthy person. He asked children to count their own as well as their classmate's pulse rate.

You can use such activities in the class.

We all know that the arteries carry fresh Oxygen rich blood to different organs and the veins bring Carbon Dioxide rich blood from different organs to the heart again. You must have read that Pulmonary artery and Pulmonary veins are an exception as pulmonary arteries carry impure blood from the heart to the lungs and the pulmonary veins carry pure blood from the lungs to the heart. Veins have valves, which allow flow of blood only towards the heart. You can explain to children that arteries are further divided into extremely

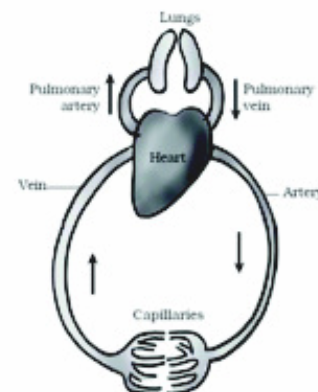
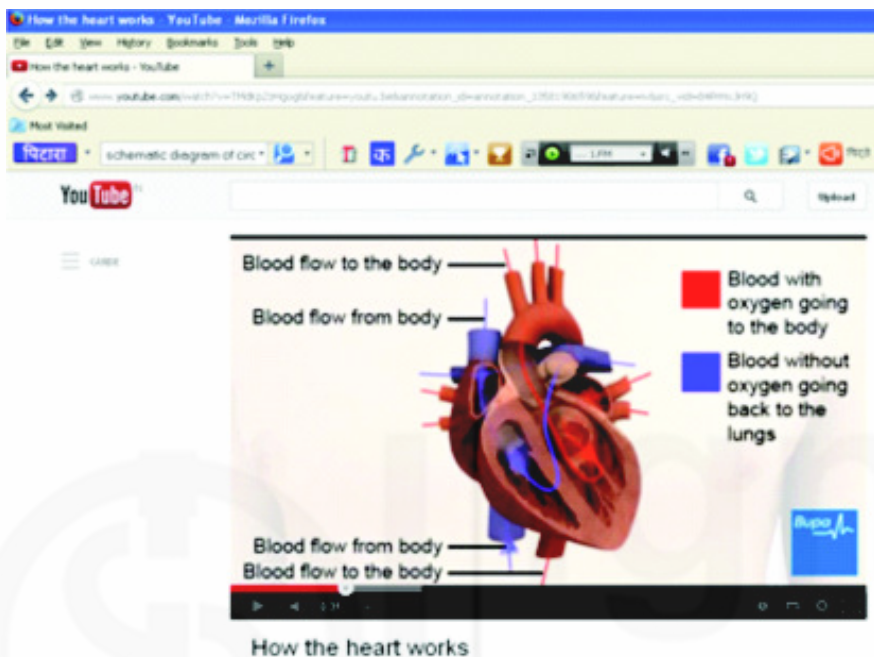


Fig. 12.4

thin capillaries, where exchange of Oxygen and food material takes place and these capillaries further join up to form veins.

Heart

Heart is one of most important organs of the human body and we are all aware of this fact. Children also have a basic idea about the major functions of the heart, i.e., pumping blood and its continuous working. They also have an idea that if the heart stops functioning, it causes a heart attack, which can lead to death. The basic structure and the functioning of the heart can be explained to children by using a working model of the heart or an animation video. The teacher can use a still model or a coloured chart in case a working model or an animation is not available.



Source: http://www.youtube.com/watch?v=TMdKp2zHgog&feature=youtu.be&annotation_id=annotation_1058190659&feature=iv&src_vid=84PrHxJri9Q

We have to discuss with children about important chambers of the heart, the major arteries and the veins. The Oxygen rich blood comes to left atrium and from there goes to the left ventricle, which pumps it to all the body parts of the body through the aorta and its connected arteries. Carbon dioxide rich impure blood collected by the veins comes through the vena cava to the right atrium and from there to the right ventricle, which pumps it to the lungs for purification. Children can also feel the heart beats of other children to get a feel of this process.

Activity 7

Take a doctor's stethoscope and give to children in your class one by one. Ask them to feel their heartbeat and also to count the number of heart beats per minute. Ask them to count their pulse too and give them an opportunity to identify the relation between the two.

Similar to the circulatory system, the excretory system also has its role in transportation. Let us discuss about it in brief.

Transportation in Plants

We have already discussed in Unit 10 that plants produce food through Photosynthesis in their green parts. Let us see how a discussion held in a class on this topic, reflects the need of explaining the concept of transportation in plants.

Ms. Srisha wanted to introduce the topic of transportation in plants in her class. She asked a few questions to children and the children replied based on their knowledge and understanding of the topic, they also raised a few questions.

Srisha (to children): In which part of the plant, food is produced?

Rohan: In the leaves and green parts of the stem.

Srisha: Good. For what kind of activities, food is required by the plants?

Sanjana: For the growth, for development of fruits, etc.

Srisha: From where do plants get nutrients for growth and food formation?

Abram: Mam, they get Oxygen from the air and underground water from the soil.

Subhash: Mam, my father is a farmer. He told me that we provide fertilizers and other nutrients like potash, NPK, etc. for a better growth of the plants.

Srisha: Very good, Subhash and Abram. Now tell me, how do the water and minerals mixed in the soil reach all the cells in the leaves and the stem?

(Children start discussing and giving many answers)

Srisha: Do you know? Plants also have a definite system of transportation of water and food.

Children: Hmm...What is that system mam?

Srisha: That system is made up of some vascular tissues named as Xylem and Phloem. Let us discuss about them in details.

Like Srisha, you can also introduce the concept of transportation in plants. You can demonstrate a few activities suggested in the Science textbook to explain the concept effectively.

Tell children that water and minerals are absorbed through hairs present in the roots. Absorbed minerals are dissolved in water and transported to various parts of the plant like the leaf and the stem through the pipe like vessels made up of special tissue known as the **Xylem**.

There is another tissue system in plants for transportation of synthesized food from leaves to all the parts of plants is known as the **Phloem**. Xylem and Phloem are known as **vascular tissues**.

Activity 8

To show movement of water through Xylem upward in higher plants

Materials: Two fresh carrots, beak, water, red ink, knife.

Procedure: Take two fresh carrots. Cut off their lower tips. Place them in water with the lower tip down containing red ink. Leave the setup for 3 hours. Then take the carrots out. Cut one of the carrots horizontally (cross-section), and the other one vertically (longitudinal section).

Observation: Children will see red colour in the central cylinder in both the carrots.

Inference: Xylem vessels transport water upwards.

Activity 9: To show transportation of food materials in plant.

Materials: A potted plant and a knife.

Procedure: Gently remove about 1 cm of the superficial part of the stem of this plain containing Phloem (at a place lower than the leaves) with the knife. Take the help of your teacher. Take care that you do not cut the central cylinder, Xylem. Leave the plant for one week. Continue to water it as before.

Observation: Children will observe that the part of the stem above the girdled cut is swollen while the lower part has not changed at all.

Inference: The food was not transported below the girdled part. It accumulated above the girdled part. It accumulated above the girdle and that part of the stem shows swelling.

Check Your Progress

Note : a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

7) Discuss the functions of Xylem and Phloem.

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12.7 EVOLUTION

While starting discussion on evolution, you can ask your learners — How many of you have seen the movie “Jurassic Park” or heard about dinosaurs? Why do we not find them around us, today? How did we come to know that they existed before we came on earth? Are there any evidences which support their existence in the past? What was the reason behind their disappearance? Guess, how did human evolve on this earth?

There are various questions which arise in learners’ minds when they see or read about the wide variety of organisms around us. How did these varieties evolve on this earth? You can tell them that “Evolution” means to unroll or that it is the gradual transformation of already extinct or existing living things to the new organisms. Evolution has occurred in all these years can be explained by various evidences.

In order to move forward on the topic “evolution” you can use following activities.

Ask your learners to find out similarities between Man & Cow; Bird and Bat; Frog and Fish, etc. then you explain to the learners that how:

- Man & Cow have two pair of limbs but man walks on one pair (hind limbs) whereas cow walks on both pairs (fore and hind limbs)
- Bird & Bat both can fly but bird has only two legs to walk and feathers to fly whereas bat has two pairs of limbs and fore limbs are modified into wings to fly.
- Frog & Fish both can live in water but frog can live on land also.

Thus, you can help your learners in identifying many similarities and dissimilarities between many organisms. This indicates that similarities show common ancestry & dissimilarities show changes occurring in them with passage of time and this is called evolution. As already discussed the forelimbs of bats are modified into wings for flying and that of human beings for holding things and in cows for walking. These type of organs which have same origin but different functions are called **homologous organs**. On the other hand the forelimbs of bats are used for flying and in birds feathers and muscles are used for flying. These type of organs which have different origin but same functions are called **analogous organs**. You can further elaborate these concepts with the help of following activity.

Activity 10

Ask learners to make a list of various animals having analogous and homologous organs. Then discuss them in the next class.

Another important evidence of common ancestry is the embryo stage of vertebrates. This was first observed by Ernst Haeckel who then gave “biogenetic law”. This law says that “ontogeny recapitulates phylogeny”. Ontogeny means biological unfolding of events involved in an organism changing gradually from a simple to a more complex level. Phylogeny means sequence of events involved in the evolutionary development of a species. You can use following activity to elaborate the concept.

Ask learners to observe each other’s eyes. Tell them to write down what parts can they see. Guide them to look at the inner corner of the eye. A red colored small fold of skin called nictitating membrane is present which is of no use for us but it is functional in frogs, birds etc. These non-functional organs are called **vestigial organs**. Other examples are non-functional vermiform appendix in humans but they are functional in ruminant animals like rabbit.

Now you come back to the question which was mentioned in the beginning of this topic. The information about dinosaur, its existence and its extinction has been evident by their fossils found. Fossils are the remains or the impression of a plant or animal that existed in the past and are found in the ground after excavation.

Check Your Progress

Note : a) Space is given below to write your answer.

b) Compare your answer with the one given at the end of this Unit.

8) Can the blood of any group be transfused to anyone? Why?

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9) Fill in the gaps

Air → → Nasal cavity → → Bronchioles →

12.8 LET US SUM UP

The living world has so many mysterious things in it. The diversity in the living world can be seen wherever we go. The organisms differ in their shape, size, color, habitat, nutrition, reproduction etc. To overcome the problem to study them easily, the concept of classification was introduced. Also scientific names were given to each organism known and these names are technically acceptable everywhere. Each organism is made up of basic unit called cell. Each cell has important constituents in it which helps it to undergo all life processes like transportation, respiration, circulation, reproduction etc. some of the examples of life processes have discussed in detail. Besides this, how the progenies continue by heredity and how new species evolved by modification and survival instincts have been understood. We must ensure that the explanation of these topics should be made with help of models, charts or videos.

12.9 UNIT END EXERCISES

- 1) What is the hierarchical system of classification currently followed?
- 2) How will you teach classification to your learners so that they listen to it with interest and understand easily?
- 3) What is the difference between:
 - Diffusion & Osmosis
 - Inhalation & Exhalation
- 4) How does the functioning of right and left auricles and ventricles differ?
- 5) How is sex of a child determined?
- 6) Differentiate between analogous and homologous organs.

12.10 REFERENCES AND SUGGESTED READING

- Science & Technology, Book for Class IX, NCERT
- Science & Technology, Book for Class X, NCERT

- Science for Ninth Class, Biology, S.Chand
- Science for Tenth Class, Biology, S.Chand
- <https://en.wikipedia.org/wiki/https://en.wikipedia.org/wiki/>
- www.boundless.com/biology/textbooks
<http://www.boundless.com/biology/textbooks>

12.11 ANSWERS OF CHECK YOUR PROGRESS

- 1) It is the kind of naming of any living being in which the scientific name of an organism has two components: first is 'Genus' and second is 'specie'
- 2) (a) Protista (b) Monera
- 3) Species is the smallest unit of hierarchical classification having organisms that are similar in all essential aspect like structure, function and can interbreed. They have descended from a common ancestor and have similar genetic material.
- 4) Difference between Prokaryotic cell and Eukaryotic cell

Prokaryotic cell	Eukaryotic cell
Generally small (1-10 um, 1um=10 ⁻⁶ m)	Generally large (5-100 um)
Not well defined nuclear region (nucleoid)	Well defined nucleus
Single chromosome	More than one chromosomes
Membrane bound organelles absent	Membrane bound organelles present

- 5) Mitochondria, present in a cell provides required energy in the form of ATP (Adenosine Tri Phosphate) for various chemical activities during life processes.
- 6) In most living beings, breakdown of glucose occurs with the use of oxygen in the cells. This is called **aerobic respiration**. Food can also be broken down without using oxygen. This is called **anaerobic respiration**. e.g. yeast. Sometimes anaerobic respiration takes place in our muscles also. It produces lactic acid and carbon dioxide.
- 7) Difference between Xylem and Phloem

Xylem	Phloem
Tube like structure, carry water and minerals salts from soil to other parts	Tube like structure, carry prepared food to other parts of plant to carry out functions
Vessels and tracheids are its components	Consist of sieve tube & companion cells

- 8) No, before transfusing blood from donor to the recipient the blood group as well as Rh factor should be matched. If this is not done then clotting may occur which may prove fatal to the recipient.
- 9) Nostrils, Trachea, Lungs.