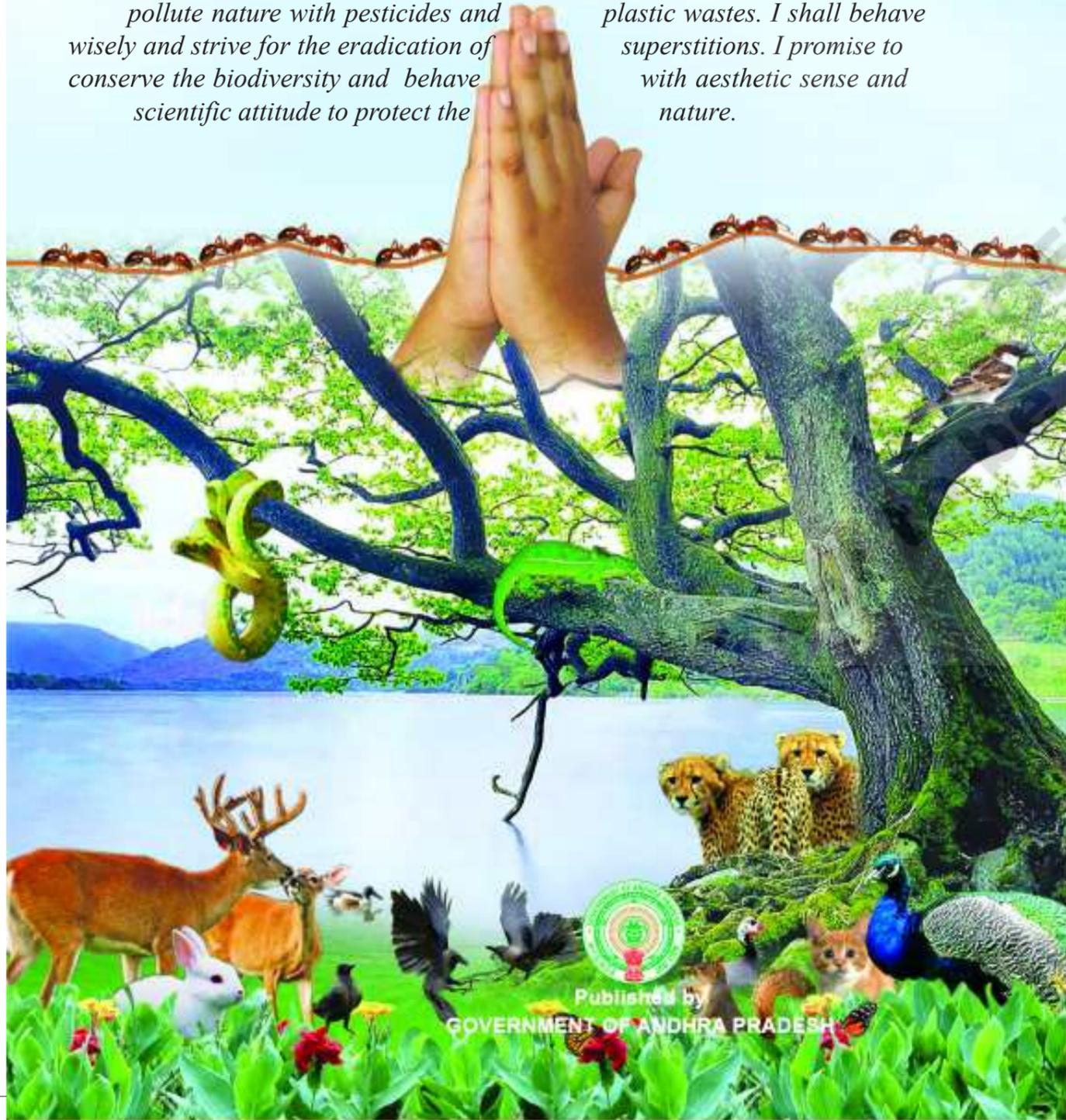


NATURE PRAYER

I humbly, bow to the flocks of birds whose twitterings make melodious morning song and streams of trees whose greenery swathe the mother earth and fill the air with glorious gases.

O! my mother earth, I take the message of dignity of hard work through never resting ants and the strength of unity through flocks of crows. I realize that twinkling squirrels and tangling leopards also have right to live like me. I promise that I shall not disturb their habitat, I shall not misuse the natural resources and pollute nature with pesticides and plastic wastes. I shall behave wisely and strive for the eradication of superstitions. I promise to conserve the biodiversity and behave with aesthetic sense and scientific attitude to protect the nature.




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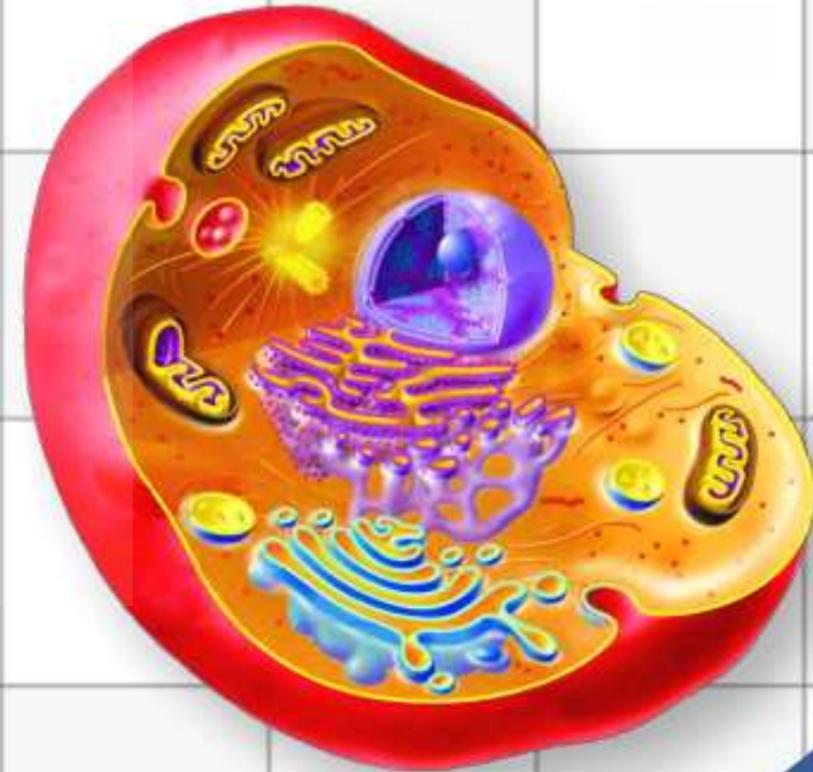
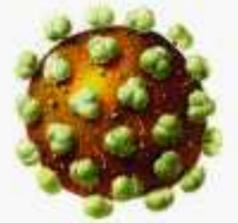
CLASS 8



Biology

F

CLASS 8



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APLEA OF SPARROW

It's okay

Our chirpings are sure to make you sick

When you get them all just with a click

Gone are the days when were auspicious

Today our existance is suspicious

We wonder...!

When was the time I lost my friends

Who chreed us at every single act

When did the slabbed roofs, pesticides

And cells towers came as

a night maring fact

We are sure to die with no plce to live

We question you as we have

no answer to give

When fore sight is far sighted

List of to be extinct is highlited

Today it's US

Tomorrow.....



INSPIRE AWARDS

Inspire is a National level programme to strengthen the roots of our traditional and technological development.

The major aims of Innovations in Science Pursuit for Inspired Research (INSPIRE) programme are...

- Attract intelligent students towards sciences
- Identifying intelligent students and encourage them to study science from early age
- Develop complex human resources to promote scientific, technological development and research

Inspire is a competitive examination. It is an innovative programme to make younger generation learn science interestingly. In 11th five year plan nearly Ten Lakhs of students were selected during 12th five year plan (2012-17) Twenty Lakhs of students will be selected under this programme.

Two students from each high school (One student from 6 - 8 classes and one from 9 - 10 classes) and one student from each upper primary school are selected for this award.

Each selected student is awarded with Rs. 5000/-. One should utilize 50% of amount for making project or model remaining for display at district level Inspire programme. Selected students will be sent to State level as well as National level.

Participate in Inspire programme - Develop our country.



Child Line - 1098 is a 24 Hours National Emergency Service to save the children who need protection.

Please make a call - save a life.



BIOLOGY

CLASS VIII

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Title Page 200 G.S.M. White Art Card

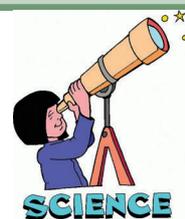
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WHAT IS SCIENCE



It is amazing to think of the facilities available today when compare with primitive man. Computers, mobile phones, internet, space shuttles, robotics, hybrid food grains, medicines, etc are all the results of ideas which originated in some human brains. They are all the people who think differently to observe and understand the nature in a specific way. Let us understand how they think and what they do.

What is science?

Science is the concerted human effort to understand or to understand better, the history of the natural world and how the natural world works, with observable physical evidence as the basis of that understanding. It is done through observation of natural phenomena, and/or through experimentation that tries to simulate natural processes under controlled conditions. Science is a process of thinking.

Science is an organized study of knowledge which is based on

experimentation. Science is a tool for searching truths of nature. Science is the way of exploring the world.

Questioning is the primary or fundamental step in scientific thinking. There are so many things around us which sprout doubts in our minds. Ofcourse they may be problems. Let us observe the following experiences, you too add your observations to enrich the list.

1. Why leaves fall from the tree when they turn in yellow?
2. How ants identify sweets kept in a tin?
3. Why can not we see stars during day time?
4. Pickles do not spoil but sambar gets spoilt, why?
5. Farmers are afraid of unseasonal rains and uncontrolled pests. How to solve these problems?
6. Why diseases occur and how to prevent and cure?

Consider some examples. An ecologist observing the territorial behaviors of blue birds and a geologist examining the

distribution of fossils in an outcrop are both scientists making observations in order to find patterns in natural phenomena. They just do it outdoors and thus enlighten the general public. An astrophysicist photographing distant galaxies and a climatologist shifting data from weather balloons similarly are also scientists making observations, but in more discrete settings.

The examples above are of observational science. There is also experimental science. A chemist observing the rates of one chemical reaction at a variety of temperatures and a nuclear physicist recording the results of angular momentum of a particular particle in the circular path are both scientists performing experiments to discover consistent patterns emerge. A biologist observing the reaction of a particular tissue to various stimulants is likewise experimenting to find patterns of behavior. These folks usually do their work in labs and wear impressive white lab coats.

The critical commonality is that all these people are making and recording observations of nature, or of simulations of nature, in order to learn more about how nature, in the broadest sense, works. We'll see below that one of their main goals is to show that old ideas (the ideas of scientists a century ago or perhaps just a year ago) are wrong and that, instead, new ideas to explain nature in a better way.

The word science comes from the Latin word "*scientia*", meaning knowledge.

What does that really mean? Science refers to a system of acquiring knowledge. This system uses observation and experimentation to describe and explain natural phenomena. The term science also refers to the organized body of knowledge people have gained using that system. Less formally, the word science often describes any systematic field of study or the knowledge gained from it.

Why do science?

The individual perspective

Why are all these people described above doing? what they are doing? In most cases, they're collecting information to test new ideas or to disprove old ones. Scientists become famous for discovering new things that change how we think about nature, whether the discovery is a new species of dinosaur or a new way in which atoms bond. Many scientists find their greatest joy in a previously unknown fact (a discovery) that explains some problems previously not explained, or that overturns some previously accepted idea.

The Societal Perspective

If the ideas above said, explain why individuals do science, one might still wonder why societies and nations pay those individuals to do science. Why does a society devote some of its resources to this business of developing new knowledge about the natural world, or what has motivated these scientists to devote their lives to develop this new knowledge?

One realm of answers lies in the desire to improve people's lives. Geneticists trying to understand how certain conditions are passed from generation to generation and biologists tracing the pathways by which diseases are transmitted are clearly seeking information improve the lives of ordinary people. Earth scientists developing better models for the prediction of weather or for the prediction of earthquakes, landslides, and volcanic eruptions etc are likewise seeking knowledge that can help avoid the hardships that have plagued humanity for centuries. Any society concerned about the welfare of its people, which is at the least any democratic society should do, will support efforts like these to better people's lives.

Another realm of answers lies in a society's desires for economic development. Many earth scientists devote their work to finding more efficient or more effective ways to discover or recover natural resources like petroleum and ores. Plant scientists seeking strains or species of fruiting plants for crops are ultimately working to increase the agricultural output that nutritionally and literally enriches nations. Chemists developing new chemical substances with potential technological applications and physicists developing new phenomena like superconductivity are likewise developing knowledge that may spur economic development. In a world where nations increasingly view themselves as caught up in economic competition, support of such science is nothing less than an investment in the economic future.

Lastly, societies support science because of simple curiosity and because of the satisfaction and enlightenment that come from knowledge of the world around us.

Science and Change

If scientists are constantly trying to make new discoveries or to develop new concepts and theories, then the body of knowledge produced by science should undergo constant change. Such change progress towards a better understanding of nature. It is achieved by constantly questioning whether our current ideas are correct or not

The result is that theories come and go, or at least modified through time, as old ideas are questioned and new evidence is discovered. In the words of Karl Popper, "Science is a history of corrected mistakes", and even Albert Einstein remarked of himself "That fellow Einstein . . . every year retracts what he wrote the year before". Many scientists have remarked that they would like to return to life in a few centuries to see what new knowledge and new ideas have been developed by then - and to see which of their own century's ideas have been discarded.

Scientists observe the nature and its laws. They discover the secrets of nature. Based on these discoveries and inventions different innovations take place. Scientists follow a specific way for their innovations. The way that they follow is called '*scientific method*'. Let us find out how they follow

How scientists work - Scientific Method

Planning an investigation

How do scientists answer a question or solve a problem they have identified? They use organized ways called **scientific methods** to plan and conduct a study. They use science process skills to help them gather, organize, analyze, and present their information.

Aravind is using this scientific method for experimenting to find an answer to his question. You can use these steps, too.

Step 1 Observe, and ask questions.

- Use your senses to make observations.
- Record **one** question that you would like to answer.
- Write down what you already know about the topic of your question.
- Decide what other information you need.
- Do research to find more information about your topic.



What soil works best for planting bean seeds? I need to find out more about the different



Step 2 Form a Hypothesis.

- Write a possible answer, or hypothesis, to your question.

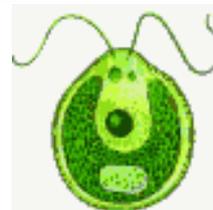
A **hypothesis** is a possible answer that can be tested.

- Write your hypothesis in a complete sentence.



My hypothesis is bean seeds sprout best in

CELL - THE BASIC UNIT OF LIFE



Our earth is a beautiful place where in different types of organisms happily co-exist. From minute masses to huge conifers, invisible bacteria to huge blue whale all have a basic unit called Cell. Let us study about cell. Before the first microscope was invented around 350 years ago, people were not aware of the living world that was not visible to the naked eye. Thereafter many scientists were observing and describing unknown world with the help of microscopes. Among the scientists who deserve mention are Athanasius Kircher (1601–1680), Jan Swammerdam (1637–1680), and Anthony van Leeuwenhoek (1632–1723) and Robert Hooke (1635–1702).



Do you know?

Antonie van Leeuwenhoek (1632–1723) in 1674 was the first human to see living bodies like bacteria, yeast, protozoa, Red Blood cell and the teeming life in a drop of water. He prepared several types of magnifying glasses, and used his lenses to study about both living and non living things using under microscope.

You may recall that all living organisms carry out certain basic functions. Can you list these functions? Different sets of organs perform specific functions. Do you know, what is the basic structural unit of an organ? To study about basic structures, a proper use of microscopes and preparation of microscopic slides is essential. (You can revise the use of microscope, preparation of microscopic slide and staining technique from Appendix-I Page:11).

Discovery of the cell

It was in the year 1665 that Robert Hooke, a British scientist, observed thin slices of cork (soft bark from Oak tree) under a simple magnifying device which he had made himself (Fig:1)

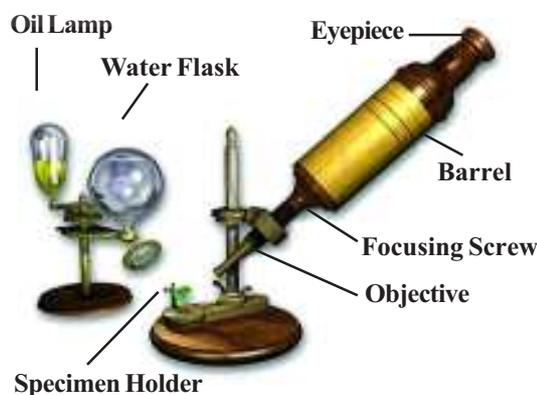


Fig-1 Robert Hooke's Microscope

He observed that the cork resembled the structure of a honey comb consisting of many empty spaces or empty box like structures. He thought that was made up of very small cavities. Robert Hooke called these cavities as “**cell**”. Cell is a Latin word for a **little room**! (Fig: 2).

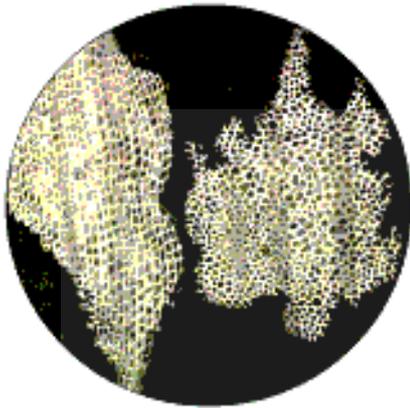


Fig: 2 To Robert Hooke, the cells in the thin section of cork appeared like this

Now let us try to see what Robert Hooke may have observed in the cork.

Activity-1

Observing a match stick

It will be difficult to get a cork. There fore let us try to see a similar type of a structure, as seen by Robert Hooke, in a section of match stick.

Take a match stick and soak it for half an hour and cut thin slices of it. Select a thin slice and place it on a slide. Put a drop of water and cover it with a cover slip ,without allowing air bubbles and observe it under microscope. Draw the figure of what you have observed.

Compare your figure with Fig-2. Wheather both are similar or is there any

difference? What are these rectangular shaped structures called?

The discovery of ‘cell’ by Robert Hooke was a milestone in the history of science. Cells of cork and of match stick are dead cells. Can we see living cells under the microscope? If so, how? Will their structure be the same as those of dead cells? With the help of the given activities you will be able to know more about cells.

Activity-2

Observing an onion peel

Peel an onion and cut out a small fleshy portion from the bulb (fig. 3a). Break this piece into two small parts and try to separate them (fig. 3b). You will notice a thin translucent film holding the pieces together. Take out the film (membrane), cut a small piece from it and spread it evenly in a drop of water on a slide. While placing the peel on the slide, make sure that it is not folded. Cover it with a cover slip and observe it under the microscope. Draw the figure of what you have observed. Compare your figure with fig-4.

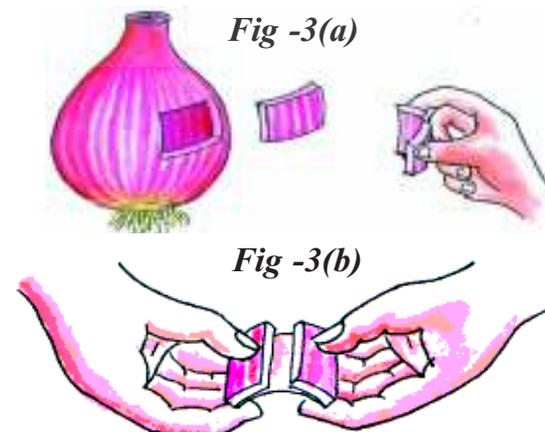


Fig-3 Extracting the peel from an onion

Are there any differences between these two figures? if so What are these differences?
The onion peel cells are plant cells.

Now let us observe cells from our own body (animal cell).

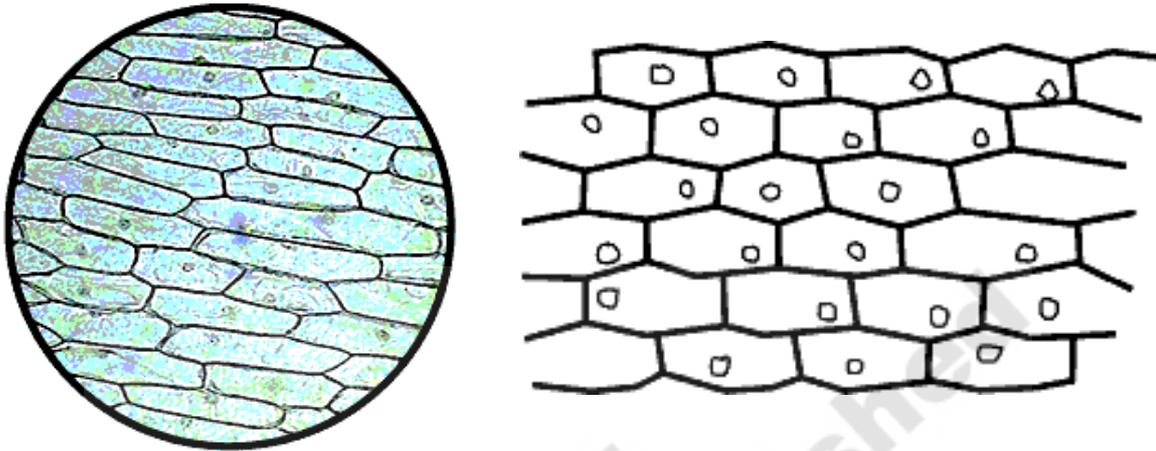


Fig-4 Onion peel cells

Activity-3

Observing human cheek cells

You have already prepared a temporary slide of an onion peel. Now prepare a slide of your own cheek cells. Wash your mouth cleanly. Take a clean wooden or plastic spoon and scrape the inner surface of your cheek.

Keep two things in mind. Firstly, wash the spoon thoroughly before using it. Secondly do not scrape too hard or else you could hurt yourself. Now take the scrapping that you have collected, and place it in a drop of water taken on a slide. Cover the slide with a cover slip. Observe the slide under the microscope. Draw the figure of what you have observed. The cell that you see would be very similar to those shown in Fig-5. Is the outer covering of both cells similar?

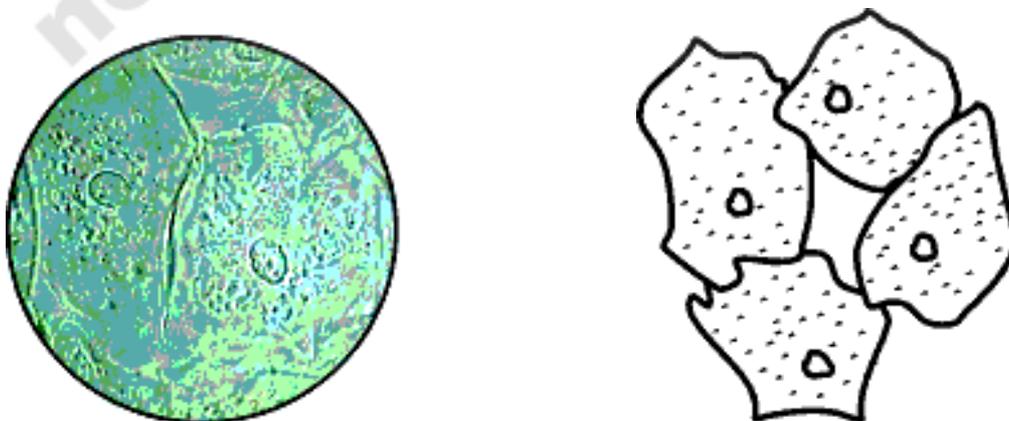
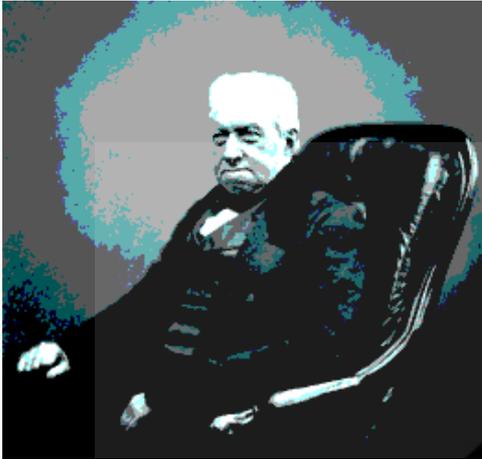


Fig-5 Human cheek cell (without stain)

A significant observation

The observations of a scientist named Robert Brown (1773–1858) have made a significant contribution to our understanding of cells. Among different parts of a cell, the nucleus is the most well



Robert Brown (1773–1858)

known part. Though it is generally believed that Felice Fontana (1730–1805) (and few other scientists) first saw the nucleus in the epithelial cells (the outermost layer of the animal body) in the 18th century, the credit for observing the nucleus in different kinds of cells and recognizing that it was an integral part of all cells goes to Robert Brown. While observing cells in the epidermis of orchid leaves, Brown noticed a near-circular spot that was slightly more opaque than the surrounding areas (image 6). He noted that similar structures were present in other cells as well. Brown claimed that this structure was an integral part of the cell and called it nucleus. This was in the year 1831 which means that there was gap of around hundred and fifty to hundred and seventy-five years between the first recorded observation of cells (around

the year 1650) and the observation of the nucleus.

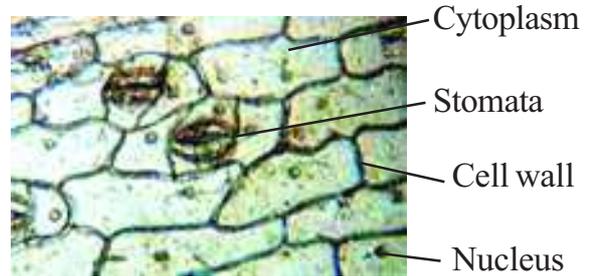


Fig-6 Plant Cell

This is what Robert Brown saw when he observed the nucleus for the first time. We can also see three stomata here: these are the pores through which the leaves exchange the gases.

Activity-4

Observation of the Nucleus in onion peel cells

For this, you need to peel a membrane from an onion once again. Now keep this membrane on a slide and add 1-2 drops of the stain (saffranin, methylene blue or red ink). Cover this with a cover slip and leave it for about five minutes. Then add water drop-wise from one side of the cover slip while soaking the extra water with a filter paper from the other side. This will help in washing away the extra stain. Now observe this slide under a microscope.

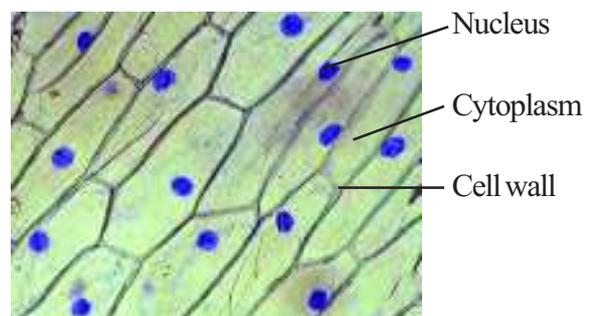


Fig-7 Onion cell showing nucleus

The blue spot observed within the cell is the nucleus. Now let us see the nucleus in our own cells (animal cells)

Activity-5

Nucleus in cheek cells

You could also take cells from the inner layer of the cheek, stain them with safranin or methylene blue and try to observe the nucleus in them.

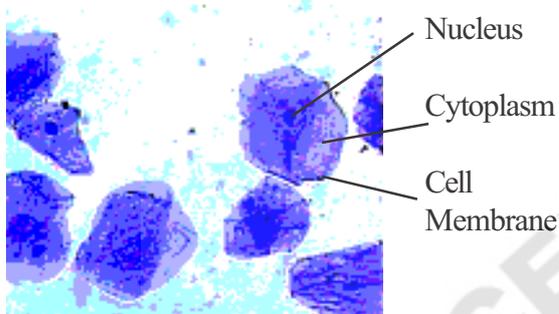


Fig-8 Cheek cells showing nucleus

Now let us compare the onion and the cheek cells.

- What are the structures present in the cells?
- Did you see a tiny dark stained thing in all the cells?
- Are they located in the centre of the cell in both the cells?
- What is difference between boundary of onion cell and cheek cell?

The boundary of a cheek cell is the **cell membrane**. This gives a shape to the cell and selectively allows substances to pass through it, in or out of the cell. On the other hand, in the cells of the onion peel, the outer covering is clearer than in cheek cells. It is because there is another layer present over the cell membrane, known as

the **cell wall**. This gives rigidity to the cell.

In both the cells you can find a dense round body called **nucleus**. In cheek cells the nucleus is present more or less at the centre of the cell, whereas in onion cells it is not in the centre. The jelly like substance between the nucleus and the cell membrane is called **cytoplasm**. It is a very heterogeneous material. It contains membrane bound structures, called **cell organelles**, as well as more complex chemicals. Cell organelles help to carry out several functions within the cell and you will study them in class IX. You shall also study why cells are considered to be, '**The structural and functional units of the living body**'.

DIVERSITY IN CELLS

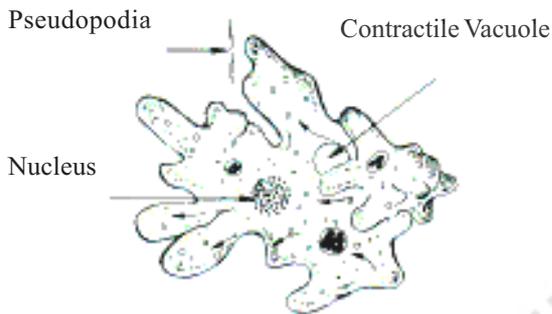
In onion peel cells you have seen that nearly all cells are similar in structure and shape. If you repeat this experiment with peels of onions of different size, what do you think your observations would be? Do bigger onions have bigger cells?

There are millions of living organisms in nature. They have different shapes, sizes and vary in the number of cells they contain. To know more about this, let us observe some more cells.

You will learn how to observe permanent slides of amoeba, paramoecium, chlamydomonas, spirogyra in the chapter on micro organisms. All these are single celled and are called **unicellular organisms** (Uni=single). In these, the single cell is capable of performing all the life processes like obtaining food, respiration, excretion, growth, and reproduction.



Chlamydomonas



Amoeba



E.coli

Fig-9 Unicellular organisms

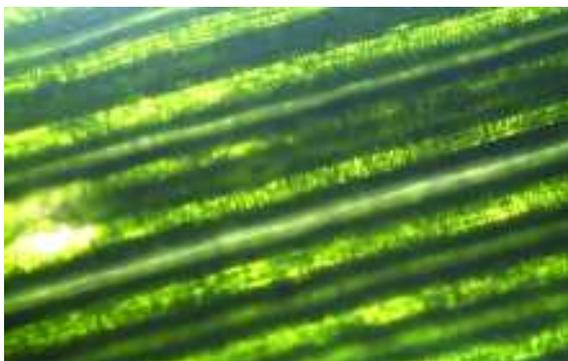


Fig-10 Cells in a grass blade

Activity-6

Observing cells in a leaf

Take a piece of grass leaf on the slide, put a drop of water, cover it with a cover slip and observe it under the microscope. Is your observation similar to the one given in fig-10? How many different types of cells or groups of cells could you see in the section?

You can do this experiment with other leaves as well. It would be preferable to choose thin leaves.

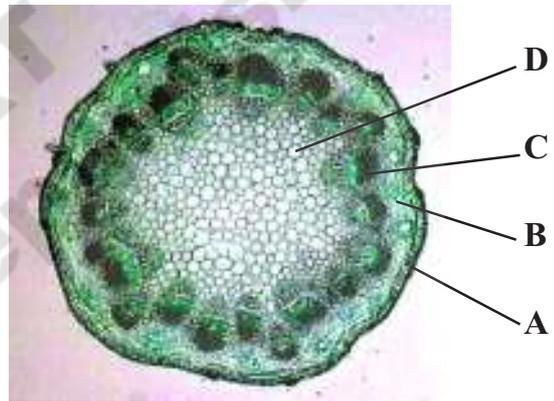


Fig-11 Transverse Section of Dicot Stem

Observe the given diagram of a section of the stem of Spinach/Tridax. Note the different types of cells that you observe in the section (fig-11). Four groups of cells have been marked as A, B, C and D in the figure.

Group A cells form the outermost layer of the stem and they give a shape to the stem as well as protection.

Major portion of stem is made up of group B cells. In a green stem this portion has special organs that carry out photosynthesis.

Group C consists of cells that join together to form long structures that conduct food and water in the plant body.

Group D cells are present in the centre of a young stem and form a hollow structure in the mature stem.

Thus in Transverse section of Tridax (Gaddichamanthi) /spinach stem you can see different shapes of cells, in one organism. Think why such a stems contains different shapes of cells in it?

Activity-7

Observe the given figures of different kinds of cells in the human body. If permanent slides of these cells are available in your school try to observe them as well.

Draw the diagram of these and label the parts that you have learnt so far and collect information about the functions of these cells.

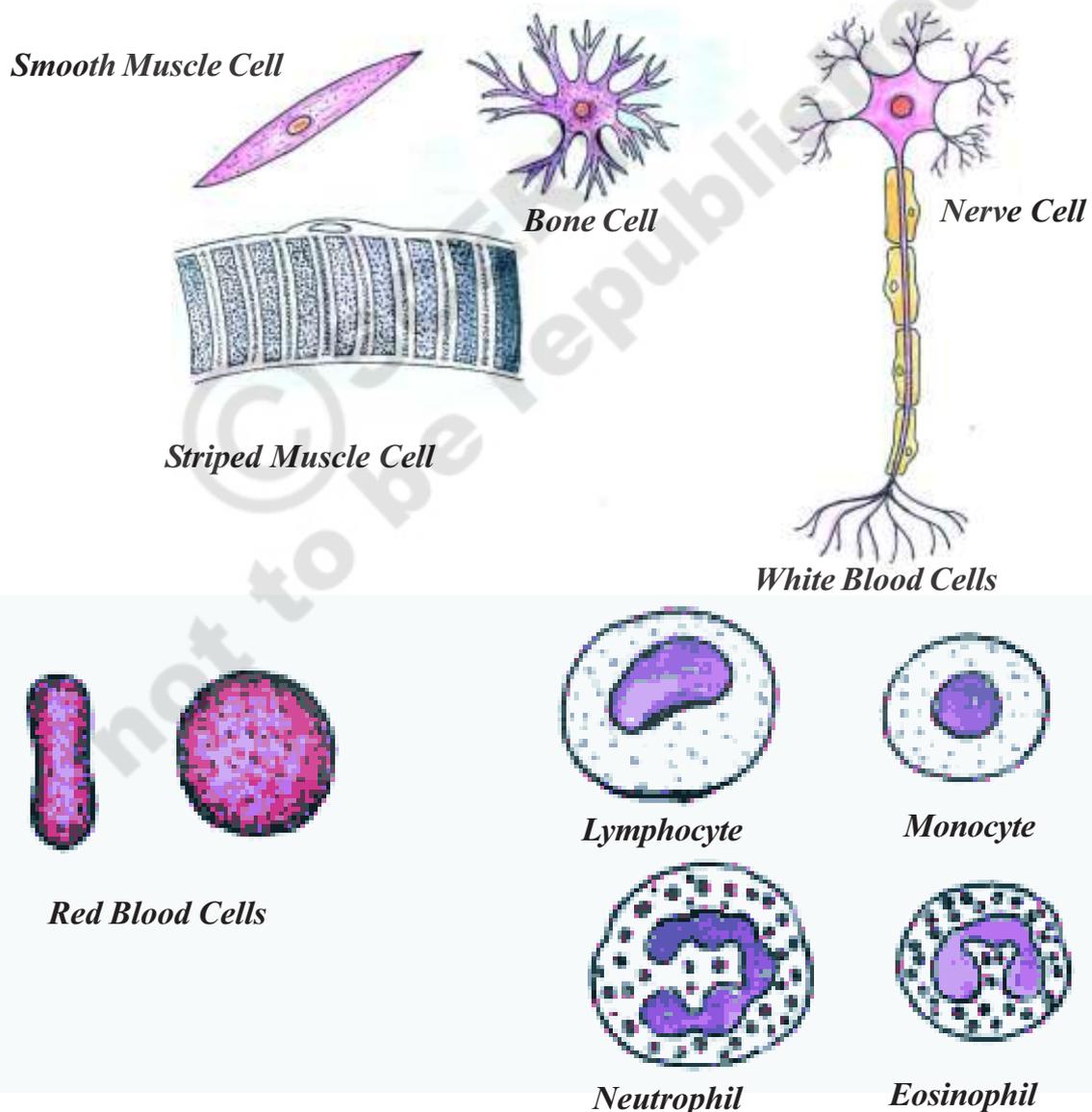


Fig-12 Shapes of the different cells in the human body

Fill the following table with the help of your teacher or with reference books.

S. No.	Name of the Cell	Shape of the Cell	Name of the Parts observed in it
1	RBC		
2	Muscle Cell		
3	Nerve Cell		
4	Bone Cell		
5	White blood cell		

- Are there any similarities in shape of the cells?
- Do you find nuclei in all the cells?

So far you have seen many kinds of cells. Are all cells similar in shape and size? The shape and size of cell vary considerably but all of these cells ultimately determined by the specific function of the cells. How

do you define the shape of amoeba? You may say that the shape appear irregular. In fact Amoeba has no definite shape. It keeps on changing its shape varying protruding out of its body. These are called **Pseudopodia** (Pseudo: false, Podia: feet). The projections appear and disappear as Amoeba moves or feeds.

Are the cells in an elephant larger than the cells in a man?

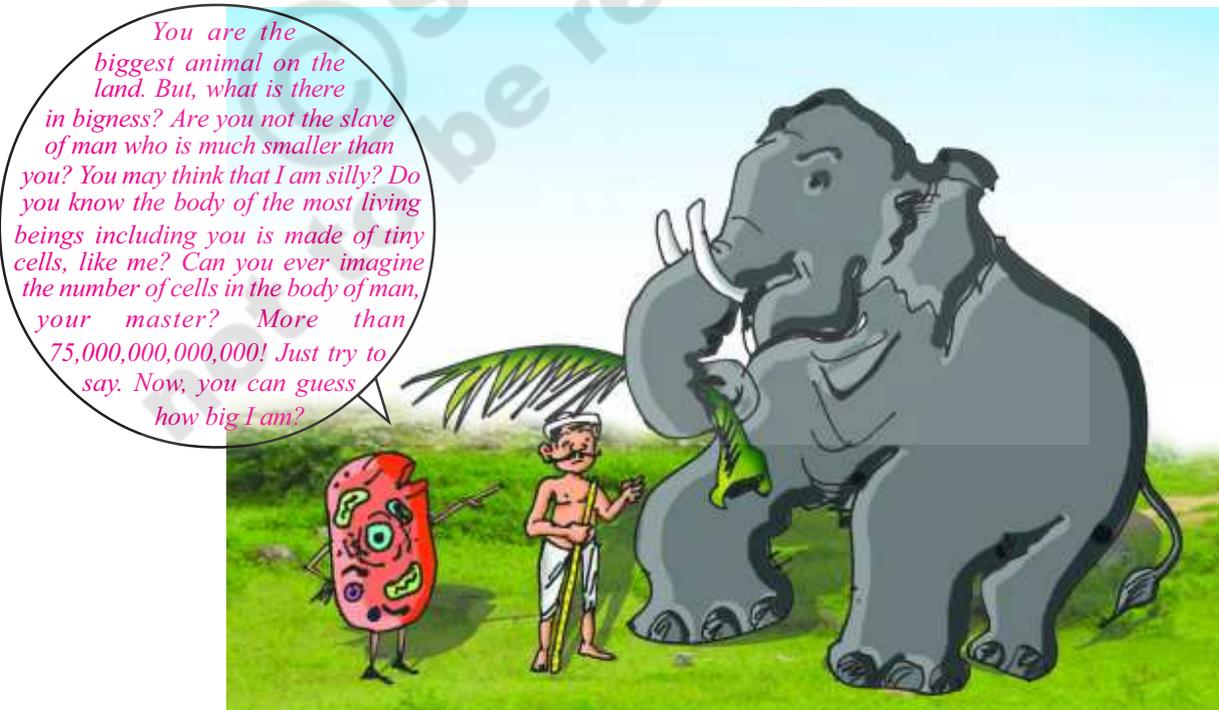


Fig-13

Have you listened to the words of the cell? Guess how big a cell is? Is the number and sizes of cells in both man and elephant the same? Are the cells of an elephant bigger than that of a man?

The size of the cells in living organism may be as small as the millionth of a meter (micron) or may be as large as a few centimeters. Majority of the cells are too small to be seen with naked eye. They can be seen only through a microscope. The smallest cell 0.1 to 0.5 micrometers is found in Bacteria. A human liver and kidney cell is 20 to 30 micrometer in size.

1 Meter = 100 Centimeters (cm)
1 centimeter = 10 millimeters (mm)
1 millimeter = 1000 micro meters (μm)
1 micro meter = 1000 nano meters (nm)

Some of the cells can be seen with naked eyes. Human nerve cell is nearly about 90 to 100 cm. The largest cell, measuring nearly 17 cm X 18 cm, is the egg of an Ostrich.

The size of the cell is related to its function. For example, nerve cell in both in man and elephant are long and branched. They perform the same function that is transferring message.

The size of the organism is depends on the number of cells and not on the size of the cell. Cells are of different shapes, sizes, and number.



Key words

Cell, Cell membrane, Cell Wall, Cytoplasm, Nucleus Unicellular, Multicellular, organ, Organelles, Pseudopodia, staining, magnification, focusing.



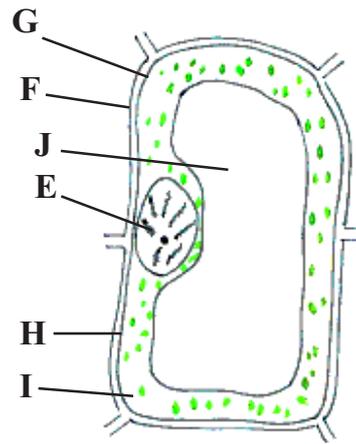
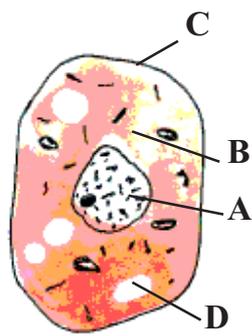
What we have learnt

- All living organisms are made of cells.
- Cells were first observed by Robert Hooke in 1665.
- Antonie van Leeuwen hook was the first to see living bodies under microscope which he had constructed himself
- The cell has 3 main parts- The cell membrane, Cytoplasm, Nucleus.
- Robert Brown discovered nucleus in orchid leaf.
- Plant cells differ from those of animals in having an additional layer around the cell membrane termed cell wall.
- Cell wall gives strength and rigidity to plants.
- Cell exhibits a variety of shapes and sizes and number.
- Single celled animals are called unicellular organisms.
- Basic functions in multicellular organisms are carried out by a variety of cells.



Improve your learning

1. Who discovered the cell for the first time? (AS 1)
2. Name two factors on which shape of the cell depends? (AS1)
3. Distinguish between unicellular and multi cellular organisms? (AS1)
4. How will you prepare slide without drying quickly? (AS1)
5. Deekshith said that, “we can’t see cells with naked eye”. Is the statement true or false? Explain. (AS1)
6. Which part of the cell contains cell organelles? (AS1)
7. Make sketches of animal and plant cells which you observe under microscope. (AS5)
8. Ameer said “Bigger onion has larger cells when compared to the cells of smaller onions”! Do you agree with his statement or not? Explain why? (AS 6)
9. Correct the statement and if necessary rewrite. (AS1)
 - a. Cell wall is essential in plant cells.
 - b. Nucleus controls cell activity
 - c. Unicellular organisms perform all life processes like respiration, excretion, growth, and reproduction.
 - d. To observe nucleus and organelles clearly, staining is not necessary.
10. Give examples of unicellular and multi cellular organisms. (AS 2)
11. Describe the structure of nucleus. (AS1)
12. What is difference between cells in onion peel and cells in spinach? (AS1)
13. Get some floating slime from a puddle, pick a very small amount of slime and put it on a slide. Separate out one fiber and look at it through the microscope. Draw the diagram of what you observed. (AS 3)
14. Deepak said, “A plant can’t stand erect without cell wall”? Support this statement?(7)
15. Collect different kinds of leaves from your surroundings and observe the shapes of the epidermal cells under microscope. Make a table which contains serial number, name of the leaf, shape of the leaf, shape of the epidermal cells. Do not forget to write specific findings below the table. (AS 4)
16. How do you appreciate the fact that a huge elephant, man and trees are made of cells, which are very small and we can look at them through microscope? (AS 6)
17. Label parts for diagrammes given below? And identify which one is plant cell and which one is animal cell. (AS1)



- | | | |
|--------|--------|--------|
| A..... | B..... | C..... |
| D..... | E..... | F..... |
| G..... | H..... | I..... |

ANNEXURE

Major improvements were made in microscopes from around 400 years ago. In the early days, there used to be just a single lens in the microscope. This is known as the simple microscope. Gradually better lenses were made. The compound microscope which used a combination of more than one lens was also invented. (It is generally believed that the first

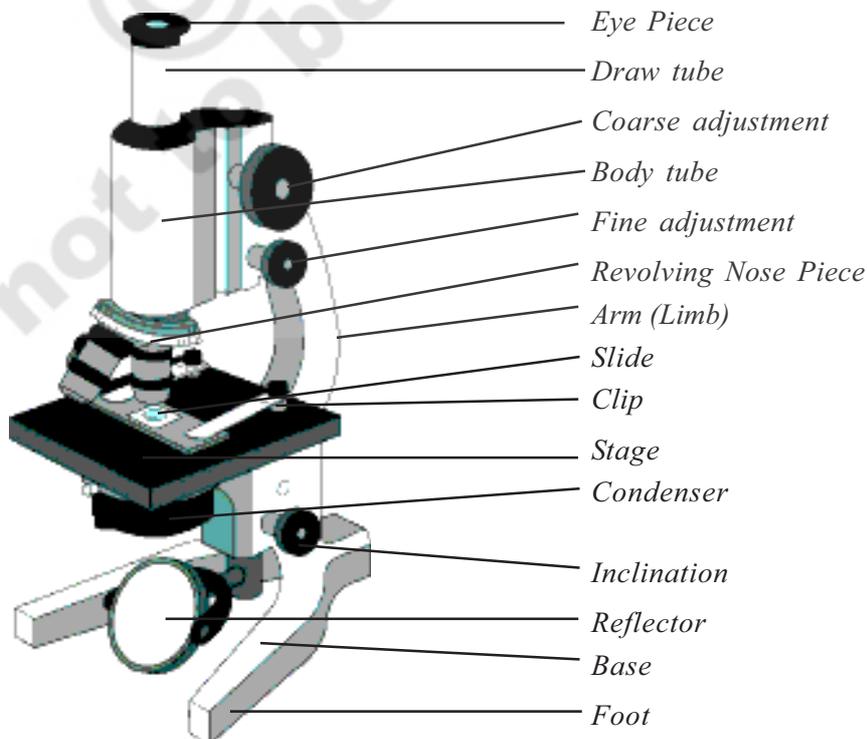


Fig-13: Compound Microscope

compound microscope was made in the year 1595 by the scientist named Janssen. Robert Hooke's microscope too was a compound microscope.) With the advent of compound microscopes, more detailed observations were made possible. Let us see how we can use the microscope.

The correct way to use microscope.

Recall what you have learnt in class VI about microscope. Now let us learn correct way to use microscope.

1. Check the microscope in the following way (a) remove the lens cap and take out the lens clean it with soft and clean cloth. (b) The knob is loose, change the piece of valve tube covering it. (c) Mirror of the microscope is always to be kept clean. Adjust it to such an angle that you see a bright back ground, while looking through lens.
2. Usually you will find three or four objective lenses on a microscope. They almost always consist of 4X, 10X, 40X and 100X powers. When coupled with a 10X (most common) eyepiece lens, we get total magnification of 40X (4X times of 10X), 100X, 400X and 1000X.
3. Wash the glass slide well and wipe it dry with clean cloth.
4. You have to move lens up and down till image looks sharp, this is called **focusing**. While doing this, the thing you are looking or water in which it is kept touches the lens, to prevent cover it with cover slip (very thin glass).
5. Put a drop of water with finger or dropper, put specimen in water, you may use needle or babul thorn. With the help of needle, cover specimen with cover slip. Dry out excess water around cover slip with filter paper or blotting paper.
6. Fasten the slide under the clips on microscope by moving the slide sideways so that the things you want see focus right under the lens, move the lens up and down to focus. Now decrease or increase the amount of light by rotating mirror. Do this until clear appearance of object with clear magnification.

Preparation of a microscopic slide

The study material to be viewed under a compound microscope is mounted on a slide. For this:

1. Microscopic slide is prepared on a 2mm thick, 3cm X 8cm rectangular strip of clear and clean glass piece called slide.
2. If the object is thin and flat it can be directly placed on the glass slide towards the centre in a drop of water with the help of a soft and fine brush. A drop of glycerin is added to the water if the slide is to be kept for longer time. Glycerin saves the material from drying (dehydration).

3. If the object is thick, cut it into a thin, nearly 0.5 mm or less thick sections with the help of a sharp razor. If the object is transparent, it may be stained with iodine, saffranin, fast green or any other suitable chemical dye, to bring contrast between the kinds of cells in the material.
4. The material in a drop of water and cover with a thin cover slip (glass 0.1 mm thick). do it carefully, holding the cover slip over the object without forming air bubbles. Extra water, if any coming out from the edges of the cover slip may be dried with a piece of blotting or filter paper.

Cover slip protects the material under study from coming in contact with the lens of the microscope and it presses upon material keeping it plane. Now your slide is ready to observe.



Fig-14: Preparation of microscopic slide

Staining Techniques

This technique is based on the fact that there are a few coloured substances that get attached to different parts of a cell. This helps to highlight particular areas in the cell. These colouring agents are known as stains and the process is called staining. We can use this technique to observe several things like microorganisms, different parts of the cell, etc. For this we need to use stains like saffranin, methylene blue etc. Red ink also works as an adequate stain. To make saffranin solution, dissolve $\frac{1}{4}$ tea-spoon of saffranin in 100 ml. of water the parts in the cell absorb colour and seen clearly.

STORY OF MICRO ORGANISMS



Part - I

Why do we add some drops of butter milk to lukewarm milk to make curd?

Why does even cooked food get spoiled after some days? Why do we get bad smell from our mouth after we wake up in the morning?

In this chapter we will try to find out

what may be involved in causing such changes.

400 years back several people wondered over such questions and tried to find out answers.

One such person was Antonie van Leeuwenhoek.

Story of Microscope invention and discovery of micro organisms



Fig.1: Antonie van Leeuwenhoek

Microbiology as a science was born in 1674 when Antonie van Leeuwenhoek observed at a drop of lake water through a glass lens that he had carefully found. Anton van Leeuwenhoek was a fabric

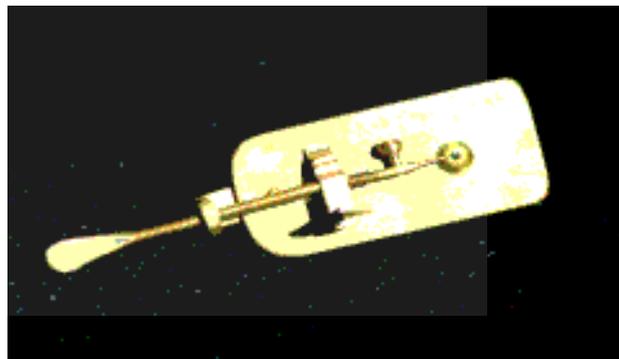


Fig.2: Single lens powerful microscope

merchant. Leeuwenhoek built a single lens powerful microscope, which could magnify the object 300 times. His curiosity and skill of making powerful lenses were the secrets of this invention of powerful microscope.

His keen observation of different things under his microscope helped him to discover small moving organisms in 1678. He called them “animalcules.” Later these were named bacteria. Along with the animalcules, he also observed many other microorganisms under his microscope which got their respective names later on. This helped further discoveries of other microorganisms.

Now let us see what are microorganisms and where we can find them.

Microorganisms

We can see several organisms in our surroundings but we can not see many of them with our unaided eyes. They can be seen only with the help of a microscope. They are called microorganisms. Some of the microorganisms are shown in Fig-2-6.



Fig-2 Bacteria of different shapes

Lactobacillus

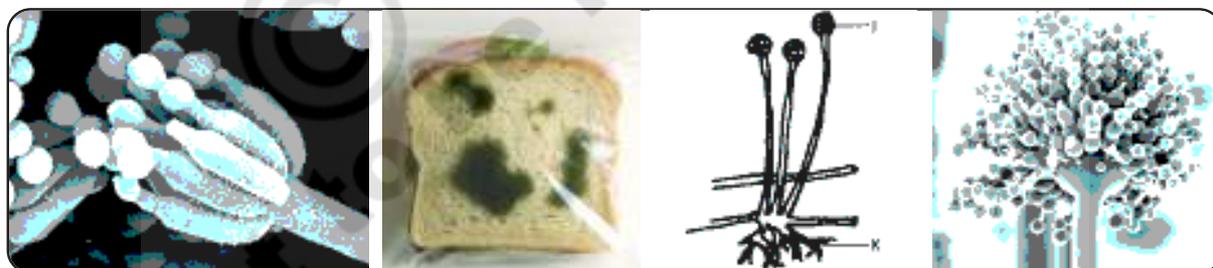


Fig-3 Penicillium

Bread mould Rhizopus

Asperigillus



Fig-4 Amoeba (500 Microns)

Paramecium (0.25m.m)

Plasmodium sp

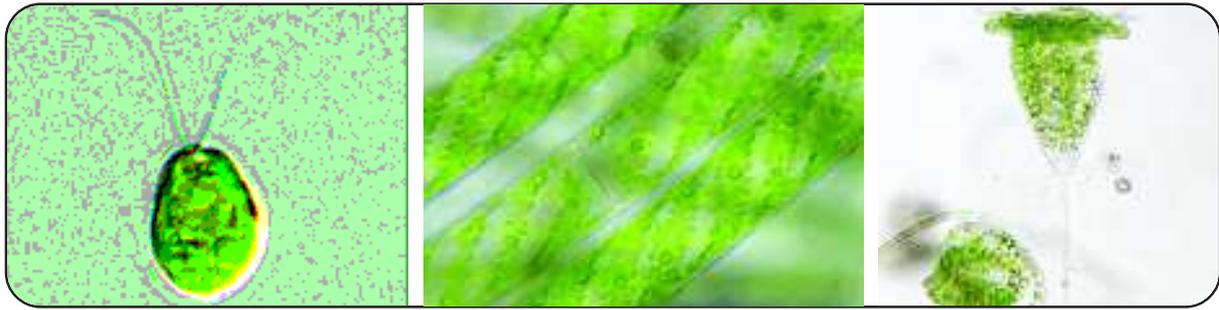


Fig-5(a) Chlamydomonas

Spirogyra

Vorticella



Fig-5(b) Spirulina

Oedogonium

Ceratium



Fig-6 Cyclops

Daphnia

Scabies mite

Eyelash mite

Groups of microorganisms

Let us study some micro organisms that belong to the groups like bacteria, fungi, protozoa, algae and certain micro arthropods with the help of some activities.

For this we will need a Microscope. You already know how to use it. You could also refer to “Chapter Cell- Basic unit of life”.

Activity-1

Collect some pond water / or water from any tank in your surroundings. Ensure to take some of the greenish scrapings from the side of the tank. Take 1-2 drops of water (from the sample you have collected) on a slide and observe through Microscope. Draw rough sketches in your note book of what you observed. Compare it with the

figures given above for observation and identification (You may also hold discussion with your friends). Take the help of your teacher as well.

Can you name the organisms which you have observed through the microscope?

We will try to know more about the microscopic world by doing the following activities.

Observing Fungi

Usually after the rainy season you might have seen some small umbrella like growths over rotten materials of dumped waste, between the grasses in a field and edges of wet rotten wooden planks. Often you may have observed white patches on the bark of trees. On these areas you can find some fungi. Now let us look at them more closely by the following activity.

Activity-2

Take some rotten part of vegetable or black spoiled part of bread or coconut with the help of a needle on a slide. Put a drop of water, place a cover slip on it and observe it under the microscope.



Fig-7(a) Photographs of curd in bowl

Draw rough sketches in your note book of what you observed. Take the help of the figures given in fig-3 bread mould - rhizopus and compare.

Observing Bacteria

We can see these in butter milk or curd or early morning scraping of tongue (before washing the mouth). We can also find them in the soil, over bark of trees, over our skin, in our arm pits and many other places. But they are not visible to the unaided eye. Now let us look at them more closely by the following activity.

Activity-3

Take one or two drops of butter milk on a slide and spread it. Heat the slide slightly on a lamp (3-4 seconds). Add a few drops of crystal violet, leave it for 30 to 60 seconds and wash the slide gently with water. Observe the slide under the compound Microscope. Draw rough Sketches in your note book of what you have observed.

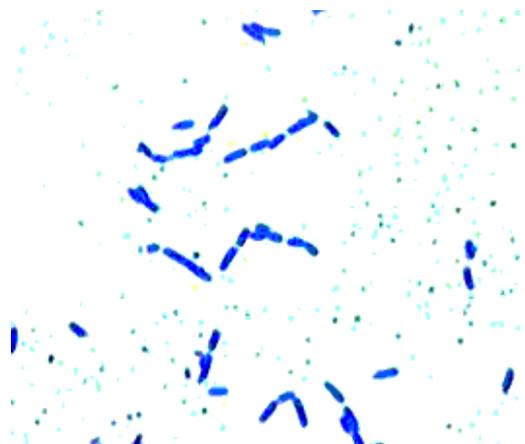


Fig-7(b) Stained lactobacillus bacterium



Do you know?

There are several Bacteria growing on our skin. Many of the disease causing ones live in some symbiotic relations with other bacteria. There are different kinds of bacteria in our intestine which are useful in digestion. Bacteria are found everywhere and there are over thousand types of them in soil, water etc. Recently two types of bacteria in 1997 Heide N. Schulz discovered a biggest bacteria *Thiomargarita namibiensis* found in coastal waters of Namibia (0.75mm), which can be seen with unaided eye.

Observing Algae

Very often to observe greenish pond water in our surroundings. It is greenish because of growth of Algae and other plants which grow in water. We can see some of algae like chara, spirogyra etc. with unaided eye, but most of the algae present in water are microscopic.

They can be observed only through a microscope. Let us collect pond water or water from the tanks with a bit of greenish scrapings. To observe some of the micro algae growing in water, let us do the following activity.

Activity-4

Select a few strands (green string like bodies). Or some part of the scrapings that have small string like bodies. Take one or two drops of collected greenish pond water (in a bottle) on a slide. Cover it with a cover

slip and observe through microscope. Draw rough sketches in your note book of what you have observed. Compare with fig-6.

Observing Protozoa

The other group of microorganisms is protozoa. They are yet another group of microorganisms present in water and soil. Let us do the following activity to observe them.

To grow protozoa, soak hay in pond water to prepare a decoction of hay. After 3- 4 days take a drop of water and observe it under the compound microscope.

Activity-5

Take one or two drops of hay decoction on a slide and observe it under the microscope. Draw rough sketches in your note book of what you have observed. Take the help of the figures given in the chapter for observation.



Do you know?

Micro arthropods

Some micro arthropods are very important for the soil. They help in increasing soil fertility by decomposing the biomass through digestion which converts the bigger compounds into smaller compounds. These are to be found on our skin, eyelids, beddings, rugs etc.

Some micro arthropods cause diseases like scabies e.g.: scabies mites. Actually these are not micro organisms like bacteria these are minute size orthopods means joint legged organisms.

Do you know?

Soil is highly rich in microorganisms such as bacteria, fungi, protozoa, microarthropods. The top eight inches of soil of one acre area may contain as much as five and half tons of fungi and bacteria. This is very much useful for growing crops. Excessive use of pesticides kills these bacteria. We can see them through a microscope or by growing them in different media.

Let us do the following activity to observe some soil microbes.

Activity-6

Observing soil microorganisms

Collect some soil from the field in a beaker or in a glass. Add some water to it and stir it. Wait for some time to allow the soil particles to settle down. Take a drop of water on a slide and observe it under the Microscope. Draw rough sketches in your note book of what you observed.

Take the help of the figures given in the chapter for observation.

From the above activities you would be able to understand how diversified are the microorganisms. You can also appreciate the fact that this is another amazing world of living organisms.

Let us try to find out where else we can find them.

Microorganisms are present everywhere around us. They are present in air, water and in the soil too.

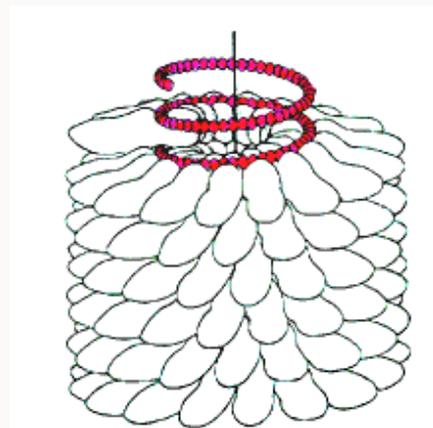
Do you know?

Viruses are an interesting type of microorganisms. They behave like non-living things when they are outside of a living cell. But they behave like living organisms when they are inside host living cells and reproduce just like bacteria, plants or animals.



HIV

(Fig.2.5 Electron Microscopic view of some Viruses)



Tobacco Mosaic virus

They can only be seen through very powerful electron microscope.

Diseases like polio, swine flu, conjunctivitis, smallpox, chickenpox and AIDS are caused by viruses.

They are also present inside the bodies of animals and plants. They can survive in all types of environments ranging from ice cold climate to hot springs, deserts to marshy lands. Some microorganisms grow on other organisms as parasites and some may exist independently.

Diseases like typhoid, tuberculosis (T.B) and septicemia (blood poisoning) are caused by bacteria. Some of the skin diseases are caused by fungi while others by micro arthropods and bacteria. Diseases like Malaria, Amoebiasis are caused by Protozoans.

Do you know?

Bacterial Staining?

Bacteria are very small/ tiny microorganisms. We must stain before seeing Bacteria under Microscope. Smear bacteria on a slide and slightly heat the slide. Then put drops of crystal violet on the slide. After 30 to 60 seconds gently wash the slide. Dry the slide and now watch the slide under the microscope in **25 X or 40 X**.



Key words

Microorganism, Microscope, Microbiology, Bacteria, Fungi, Protozoa, Algae, micro orthropods, Virus, discovery, invention



What we have learnt

- Microorganisms are very minute living things. We cannot see them with our naked eye.
- We can see microorganisms with the help of Microscope.
- Antonie van Leuwenhoek invented a powerful single lens microscope.
- Microbes are present everywhere in our surroundings.
- Bacteria, Fungi, Protozoa, and Algae are major groups of microorganisms.
- Viruses are special type of microorganisms, which lie between living and non living organisms. They can reproduce only in host living cells.



Improve your learning

1. Observe some permanent slides of microorganisms in your school lab with the help of microscope. Draw its picture. (AS 5)
2. Which organisms are interlinked between living and non-living organisms? Why do you think so? (AS1)
3. Prepare a model of any microorganism. And write a note on them. (AS 5)
4. Visit any bakery or milk chilling center near to your school with the help of your teacher or parents. Learn about some techniques to culture and usage of some Microorganisms and prepare a note on them.(AS 4)
5. What are micro-organisms? Where we can find them? (AS 1)
6. What type of micro organisms we can observe in pond water? (AS1)
7. How can we observe Lactobacillus bacterium? (AS 3)
8. Whether microorganisms are useful and harmful. How explain.(AS1)
9. How human actions causing death of useful bacteria and fungi. What happens it continue. (AS 7)
10. Why cooked food spoils within less time but not uncooked food. Give your reasons.(AS1)
11. Why should we clean our hands with soap before eating?(AS 7)

STORY OF MICRO ORGANISMS



Part-II

Microorganisms - Our friends or foes?

Microorganisms are present everywhere. They are to be found in air, water, soil; within the bodies of animals and plants and over the surfaces as well. Some microorganisms are very useful and help us in many ways while some of them are harmful.

In this section we will study about how microorganisms help us and how they harm us.

Useful (Friendly) Organisms

Some microorganisms are very useful to our everyday life. For example in making of curd and in preparation of idly, dosa, bread and cake. Some microorganisms are also in preparation of medicines required to cure different diseases. Some of them are farmer friendly as they increase soil fertility. Let us do some activities. How microbes are useful to us.

Activity-1

Take some lukewarm milk in two small

bowls. Add a few drops of butter milk or little curd in one of the bowls. In the second bowl do not add anything. Keep the two bowls in a warm place and observe the milk in the bowls after 5 to 6 hours.

- What changes did you observe?
- What is the reason for this?

Curd or buttermilk contains bacterium named *Lactobacillus*. *Lactobacillus* converts the milk into curd.

Activity-2

Take 100 grams of maida in a bowl, add one or two spoons of yeast powder, add some water and knead it to make dough. Keep the dough in a warm place. Observe the dough after 3-4 hours.

- What changes do you observe in the dough?
- What might be the reason? Discuss with your friends and write about it.

You might have observed your mother preparing fermented foods like idly and dosa. What will be the reason for preparing Idli and Dosa dough one day before?



Fig. 1: Cups containing Myda dough.

- In the above figure yeast was added to maida dough placed in one of the two cups identify it.

when yeast is added to the dough for preparing bread, the dough rises. This is due to the production of carbon dioxide gas during the process of fermentation. Bubbles of the gas fill the dough, increase its volume and make it spongy in nature.

Activity-3

Commercial use of microorganisms

Take some of water in two separate beakers. Add 5 to 10 spoons of sugar to each beaker, then add 2 to 3 spoons of yeast to one of the bowls only. Close both of the bowls with lids and keep them in a warm place. After 3 to 4 hours remove the lids and smell the contents.



Fig-2(a) Antibiotic capsules

- What differences did you observe between the two bowls?
- What will be the reason for the odour in yeast mixed bowl?

This is the characteristic smell of alcohol. Sugars are converted into alcohol by yeast. This process of conversion of sugars into Alcohol is known as **fermentation**. This process is used on a large scale in the production of alcohol, wine, beer and acetic acid. Yeast is grown in natural sugars present in grains like barley, wheat, rice and crushed fruit juices like grapes.

Molasses produced in sugar industry is used in the preparation of ethyl alcohol by adding yeast for Fermentation process.

Medicinal use of Microorganisms

Sometimes when we fall ill, get injured or need to undergo an operation doctors prescribe some medicines that kill the bacteria involved. Such medicines are called as antibiotics. These antibiotics are produced by growing specific microorganisms. Nowadays a number of antibiotics like penicillin, tetracycline, streptomycin and erythromycin are being produced. Antibiotics help in curing many



Fig-2(b) Antibiotic injections

bacterial diseases like typhoid, gonorrhoea and prevent infections like Septicaemia.

Antibiotics are also used to control the bacterial diseases in plants and animals.

? Do you know?

We must use antibiotics prescribed by qualified doctor. If you use antibiotics without consulting a qualified doctor it may harm you. Unnecessary use of antibiotics, affects blood cells which fight infections. Sometimes they may kill useful bacteria too in our intestine and this increases the resistance towards anti biotics. Excess use of antibiotics weakens the body.

The story of discovery of the antibiotic Penicillin



Fig-3(a) Dr. Alexander Fleming in his lab

Fig-3(b) *Penicillium sp* inhibiting bacterial growth in Petridis

Dr. Alexander Fleming was an army doctor in First World War. He observed that many injured soldiers died because of bacterial infection of wounds.

He was working on antibiotics in his lab. One day he keenly observed that some fungi (mould) were preventing the growth of bacteria in the petridish, in which he was growing bacterial colonies.

He separated the substances released by the fungus and tested it on some other disease causing bacteria. This substance also killed many other disease causing bacteria. The mould or fungus separated was identified as *Penicillium notatum*. The

substance which was produced by the fungus *Penicillium* is named as Penicillin. Substances that killed bacteria were generally named as antibiotics by Dr. Fleming.

The discovery of the antibiotic, penicillin was announced in 1929. In 1945 Dr. Alexander Fleming was awarded the Nobel prize along with other scientists (Dr. Howard flory, and Dr. Ernst.B.chain).

The discovery of penicillin paved the way to the discovery of many antibiotics like streptomycin, erythromycins etc. Can our body prevents the diseases without using antibiotics?

Do you know?

Inventor of Aureomycin

This is the picture of **Dr. Yellapreggada Subba Rao**. He was born in west Godavari district of Andhra Pradesh state, India. He discovered Aureomycin i.e tetracycline which cures number of bacterial diseases like Typhiod, plague, Tuberculosis etc.



Vaccine

Doctors prescribe medicines in the form of tablets, syrups, injections etc, to have an control on diseases. We are often protected against certain other diseases by vaccination.



Fig-4 Children consuming polio drops.

This protects us from getting the diseases over a long period of time (often throughout our life). You may have heard that children below five years must take polio drops. Why are polio drops given to children? What is the purpose of polio drops?

dangerous deasease what could be done to make the polio free society? Discuss in you class room about polio contamination and its methods of prevention. Write your findings in the following lines.

Have you given polio drops, when you were a child? Do you know about puls polio programm?

.....
.....
.....

Our national objective is to make Polio free society. What do they do in this programme? You know that polio is a

- collect a pamphlet or broucher on pluse polio programme and discuss the points which are mentioned in them.
- What diseases control by vaccination?

Do you know?

Dr. Jonas Salk discovered vaccine for Polio in 1952. He wanted to distribute it freely to everyone. So he never patented his polio vaccine. Dr. Albert Sabin discovered oral polio vaccine in 1957.

Dr. Jonas Salk



Whenever a disease causing micro organisms enter our body, the body produces some defenders to fight against them, these are called as antibodies. Antibodies fight the disease causing micro organisms.

When a vaccine is given which contains weak micro organisms our body learn to fight them by producing anti bodies whenever danger comes. When the disease causing micro organisms enter in our body, the already present antibodies fight and eliminate them. And the disease is controlled. The weakened disease causing micro organisms which are injected into our bodies are called as **vaccines**. Polio vaccine is given in the form of oral drops which prevents polio in children. While many other vaccines are injected to prevent diseases like smallpox, chickenpox, hepatitis, tuberculosis etc.

Now, we know of several vaccines and are protected against several diseases causing microorganisms. But vaccines

were not known even 300 years ago. It was only after many experiments conducted by several scientists in 18th century helped us to got them. The most remarkable of such experiments were that conducted by Dr. Edward Jenner in 1796 that give us the first vaccine against a disease caused in human.

Nowadays vaccines are made on a large scale from microorganisms to protect human and other animals from several diseases.

Activity-4

Visit nearby PHC and collect information about vaccination given to 0-15 years children. Meet a doctor or a health worker and ask what types of vaccines are there? Which disease can be prevented? When it should be taken? List them out.

Do you know? Vaccine for Rabies was discovered by Louis Pasture. Rabies causing virus enters in to our body through dog bite, only if the dog also has the same infection.

Story of discovery of Smallpox vaccine



Fig-5 Baby with small pox



Dr.Edward jenner inoculating vaccine

The decision of Dr. Edward Jenner to setup his medical practice in country yard i.e. in a village, which helped mankind save from extinction from diseases with discovery of vaccines. He keenly observed that the milkmaids who developed cowpox, a less serious disease, did not develop the deadly smallpox. He thought they are developing immunity which is preventing small pox, a very dangerous disease wiping out millions of people in those days. In 1796, Jenner took the fluid from a cowpox pustule on a dairymaid's hand and inoculated a 8 years old boy with his parents permission. Six weeks later, he exposed the boy to smallpox, and the boy did not develop any symptoms of smallpox. This



Fig-6(a) *Nostoc*

invention of smallpox vaccine saved millions people from deadly disease. This showed the way for the discovery of number of vaccines which prevent us from harmful diseases. The word vaccine comes from 'vaca' which means cow.

Soil Micro organisms in soil fertility:

About 78% of air around us is nitrogen gas. Plants need it mainly for synthesizing proteins. But they can not make it from the atmosphere directly. Micro organisms like Rhizobium, nostoc, anebena, azotobacter, etc., help to provide this essential element to the plants by fixing them from atmosphere to form certain compounds. That they release into the soil that can be taken up by plants.



Fig-6(b) *Anabina*

The micro organisms present in the soil like fungi and bacteria degrade biological wastes present in the soil into small compounds, some of which are essential for plants.

? Do you know?

What is Bt?

Bt means *Bacillus thuringiensis* is name of a bacterium. It produces a toxin which kills pests on plants or crops. The bacterium is used as bio pesticides. In transgenic crop plants this toxin producing gene was separated from the bacterium and transferred into the crop plants. So this can protect it from pests. For example B.t. cotton.

Activity-4

Take two pots or dig two pits in the corner of the garden at home or ground at your school. Fill them up to half with loose soil. Put some biological wastes like fallen leaves, vegetable wastes, waste papers etc., in one of them. Fill the second one with plastic wastes, polythene bags and with some empty glass bottles.

Now cover the pits or pots with some loose soil. Sprinkle some water on the pots /pits. Do this every day. After three to four weeks remove the upper soil from the pits and observe the changes. What changes you have observe? Note them down.

Think and discuss with your friends. Is there any harm with non-decomposed material? Discuss.



Fig-7 Compost pit

You may have observed the same thing happening in your own surroundings as well. Microorganisms present in the soil, air and water act upon wastes around us and decomposes them. They are converted into

simple substances. Thus microorganisms help us in cleaning the environment.

- What would happen if microorganisms were absent, in our surroundings? What might be present in our surroundings?

Do you know that micro organisms like several bacteria help in the process of sewage treatment.

Harmful microorganisms:

Now let us learn about some of the micro organisms that are harmful to us. microorganisms can cause diseases in crop plants, livestock and in human beings. They also spoil food, clothes and many other things.

Diseases causing microorganisms in human beings:

Activity-5

Meet a doctor of your locality and ask him about the different types of diseases, caused by different micro organisms. Note them down and discuss with your friends.

Recall that microorganisms are present everywhere in our surroundings. Microorganisms which cause diseases are called as “pathogens”.

Pathogens enter into our body through air we breathe, water we drink and food we eat. They can also be transmitted by direct contact with infected person or carried through animals or insects.

You might have observed, that times some of your family members or friends get cold and cough with the sudden change of weather. When the infected person

sneezes or coughs, the pathogens enters into air from such infected persons. When this air containing pathogens enter into the body of healthy person and may cause cold! (we commonly use these terms). This type of diseases which spread from infected people to healthy ones are known as “communicable diseases”. These get spread through air, water, food or through physical



Fig-8 Anopheles female mosquito biting

contact of infected person (or his used towels, kerchiefs) or through insects like houseflies and mosquitoes. Common cold, conjunctivitis, typhoid, smallpox, chickenpox, swine flu, tuberculosis are some of the communicable diseases.

Some insects and animals carry diseases causing microorganisms. They are called

as ‘vectors’. The microorganism ‘plasmodium’ causes malaria. The female Anopheles mosquito carries plasmodium and thus it is the vector. Mosquitoes are vectors for other diseases as well. By controlling mosquitoes, we can prevent diseases caused by them. Mosquitoes breed in stagnant water. We should be careful not

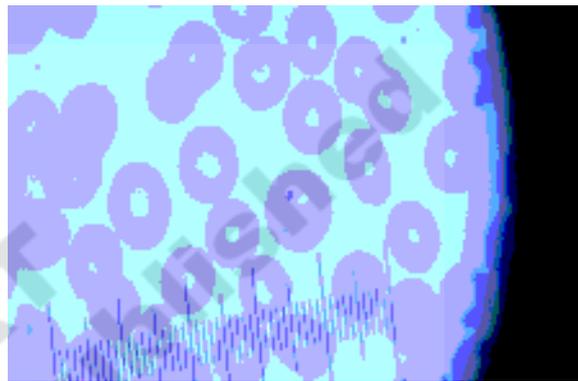


Fig-9 Plasmodium in RBC.

to let water collect anywhere in our surroundings, including left over waste pots, waste flower pots, tyres, bowls etc.

- Why should we take care for our surroundings clean?
- What precautions should we take to prevent mosquito bite?
- What are the other diseases caused by mosquitoes?

Do You Know?

Dr. Ronald Ross discovered that female Anopheles mosquitoes are carrier of the causative Microorganism (parasite) for Malaria. For this discovery Dr. Ronald Ross got **Nobel prize** in 1902. He discovered it in Secendrabad. For full story of discovery of Ross. Refer annexure for more details.





Fig-10 House fly on food

House flies also carry disease causing microorganisms and spread the diseases like typhoid, cholera, etc. When they sit on garbage, excreta of infected persons or animals, pathogens stick to their bodies.

When these flies sit again on a uncovered food, they transfer the disease causing bacteria into the food. Whoever eats this food may have chances to get these diseases. So we must avoid taking uncovered food. We must always cover the food. Houseflies breeds on garbage. We can control houseflies by keeping our surroundings clean.

- Where do you find more number of houseflies? Why?

One day Srikanth went to hospital with his mother. There he saw the following chart on a wall.

TABLE-1: SOME COMMON DISEASES CAUSED BY MICROORGANISMS IN HUMAN

Name of the disease	Causative Microorganism	Mode of transmission\	Preventive measures
Tuberculosis	Bacteria	Air	* Vaccination (BCG) * Avoid using infected persons towels, Hand kerchiefs, Glasses etc
Chicken pox	Virus	Air	* Vaccination (Varisella)
Measles, mumps	Virus	Air	* Vaccination (MMR)
Polio	Virus	Air, Water	* Vaccination (Polio drops)
Swine flu	Virus	Air	* Vaccination
Cholera, Typhoid	Bacteria	Contaminated Water, Food Housefly (vector)	* Personal hygiene and good sanitary habits * Consume boiled drinking water
Malaria	Parasite	(vector) Mosquitoes	* Use mosquito nets, repellents. * Control breeding of mosquitoes by not allowing water stagnation in our surroundings
Dengue	virus	Mosquitoes	„
Chikungunya	virus	Mosquitoes	„
Japanese Encephalitis	Virus	Mosquitoes	„

Study above table and answer following questions.

1. What diseases can be prevented if we can control Mosquitoes?

2. Which diseases we can prevented by vaccination?

3. What are the diseases which are transmited by contaminated water?

4. Can you name some diseases which are transmited by Air?

5. Can we protect from bacteria and protozoan diseases through vaccination? Discuss in your class.

Disease causing microorganisms in animals

Some examples are like Anthrax mainly in cattle (also affects humans), foot & mouth disease, viral disease in prawns etc.



Fig-11 Anthrax disease in sheep

Disease causing micro organisms in plants:

Microorganisms also cause diseases in plants. Diseases in our crop plants are studied to save our crops. The following table shows some diseases caused by microorganisms in crop plants.

TABLE-2: Shows some of plant diseases, causative microorganisms and mode of transmission.

Name of the plant disease	Causative Microorganism	Mode of Transmission	Figure
Citrus canker	Bacteria	Air	
Red rot of sugarcane	fungi	Air, seedlings	

Tikka disease of groundnut	Fungi	Air, seeds	
Tobacco mosaic	Virus	Insects	
Smurt disease of Rice	Fungus	Air	

Food poisoning:

Sometimes you might have listened or read in news papers that some people were hospitalised due to food poisoning. Food poisoning could be due to the consumption of spoiled food. Some microorganisms produce toxic substances in spoiled food. These toxic substances make the food poisonous. Taking stale food may lead to vomiting, motions, even to death. Cooked food spoiled in less time than raw food.

Do you know?

Clostridium botulinum a bacterium which is widely responsible for causing food poisoning. The disease is known as botulism.

Food preservation:

If microbes grow on our food, they spoil it. Spoiled food emits bad smell and tastes bad. Water or moisture present in food items helps the microorganisms to grow. How can we preserve our food? We knew the cause of food spoilage i.e. growing

of microorganisms. Think how can we prevent the growth of microbes on food?

You have learnt in class-VI that different methods are adopted to preserve food at home. For example while making pickles, salt and oil are added. Fishes are preserved by adding salt or smoking them. Jams and Jellies are preserved by adding sugar after boiling fruits or fruit extracts. Vegetable slices and fishes are preserved by adding salt and drying in sun light. What happens in all these methods? Think, water or moisture is removed from the food items. Thus microbes cannot grow in these conditions.

Let us study some other methods of food preservation.

Heat and cold method

You might have observed your mother boiling the milk before using or storing it. Boiling helps in killing several types of microorganisms present in milk. After lunch or dinner we preserve our remaining food items in refrigerator. We preserve fruits and vegetables and some other food

items in the refrigerator. Refrigeration helps to inhibit the growth of microorganisms. Micro organisms do not grow or cold conditions.

Pasteurisation

Another method of preservation is pasteurisation. You may have read this word written on some milk packets. In this process milk is heated up to 70 degrees C for 15 to 30 seconds and then suddenly chilled and stored. This prevents growth of most microorganisms. This process was discovered by **Louis Pasteur**. So this method is known as **pasteurisation**.

Invention of Pasteurisation

Louis Pasteur was born in a village of France in 1822. He was a painter. He wanted to become a teacher. He was interested in mathematics, physics, and chemistry, and he became a researcher. He was doing his research on crystals. In those days the wine industry of France was in trouble with spoilage of preserved wine. They approached Pasteur. Pasteur studied the problem and hypothesised that



microorganisms may be the cause of wine spoilage. He thought that these microorganisms can be controlled by heat. This led to the invention of Pasteurisation. He proposed germ theory of diseases i.e. microorganisms causes diseases. He also invented vaccine for Rabies. He studied and conquered Anthrax, by inventing the Anthrax vaccine. He studied several other conditions of diseases in humans and animals and showed how to control them. He had saved the silk industry of Germany and France by controlling microbial diseases caused to the silk moth.

Lazzaro Spallanzani is the first person to prove experimentally that microorganisms could be killed by boiling (1768).

Storage and packing

Nowadays, dry fruits and even vegetables are sold in sealed and air tight packets, which prevents the entry of microbes from outside.

Thus proper preservation of food helps us, in the following ways:

- 1) This prevents spoilage of food.
- 2) Food can be preserved for longer period.
- 3) Quality of food is ensured for a long time.
- 4) Variety of food items may be available in far away places, at any seasons.
- 5) Can you name different fruits import from outside of the state?

Invention of pasteurisation led to the invention of sterilisation process. In this process microbes are killed. The materials are kept in a sterilisation chamber and are heated up to very high temperature for upto 30 minutes. During operations surgeons use only sterilised instruments and other sterilised materials, which avoid getting infected.

Nitrogen fixation

Activity-6

Take root nodules of any pulse or leguminous plants crush on a slide, put a drop of water or any oil on it and observe under microscope. Draw rough sketches of what you observe. Discuss with your friends.

You have learnt about rhizobium bacterium previously. Rhizobium is



Fig-12 Root nodules of legume plant

present in the root nodules of many leguminous (pulses) plants, such as beans and peas. The bacterium rhizobium takes nitrogen from atmosphere and fixes on the roots of plants. Plant gives shelter to the bacterium. Thus both help each other. This relationship is known as **symbiosis**. Growing pulse crops thus helps in increasing soil fertility.



Key words

Lactobacillus, penicillum, fermentation, stirilisation, vaccination, bacillus thuringiensis, pathogens vectors, pasteurisation, symbiosis.



What we have learnt

- Some microorganisms are useful and some microorganisms are harmful.
- Microbes are useful in home, industry, cleaning the environment.
- Soil microbes degrade organic wastes into useful nutrients. This helps plants in their growth and development.
- Some microorganisms cause diseases in humans, plants, and other animals.
- Some insects and animals act as vectors of microbes.
- Some microbes release toxins in improperly preserved food, which causes food poisoning.

- Pasteurisation helps in milk preservation.
- The bacterium 'rhizobium' present in root nodules of leguminous plants fixes atmospheric Nitrogen.



Improve your learning

1. Collect more information about scientists who invented and discovered other facts related to Microorganisms. How these discoveries helped mankind? Make a chart presentation and paste it on your classroom wall Magazine.(AS 4)
2. Make an Album of scientists and their discoveries related to Microorganisms.(AS 4)
3. Take three bowls and mark as A, B, C. Pour lukewarm milk in bowl A, hot milk in bowl B, cold milk in bowl C. Add one tea spoon of curd or butter milk in three bowls and stir them slightly. Cover the bowls with lids. Keep the bowls undisturbed for five to six hours. In which bowl milk turned into curd? Give your reasons. (AS 3)
4. What are antibodies? When do they develop? How they help us? (AS1)
5. How vaccines works in our body? (AS1)
6. If there are no micro organisms on the earth what will happen? (AS 6)
7. What are the precautions to eradicate malaria? (AS 7)
8. How you appreciate Edward Jenner's experiments? (AS 6)
9. Visit a nearby milk chilling centre. Observe the process and make a report on it.(40
10. "Prevention is better than cure" comment. (AS 6)
11. Raheem tells to his neighbours, "stagnation of sewage in our surroundings is harmful to our health." Do you support this? Why?(AS 6)
12. What are the differences between Antibiotic and Vaccine? (AS1)
13. Jeevan said that "If there are no micro organisms earth will remain with wastes" will you agree this statement, why? (AS 6)
14. Invention of pencilline protect the world from deaths during first world war, explain.
15. One medical store owner is giving antibiotics to his customer who is suffering with fever without a doctor's prescription? But the customer's daughter Malathi is telling her father not to take antibiotics without doctor's prescription. Whom do you support and why? (AS 7)
16. Pranavi is suffering from serious illness. Doctor prscribed antibiotics for five days. After three days of usage she stopped taking antibiotics. Is it right or not, discuss. (AS 6)

Story of Discovery of Malaria Parasite in Female Anopheles

by Dr. Ronald Ross



Dr. Ronald Ross



Nobel Prize

Dr. Ronald Ross was a military doctor, who did his research extensively on malaria for 16 years (1881-1897) in India. He finally discovered malaria causative microbes in female anopheles mosquito which fed on malaria infected patient. He found the route map of malaria disease. For that he got Noble Prize in 1902.

All of us know about Malarial fever. We frequently talked about this fever. The study of the mosquito causing malarial fever was done alone by the scientist Ronald Ross. A remarkable part of the study was carried out at Secundrabad. He expresses his experiences in his lecture at Noble prize presentation ceremony.

“I reached India in 1895 and found myself appointed as a medical officer of regiment of native soldiers at Secundrabad and many were suffering from malarial fever. A survey was immediately made of the malarial parasites existing among these men and I found myself able to confine for India. At the same time the mosquitoes which abounded in the barracks and hospital. Before leaving England I had made many attempts to obtain literature on mosquitoes especially the Indian ones, but without much success. Consequently I was forced to rely entirely on my own observations; and I noted that the various species of mosquitoes of the locality belonged to two different groups, separated by many traits, and called these groups for my convenience, *brindled mosquitoes* and *grey mosquitoes*. It was until 1897 that I clearly recognized a third group which called *spotted-winged mosquitoes*”.....



Ronal Ross done siginificant discovery on malaria in this building at secundrabad in 1897

Ronald Ross was born on 13th May 1857 at Almora in present Uttarakhand state in our India. His father was an Army Major. At age of 8 years young Ronald was sent to England for his education. He was interested in painting and mathematics. He wanted to settle down as a painter. But, on his father's insistence he selected medical carrier. After completing his medicine, he joined in Indian Military Academy in 1881. While he was studying medicine he faced a malaria patient. He treated many patients of malaria with quinine and cured it. But many people died with malaria because they failed to get treatment.

While he was working at Bangalore, he was allotted a bungalow. He was pleased to live in it but was irritated by the large number of mosquitoes. He noticed that there were more number of mosquitoes in his bungalow than in any other. He keenly observed that a barrel with water was full of mosquito larvae. Ross removed the water from the barrel and found that the number of mosquitoes got reduced. This started in thinking that if water was removed from the place it might be possible to eliminate them completely. Ross noted that malaria killed more than one million people in India. So he become interested in malaria, one of the important tropical diseases occurring in India.

After working 7 years in India he went back to England. He did his diploma in microscopic techniques. He met Dr. Patrick Manson who guided him throughout his research. He was with him through thick and thin. Patric Manson shared his proposed theory (hypothesis) that mosquitoes carries malaria as they carry filaria. This was to change Ross's life forever. He proposed that mosquitoes were carrying flagellated spores in their stomach. The mosquitoes died laying their eggs. The "flagellated spores" emerged into the water, ready to infect anyone who drank the water. Ronald Ross tried on this hypothesis. But he came to a conclusion that water would not cause malaria infection.

Ross was discouraged by the above reasons. But Patric Manson encouraged Ross not to give up his work and advised that malaria parasite germs would not go for no purpose, in a mosquito's body. Ross then hypothesised that the malaria disease is communicated by the bite of the mosquito which injects a small quantity. Parasites may enter in this manner into the human system.

To test this hypothesis Ross allowed mosquitoes that had fed on malaria patient to bite a healthy man. But the healthy man was not infected. Repeated the experiment again and again and failed. Unfortunately he was using Culex mosquitoes in his experiment, which do not transport malaria. This fact came to light a little later.

One day his attention was drawn to a different mosquito that was sitting on a wall in a peculiar posture and he called it as “dappled-wing” mosquito. He was inspired again. He knew that only one species can capable of carrying filariasis. Dr. Patric Manson also suggested him that a particular mosquito species might be the reason for the malaria plasmodium.

Ross suddenly realised that he had used the wrong species of mosquitoes in his experiment. He returned to Secunderabad on June 1897. He commenced work by making a careful survey of the various kinds of mosquitoes. He continued his study by examining the dissected mosquitoes under microscope, after feeding on malaria patients. Almost every cell was examined under the microscope.

On the 15th August, 1897 his assistant brought a larvae, many of which hatched out next day and among them he found several dappled-winged mosquitoes. Delighted with this capture, on August 16th, he fed them on his malaria patient Hussein Khan with crescents in his blood. On 17th he dissected two of these mosquitoes but found nothing unusual. On the 19th he killed another and found some peculiar vacuolated cells in the stomach about 10 microns in diameter.



Ross rough drawings and notes about what he observed

On August 20th 1897 he found a clear and circular outlines about 12 micron diameter cells, each cell containing a type of cell, black pigmented one. He made rough drawings in his note books. At last by this way Ross discovered the route map of malaria i.e., infected patients blood to mosquito stomach to salivary glands to infect into a healthy person. So we celebrate August 20th World Malaria day. He had done his experiments on malaria in birds also with his assistant named Mohammed Bux.



In Ritwik's school one day, a small baby pigeon (squab) fell down from the ventilator. With the help of his friends, he carefully put it back in the ventilator. While keeping it back, he observed some



Fig-1 Nestling hatching out

eggs in its nest and two other baby birds that were trying to come out of the eggs. He waited to see if the eggs hatched as well and wondered.

Do all eggs hatch into nestlings?

- Can there be pigeons if there were no eggs?
- Can there be eggs if there were no pigeons?

Probably we can not find an accurate answer to such questions. These questions

are related to reproduction. You have already studied about "*Reproduction in Plants*" in class seventh. Now you will study about reproduction in animals in this chapter.



Fig2 A nestling

- Do all animals lay eggs?
- Are there any animals that give birth to young ones?
- How can we identify which animals lay eggs and which give birth to young ones?
- Are there any patterns in nature that give clues to modes of reproduction?

You might have seen a lot of small and big animals around you. Some of them have external ears (ears visible from outside) while some do not.

Names of some animals are listed below. Observe carefully and fill the table.

Deer, Leopard, Pig, Fish, Buffalo, Giraffe, Frog, Sparrow, Lizard, Crow, Snake, Elephant, Cat.

Sl. No.	Animals that have external ears	Animals that do not have external ears

You can also add some more names of animals you know, to this table.

- Think how animals could hear without external ears?

Now let's think if there is any other pattern of recognizing these animals.

Read the names of animals given below and try to fill the table given below.

Cow, rat, crow, pig, fox, hen, camel, duck, frog, elephant, buffalo, pigeon, cat, peacock, lizard. You can also add a few more animals to this list.

Sl. No.	Name of animals	Presence of external ears(Yes/No)	Presence of epidermal hairs on the skin / feathers on their wings

- Is epidermal hair seen in those animals whose ears are visible outside?
- Do animals that have epidermal hair give birth to young ones or lay eggs?

Viviparous and Oviparous Animals :

From the above table you could observe that animals giving birth to young ones have epidermal hair on their skin and external ears. The animals that lay eggs do not have epidermal hair or external ears. The animals which lay eggs are called **Oviparous** while those which

give birth to their offsprings are called **Viviparous**.

In class 7 you learned how the seed of a plant germinates and grows into a plant. When a living organism (plant or animal) produces offsprings (young ones), the process is called reproduction. This is one of the basic life processes. This is essential for the continuation of the species.

Let us try to understand the modes of reproduction.

Modes of Reproduction in animals:

Animals reproduce both sexually and asexually.

We had already studied how potato, bryophyllum and chrysanthemum reproduce? It was asexual mode of reproduction in plants. Now we shall see how animals reproduce asexually.

Asexual reproduction

In some animals the formation of gametes does not take place. Still they produce offsprings like themselves. As the formation of gametes does not take place there is no question of fusion of gametes. Such process of reproduction is called Asexual Reproduction.

Do you know animals that reproduce asexually? Perhaps, you have not seen such animals, but they do exist. Some of these are amoeba, paramecium, hydra, etc.

Activity-1

Observation of Budding in Hydra

Get permanent slides of different stages of budding in *hydra*. Observe them under a microscope. Look out for any bulges from the parent body. Count the number of bulges and also observe the difference in their size from one slide to the next. Also, note the size of the bulges. Draw the diagram of hydra as you see it. Compare it with the figure given below.

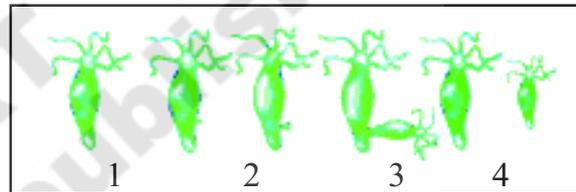


Fig-3 Budding in Hydra

Recall what you have observed in the first slide? Compare Slide 1 & 2 to observe which part of its body develops a swelling?

Observe all the remaining slides.

- What you have observed in slide/picture 1, 2 and 3?
- What is the main difference between slides 1 and 2 as well as 3 and 4?
- What does the swelling (bulge) develop to?

Hydra, a microscopic organism reproduces **asexually**. In each hydra, there may be one or more bulges, called **buds**. In class 7, you learnt about budding in yeast. In Hydra also we see budding where new individuals develop from the buds. This type of asexual reproduction is called "**Budding**".

Does *zygote* form in this type of reproduction, why?

Write the similarities and differences between budding in yeast and hydra according to your observations and diagrams given in the text. Now let us study this process in another organism. You may have seen the following diagram in your previous classes.

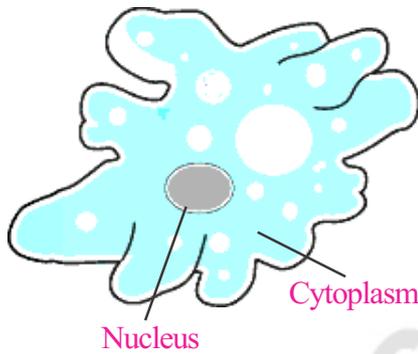


Fig-4 Amoeba

This microorganism called amoeba lives in fresh water. Its body is made up of a single cell and hence called *unicellular organism*.

Observe the slide of an amoeba with the help of a microscope and also observe the diagram. Are you able to see a distinct round shaped organelle in its centre? Do you know what is it? Ask your teacher. What function does it perform?

Activity-2

Observation of Binary fission in Amoeba

Observe the given diagram carefully and fill the following table.

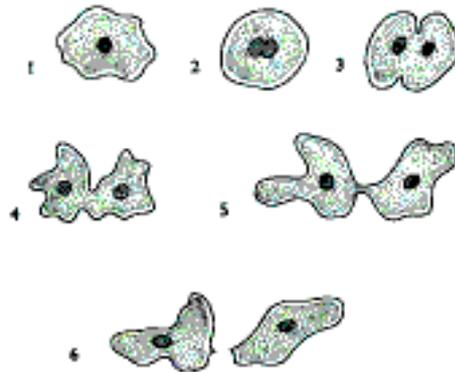


Fig-5 Binary Fission Amoeba

Changes in the nucleus/body structure
1 st diagram:
2 nd diagram:
3 rd diagram
4 th diagram
5 th diagram
6 th diagram

How many amoebae are formed at the end?

After the *nucleus* gets matured, it starts dividing, (fig-5). After the complete division of the nucleus the body of amoeba divides into two. Thus a single parent forms to *two daughter* amoeba. Thus the parent becomes nonexistent. This type of asexual reproduction in which an animal reproduces by dividing into two individuals is called Binary Fission.

Are budding and fission the only methods of asexual reproduction in animals?

Apart from budding and binary fission there are some other methods by which a single parent produces young ones. To know more about it you can ask your teacher or refer any related books in your library. You will also study about these in higher classes.

Sexual Reproduction

In the chapter on reproduction in plants, we have also studied about the process of sexual reproduction in plants. In this process, pollen grains produced in the pollensack reach the stigma of a flower, where they germinate. A long tube is formed from the pollengrains that reaches the ovary. The male reproductive cell of the pollen grain travels down this tube to the

ovary where it fuses with the female reproductive cell. So, sexual reproduction is basically the *fusion of the male reproductive cell with the female reproductive cell*.

In animals as well, sexual reproduction occurs by the fusion of female reproductive cell or *ovum* and the male reproductive cell or the *sperm*. The body formed thereafter is called *zygote*

You have studied in class 7th that formation of zygote is very important to give rise to offspring. Do you know from where the male gametes and female gametes are produced in animals?

You have already learnt where they are produced? collect any male and female flower from your surroundings.



Fig-6(a) Male Flower

Its Parts :

1. _____
2. _____
3. _____
4. _____



Fig-6(b) Female Flower

Its Parts :

1. _____
2. _____
3. _____
4. _____

Like plants, animals also have specialized organs for reproduction.

Let us try to understand the reproductive system of human beings.

Now write a note on where male and female gametes are produced in plants. Illustrate with a diagram.

Male reproductive system

You might have seen a cow giving birth to a calf. A she goat gives birth to a lamb and a woman gives birth to a baby. Have you ever thought about the role of a man (male) in giving birth to a baby?

Let's recall how a seed is formed from a flower? Is it formed only from ovary? Do

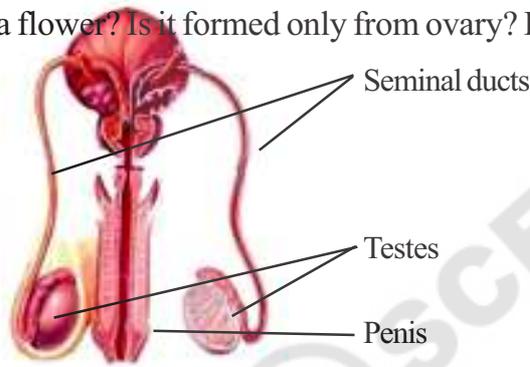


Fig. - 7 : Male reproductive system

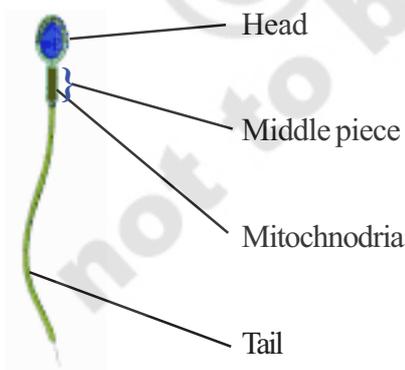


Fig-8: Human Sperm

pollen grains play any role in formation of seeds? Likewise a male produces sperms which is quite essential for reproduction.

The male reproductive organs are situated just below the abdomen. It includes a pair of *Testis (testes in plural)*. Two

sperm ducts (also called *Seminal ducts*) and a Penis. The *testes* are egg shaped and produce the male gametes or sperms. It is connected with a pair of seminal ducts through which sperms travel and ejaculate out with the help of penis.

Millions of sperms are produced by the testes (fig-7). These are microscopic and single celled. Each sperm has a head, a middle piece and a tail. The head bears a nucleus. It gets energy from Mitochondria present in the middle piece.

Can you imagine what purpose the tail of a sperm serve?

Female reproductive system

The female reproductive organs are situated inside the abdomen just below the navel of women. It contains a pair of *ovaries, oviducts* (also called *fallopian tubes*) and *Uterus* (see the figure). The Ovaries lie inside the abdomen, in the hip region of the body, one on each side of the Uterus. Each Ovary is placed just below the funnel shaped opening of the fallopian tubes.

The Ovary produces female gametes called *ova* (ovum in singular) or eggs. In human beings, a single matured egg is released into the oviduct by one of the ovaries every month. Uterus is the part where development of the baby takes place. Like the sperm, an OVUM is also a single cell. The ovum is surrounded by an outer covering and a nucleus floating in cytoplasm is found in the centre of it.

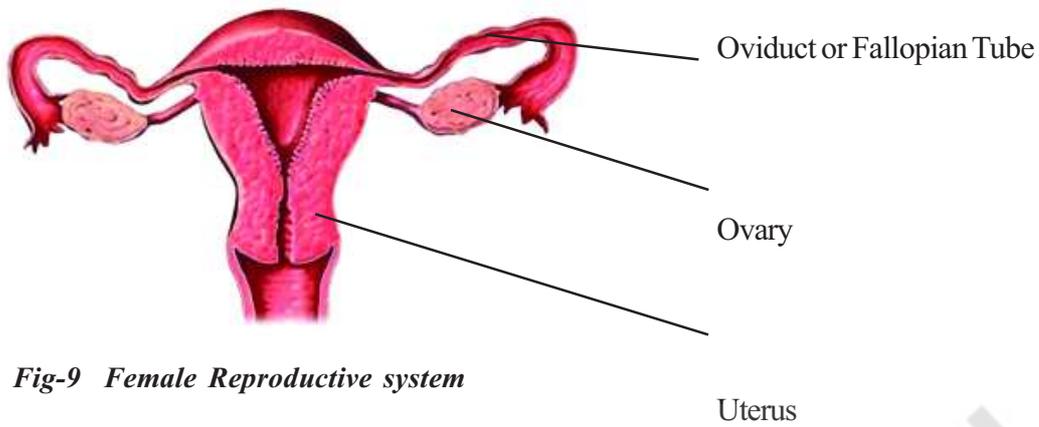


Fig-9 Female Reproductive system

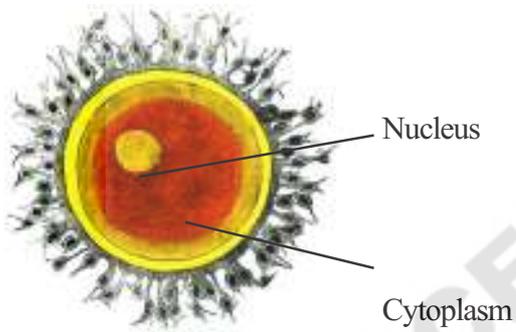


Fig-10 Human Ovum / egg

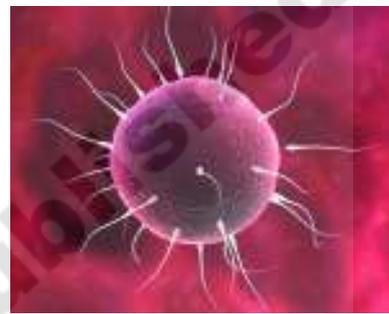
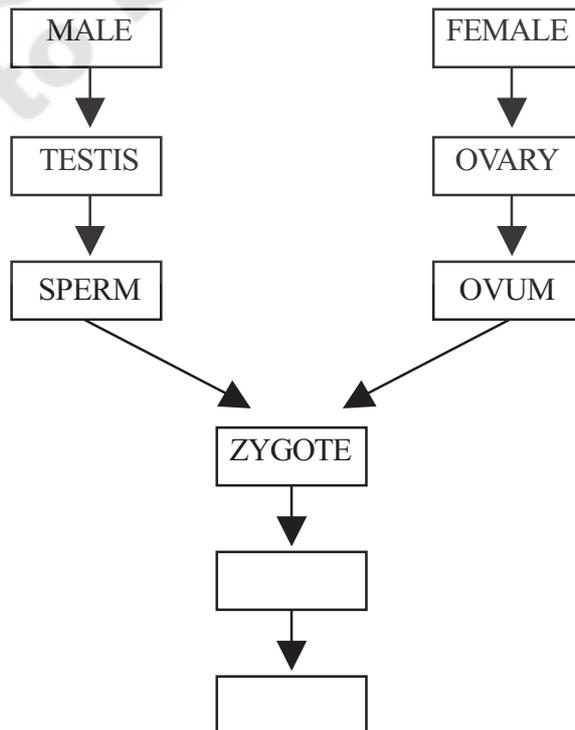


Fig-11 Fusion of ovum and sperm (fertilization)

Fusion of ovum and sperm (fertilization)

Look at the flow chart given below:



In the first step of reproduction fusion of sperm and ovum takes place, which, you already know, is called “Fertilization”. During fertilization the nuclei of the sperm and the ovum fuse to form a single nucleus. This results in the formation of a fertilized egg or zygote.

Sperm + ovum → zygote

Internal fertilization

For internal fertilization to take place inside, it is necessary for the sperm to reach inside the body of the female. Animals in which fertilization is internal have some arrangements for ensuring that the sperm enters the body of the female. This type of fertilization occurs in different organisms like insects, snakes, lizards, birds and mammals etc.

Observe the diagram of the female reproductive system and say where an ovum and sperm have a chance of fusion?

Development of the embryo

Fertilization results in the formation of a zygote. This zygote divides repeatedly to give rise to a ball of cells. (Fig-12).

The cells then begin to form groups that develop into different tissues and organs in the body. This developing structure is termed as an *Embryo*. The embryo gets

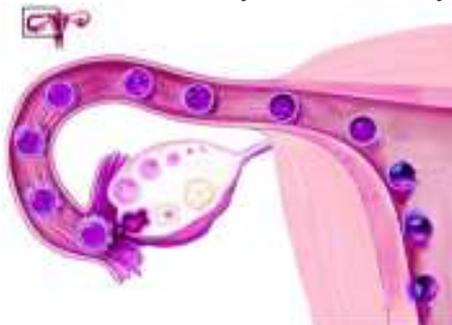


Fig-12 Zygote formation and development of an Embryo

embedded in the wall of the uterus for further development.

The embryo continues to develop in the uterus. It gradually develops body parts such as hands, legs, head, eyes, ears etc. When the embryo develops fully and all other parts are distinct, it is called a *foetus*. The period from zygote to fully developed foetus is called “*Pregnancy*” period. Usually, after completion of this period (about 270-280 days) a baby is born. This is called gestation period.

Now, you can try to fill the incomplete boxes in the previous page.

- What would happen if fusion of sperm and ova doesn't take place?
- Why animals give birth to their babies?
- What happens if each couple to give birth to more than two babies. Is it necessary to control population?

Think what would happen if all the animals stop giving birth to their babies.

Fertilization takes place by fusion of gametes from mother and father. Does it affect the resemblance of the offsprings with their parents?

Activity-3

Observation of resemblance in parents & children

Divide your class into 4 or 5 groups. See that all groups have at least 5-6 members. Collect photos of parents of all the members. Now compare the faces of your friends with their parents. See what parts of your friend's face resemble his/her mother or father. Table given below will help you to note the similar and dissimilar

characters.

Fill the table:

S. No	Name of your friend	Name of the organ	Character Resembles mother	Character Resembles Father	Other characters
1.		A. nose B. eye C. eye brow D. E.			
2.					

Now discuss with your teacher why some characters of your friends resemble that of their mother or father. Similarly, look at your brother or sister. See if you can recognize some characters in them similar to those of your mother or your father. You can ask your teacher and know why sometimes no characters match with your father or mother.

You can make your own table for this.

Do you know?

Test tube babies:

You might have heard that in some women oviducts are blocked. These women are unable to bear babies because sperms cannot reach the eggs for fertilization. In such cases, doctors collect freshly released egg and sperms and keep them together for few hours for *IVF or in vitro fertilization* (fertilization outside the body). In case fertilization occurs, the zygote is allowed to develop for about a week and then it is placed in the mother's uterus. Complete development takes place in the uterus and the baby is born like any other baby. Babies born through this technique are called test tube babies. This term is actually misleading because babies cannot grow in test tubes

Fertilization - outside the body

You know that it is necessary for the sperm and ovum to come together for fertilization. In some animals fertilization takes place inside the body of the female

while in others it takes place outside her body. The process of fertilization that occurs outside an organism's body is called **external fertilization**.

We shall study about this by taking the example of frog. Frogs reproduce externally. Observe the pictures how they go about it.



Fig-13 Life Cycle of Frog

Life cycle of frog

Do all young ones (off springs) resemble their parents?

In class seventh you have learnt about the life history of silk moth. Does the larva of a silk moth resembled its adult? The young ones of some animals resemble their parents and some do not, when they emerge from eggs.

Such animals undergo a process called, metamorphosis (*META-beyond, MORPHE-form*), thus transformation of shape of the body occurs during development over a period of time and only then they begin to

resemble their parents.

Have you ever seen some fish like forms



Fig-14 Tadpole

swimming in a pond? Refer to the diagram to identify them. These fish like forms are called **tadpoles**

Where do you observe them? In nearby pond / ditch / slow flowing streams etc?

Think why frogs croak in a rainy season?



Fig-15 Copulation

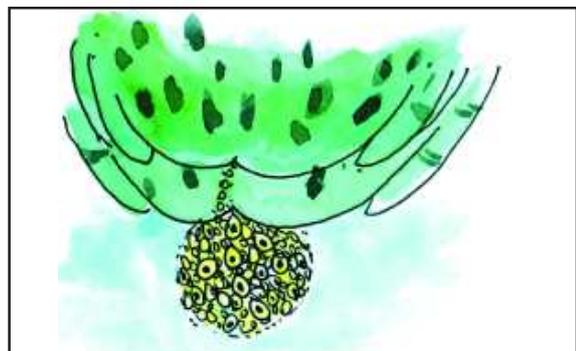


Fig-16 Release of eggs and sperms

Project work :

NOTE: this project work needs patience and carefulness. Teachers should be cautious while doing this project. Care should be taken at the time of collection of eggs of frogs from a nearby pond or slow flowing streams. If eggs are not available, need not to worry. You can start your project after collecting Tadpoles.

Step: 1

Go to a nearby pond or a slow flowing stream where usually sewage stagnates during rainy season. Collect few eggs of a frog with the help of wide mouthed bottle as shown in the Figure-17. While collecting eggs, take care that the clusters of eggs are not disturbed and isolated.



Fig-17 Eggs in a pond

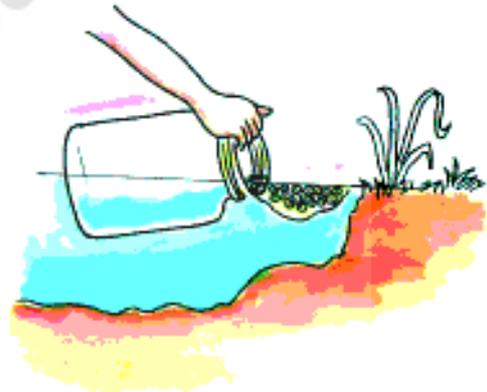


Fig-18 Collection of Eggs

Step: 2

After collecting eggs, take a tub of 15 cm depth and a radius of 8-10 cms. Transfer the eggs along with the weeds and algae that you have collected from the pond into the tub. Carefully observe the eggs. You will find a blackish part in the middle of the eggs. That is the embryo of the frog.

To conduct this project you require:

- Wide mouthed transparent bottle/ tub.
- Transparent glass.
- Dropper
- Petridish
- Some pebbles
- Magnifying lens

Step: 3

Observe the tub daily and note down the changes in your observation book. Draw diagrams after observing for atleast once in three days.

1-3 days observations diagram	4-6 days observations diagram	7-9 days observations diagram	10-12 days observations diagram
13-15 days observations diagram	16-18days observations diagram	19-21days observations diagram	22-24 days observations diagram
25-27 day observations diagram	28-30days observations diagram	31-33 days observations diagram	34-36 days observations diagram
37-39 days observations diagram	40-42 days observations diagram	42-44days observations diagram	45-46 days observations diagram

Step: 4

To observe the tadpole take a transparent glass and fill it with some water taken from the previous tub where tadpoles are preserved for observation. Take a plastic dropper and fill in some water along with a



Fig-19 Observation through a dropper

tadpole. (See the figure -11)

It is not easy to watch the tadpole in the dropper when it grows older. For this, you need to take help of a watch glass or any other glass bowl.

Step: 5

- Try to answer these questions after your observation:
- How many days did it take for the eggs to hatch?
- How does the tadpole look like?
- When did you find gill slits in a tadpole?
- On which dates did you observe:

Heart :

Intestine :

Bones :

Rectum :

Hind limbs

Fore limbs :

Step: 6

Having observed hind limbs, keep pebbles in the tub as shown in the figure-12. It is for accommodating tadpoles to settle out side for some time. It is essential in this stage as respiration through lungs are evolving.

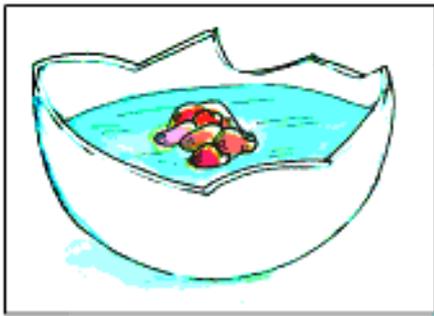


Fig-20 Setup for late tadpole

Now try to answer the following questions:

- When did gill slits disappear?
- When did the tail completely disappear?
- How many days did it take for a tadpole to transform into an adult frog?

Do you know?

Some animals like earthworms are neither male nor female. They carry both male and female reproductive organs. Such animals are called “**bisexual animals**” (also called **hermaphrodite**).

Write a note on what you have learnt about external fertilization. We see that external fertilization in frog takes place in water.

Give some examples of other animals in which external fertilization takes place in water.

Though you have studied different modes and processes of reproduction, these are not the only way how the animals reproduce. Besides these, there are also some other modes of reproduction. You will learn about these in your higher classes

Story of Dolly, the clone



Cloning is the production of an exact copy of a cell, any other living part, or a complete organism. Cloning of an animal was successfully performed for the first time by Ian Wilmut and his colleagues at the Roslin Institute in Edinburgh, Scotland. They successfully cloned a sheep named Dolly (see figure-c below) Dolly was born on 5th July 1996 and was the first mammal to be cloned.



- A) Finn Dorset sheep B) Scottish black face ewe C) Dolly

Fig-21

During the process of cloning Dolly, a cell was collected from the mammary gland of a female Finn Dorset sheep. Simultaneously, an egg was obtained from Scottish blackface ewe. The nucleus was removed from the egg. Then, the nucleus

of the mammary gland cell from the Finn Dorset sheep was inserted into the egg of the Scottish black face ewe whose nucleus had been removed. The egg thus produced was implanted into the Scottish black face ewe. Development of this egg followed normally and finally Dolly was born. Though Dolly was given birth by the Scottish black face ewe, it was found to be absolutely identical to the Finn Dorset sheep from which the nucleus was taken. Since the nucleus from the egg of the Scottish black face ewe was removed,

Dolly did not show any character of the Scottish black face ewe. Dolly was a healthy clone of the Finn Dorset sheep and produced several offsprings of her own through normal sexual means. Unfortunately, Dolly died on 14th February, 2003 due to certain lung disease.

After claims of Dolly, several attempts were made to produce cloned mammals. However, many died before the birth or die soon after the birth. The cloned animals are many-a-time found to be born with several abnormalities.



Key words

Reproduction, Budding, Uterus, External fertilization, Pregnancy, Zygote, Off springs, Binary fission, Ovary, Internal fertilization, Embryo, Testes, Epidermal hairs, Foetus, Oviparous, Sperms, Fertilization, "Bisexual animals, Viviparous, Ova, Asexual reproduction, Sexual reproduction, Metamorphosis.



What we have learnt

- Animals such as human beings, cows and dogs which give birth to young ones are called viviparous animals.
- Animals such as hen, frog, lizard and butterfly which lay eggs are called oviparous animals.
- Viviparous animals have external ears and epidermal hairs on their skin.
- There are two modes by which animals reproduce. These are: (i) Sexual reproduction and (ii) asexual reproduction.
- The type of reproduction where fusion of gametes does not take place is called asexual reproduction.
- Asexual reproduction is common in micro-organisms.
- Budding, fission etc are some common methods of asexual reproduction. Budding is observed in Hydra and binary fission is observed in Amoeba.

- Reproduction resulting from the fusion of male and female gametes is called sexual reproduction.
- The reproductive organs of a male consists of testes, sperm ducts and penis.
- The reproductive organs of a female consists of ovaries, oviducts and uterus.
- The ovary produces female reproductive cells called ova and the testes produces the male reproductive cells called sperms.
- The fusion of ovum and sperm is called fertilization. The fertilized egg is called a zygote.
- Fertilization that takes place outside the female body is called external fertilization and that which takes place inside the female body is called internal fertilization.
- Internal fertilization is observed in human beings and other animals such as hens, cows, dogs etc.
- External fertilization is very common in aquatic animals such as fish, starfish etc. it is also seen in frogs.
- Due to fertilization offsprings get some characters from their parents.
- The zygote divides repeatedly to develop into an embryo.
- The embryo gets embedded in the wall of the uterus for further development.
- The stage of the embryo in which all the body parts are identifiable is called foetus.
- The transformation of the larva into adult through drastic changes is called metamorphosis.
- Apart from natural reproduction system, nowadays, most sophisticated techniques of artificial reproduction are also available.



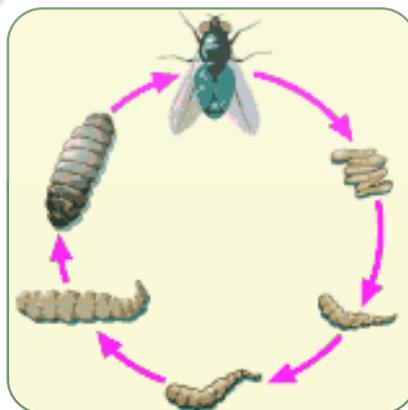
Improve your learning

1. What would happen if all the organisms stop the process of reproduction? (AS 2)
2. Differentiate between: (AS1)
 - a) Sexual reproduction and asexual reproduction
 - b) Gametes and zygote
 - c) External fertilization and internal fertilization
 - d) Viviparous and oviparous animals
3. Compare the reproduction in Hydra and Amoeba. Note down the differences in your notebook. (AS1)

4. Why do fish and frog lay more number of eggs where as cow and human beings usually give birth to only one at a time? (AS1)
5. Can animals produce offsprings even without formation of zygotes, how? Explain with suitable example. (AS1)
6. Kavitha found a tadpole in a pond. She collected it carefully and put it in an aquarium supposing it as a fish. After some days what did she find and why? (AS 3)
7. How can you identify the animal is viviparous or oviparous. (AS1)
8. Who am I? (AS1)
 - a) I am formed by the fusion of male and female gametes...
 - b) I am a gamete that has a tail and travel to fuse with female gamete...
 - c) I am a fully developed embryo inside a mother's body...
9. State the reason why most of the terrestrial animals' fertilisation takes place internally. (AS1)
10. Observe the following figures and write the functions of them. (AS1)



11. a. By taking help of the given words label the following life cycle? (AS1)
(eggs, adult, pupa, larva)



- b. Explain the process of metamorphosis in housefly by taking help from in the given diagram.

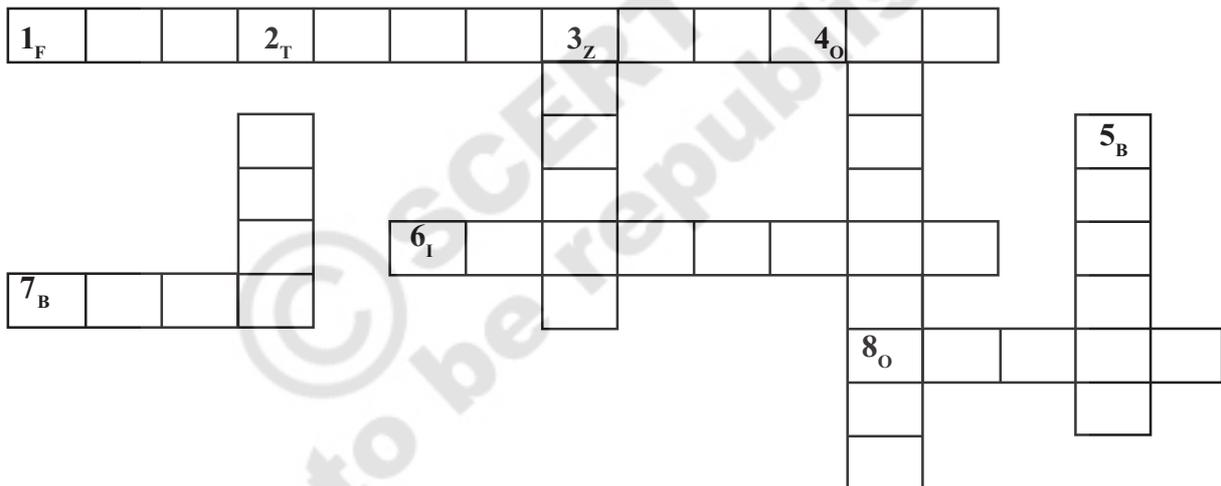
12. Complete the cross-word puzzle using the hints given below (AS 6)

Across

1. The process of the fusion of the gametes.
6. The type of fertilization in hen.
7. The term used for bulges observed on the sides of the body of Hydra.
8. Eggs are produced here.

Down

2. Sperms are produced in these male reproductive organs.
3. Another term for the fertilized egg.
4. These animals lay eggs.
5. A type of fission



13. Collect information from your library or from other sources like internet and discuss the life cycle of butterfly in the symposium at your school. (AS 4)

14. How would you appreciate Ritwik's work when he kept back the pigeon squab in the ventilator? If you were in Ritwik's place what would you do? (AS 7)

15. What happens if a couple give birth to more than two babies? Is it necessary to control population why? (AS 7)

16. Sketch the diagrams of male and female reproductive systems? (AS5)

REACHING THE AGE OF ADOLESCENCE



Naveen is studying VIII class. He is so active, remaining idle for over six months. He even feels shy while talking to strangers and even with the relatives visiting their home. If he starts speaking, his voice becomes somewhat hoarse. He does not care to follow suggestions and advises of his parents. He shows restlessness if parents tell him to pack the baggage or bring goods from the shop. His parents are worried on noticing his changing behavior. Naveen's Grandmother says he is growing now, that is why he is not listening to their words.

- Some of you also may behave like this, Why?
- Have you noticed that you are growing?

Usually, we see changes in the age of 13-19 years. This period is called "Adolescence". During this period changes are observed inside (internal) and outside (external) the body. For example, Changes in voice, growing tall etc.

Do you observe these changes in you too? Write down the changes usually you observed during your adolescence.

Have you reached the age of "Adolescence"?

- Is mustache growing on your upper lip?
- Did your voice change?
- Are hairs growing under arm pit?
- Are there pimples or acne on your face?
- Are you taking care of your face by applying powder and combing your hairs frequently?
- Are you feeling shy when talking with opposite sex?
- Are you not interested to play with opposite sex which you have done earlier?
- Are you showing restlessness while your parents suggest to do something?

If your answers are 'Yes' for most of the above questions it reflects that you are in adolescence phase.

During adolescence, changes occur in external, internal parts of the body. You will show interest to spend time with peers. The changes may be misleading. That could be one of the reason for worry of your parents.

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During adolescence, changes occur in external, internal parts of the body. You will show interest to spend time with peers. The changes may be misleading. That could be one of the reason for worry of your parents.

Adolescents does not show interest to discuss about the changes with their parents. This is a complex stage of life, because they grow from childhood to adolescence. They have a lot of stress due

to these changes and are unable to decide whether they belong to adulthood or childhood. This is the period of confusion and transition.



Fig-1

Changes at adolescence

Increase in Height

Growth is one of the important characteristic in human beings. Can we go on growing through out our life time? We can't grow like plants. We grow to certain height for certain period only. This change takes place in adolescence. at maximum pace. You may have observed that you and your friends are growing and slowly losing the child like features.

An individual reaches his /her maximum height during adolescence period only. You may also be growing taller now.

- Do you know upto which age you will grow?
- Can you guess how much height you will get?

Activity-1

Observing growth rate

The following chart gives the average rate of growth in height for both boys and girls with age (table-1).

The figures in column-2 and 3 give the percentage of the height a person has reached at the age, as given in column-1.

These figures are only representative and there may be individual variations.

TABLE-1

Age in years	% of full height(boys)	% of full height (girls)
8	72	77
9	75	81
10	78	84
11	81	88
12	84	91
13	88	95
14	92	98
15	95	99
16	98	99.5
17	99	100
18	100	100

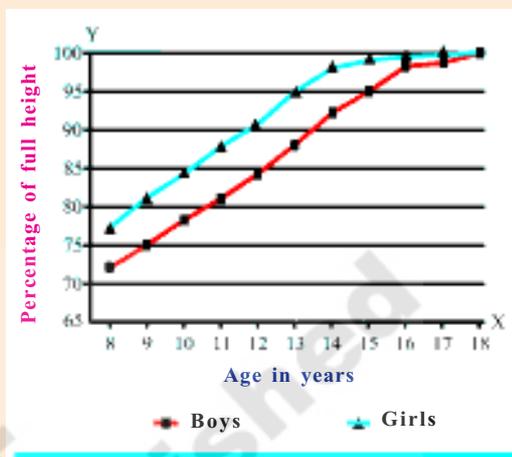


Fig-2

What have you observed from the above table? Using the data of table-1, graph has been drawn. Observe the graph and answer the following questions.

- When does growth in height nearly stop?
- Which period of age according to you is the fastest growing period for girls?
- Which period of age is the fastest growing period for boys?
- Who do grow faster? How can you say?

Initially the girls grow faster than boys. But by about 18 years of age both reach their maximum height. The rate of growth in height varies in different individuals.

Some may grow suddenly and then growth slows down gradually.

I will tell how much height you will grow:

Yes. Its real. You can also tell how much height your friend will grow. For this you need the following formulae.

$$\frac{\text{Present height (cm)}}{\text{Maximum height that you may gain}} \times 100 =$$

% of full height at this age (as given in the chart)

For example Sneha is 13 years old with 125 cm tall. At the end of the growth period she is likely to be $125/95 \times 100 = 131.5$ cm.

Use the information as given in Table- 1 and calculate the maximum height that you will reach.

Table -1 shows that girls grow faster than boys in their adolescent period. As for

example by the age of 11, a boy has reached 81 % of his probable full height, while a girl has reached 88% of her full height. Form a group with six students in your class. Measure your height and calculate your future heights in the following table.

TABLE-2

Name of the Student	Age	Present height	Maximum growth in height

The above activity helps you to calculate how tall you would be. To reach a proper height there are several factors involved. One of them is proper nourishment.

Collect body measurement data of the selected 15 students. For this you need to observe health record which is available in your school.

Activity-2

Changes in your body

Form five groups in your class. Take at least 15 students in each class. Your selection should be random which means students with Odd role number or name that start with letter 'S' etc.

Find an average body measurements for boys and girls in each class separately (If school health record is not available you will take teachers help to measure the components perfectly) record them in your note book as per the table given below.

(For component under voice, you put tick (✓) mark in relevant column)

TABLE-3

S.No	Name	Age	Height	Chest	Shoulder	Voice	
						Soft	Horse

For each class (VI to X) you have to prepare one table. And then we have to calculate averages of the collected information with the help of your teacher.

- Find the average for each component of your table.
- What relations do you find in these four components?
- Is there any sudden change or gradual change that you observe?
- Between which classes do you find a maximum growth in height?

Information collected by you will give a clue to some changes that you notice that in your body as you grow especially during a particular period of life, that is the adolescent period.

You might have noticed that boys in your class have broader shoulders and wider chests than the boys of class 6. In girls the region below the waist starts becoming wider to prepare the body to deliver baby in future. Muscles of the body grow more prominent in boys than in the girls. Thus changes occurring in adolescent boys and girls are different.

Voice Change

- If you attend a phone call of a child, can you say whether the child is a boy or a girl? Why?
- When could you identify the voice of a boy or a girl? Why?
- Why do break in voice commonly occur in boys during adolescence?

Generally change in voice is seen during adolescence

the voice of boys become hoarse in this stage. Let us know about this.

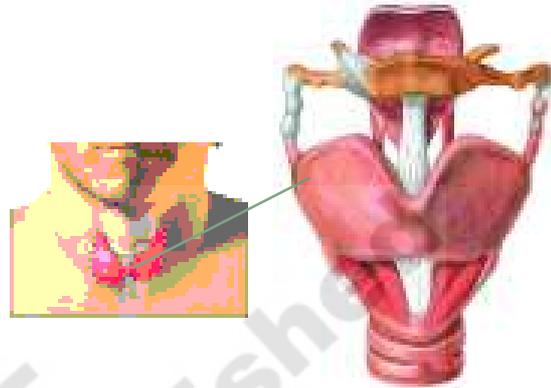


Fig-3

Adam's apple in an adolescent boy

Look at figure 4 and observe some projections at the boy's throat. Try to see the same things in any of your school mates. This is known as Adam's apple.

The Adam's apple is actually a partial growth of our voice box or larynx. The larynx is made up of 9 cartilages (the kind of substance that you can feel by bending your external ear) one of which is the largest, called as thyroid cartilage. The Adams apple is formed due to elongation of the thyroid cartilage which protrudes out in front of the neck. This is caused mainly by some male hormone (regulatory chemicals) during adolescence. As a result of this, muscles (chords) attached to the cartilage get loosened and thickened. When air passes through these loosened and thickened chords a hoarse sound is

produced. The laryngeal prominence is usually more prominent in adult men than in adolescent boys.

This is the reason for disturbance in your voice in the stage of adolescence. At the end of the adolescence stage you will get perfect voice.

Sweat and pimples:

Naturally in adolescence, boys and girls take care of their face and look frequently in mirror. They also feel worried of their pimples and acnes. Sometimes these pimples lead to infection. Can you guess the reason?

The secretions of sweat and sebaceous glands in adolescents are very active. Many adolescent boys and girls get pimples on the face, because of increased activity of these glands in the skin. Owing to extra secretions sometimes a distinctive odor is also produced from their bodies. Do not squeeze the pimples. They make your face appear with black spots.

What should be done?

- Do not scratch the pimples
- Wash your face regularly with a mild soap
- Use luke warm water to wash pimples and acne.
- Never get worried of pimples because stress and strain may help them to increase.

Development of sex organs

Let us recall about the male and female reproductive organs already learnt in the previous chapter.

At this age, male sex organs like the testes and penis develop completely. The testes also begin to produce sperm. In girls, the ovary enlarges and eggs begin to mature. Ovaries also start releasing mature eggs.

In girls breasts begin to develop whereas in boys, facial hair, moustaches and beards begin to grow. Hair starts growing on the chest of boys. In both boys and girls hair grows in the armpits and at the genital region. They are called '**secondary sexual characters**'. The sex organs by which children are identified as boys or girls at birth represent **primary sexual characters**.

Reproductive phase of life in humans:

Reproduction is most important for continuation of human race. You know the reproduction takes place by the fusion of male and female gametes.

Do you know? When do you get the reproductive capacity?

Adolescents become capable of reproduction when their testes and ovaries begin to produce gametes. Actually there is no specific age; mostly in between 11-15 years. It differs from person to person. (Now a day reaching age of adolescence in girls become reduced. Some observations

explains that because of polluted food material like Estrogen contain milk. This fact may also effect the boys and delay the reach of the reproductive phase.) The capacity lasts for a much longer in males than in females. Though their bodies are prepared for reproduction physically, mental growth and maturity are still farway..

Look at the sequential order of reproductive stage and answer the questions that follow

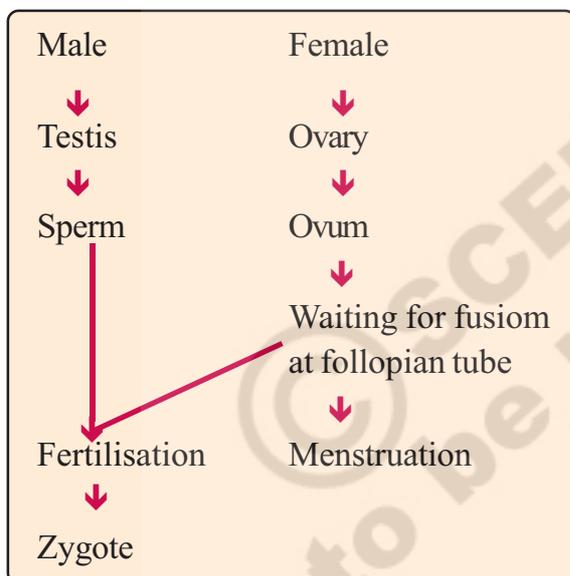


Fig-5

Schematic diagram of menstrual cycle and reproduction

The first menstrual cycle begins at adolescence and is termed as 'menarche'. It is the sign of starting of release of ova in female reproductive life.

- Do the production of eggs last long in females?
- What would happen if ovulation stops?
- What happens if ovum is not released?

- How does nature prepare the uterus to receive the fertilized egg?
- What happens if fertilization does not take place?

In females, the reproductive phase of life begins usually around 10-12 years of age and generally and lasts till the age of approximately 45-50 years. The ova begin to mature with the onset of adolescence. One ovum matures and is released by one of the ovaries once in about 28 to 30 days. During this period the wall of the uterus becomes thick so as to receive a fertilized egg and this results in pregnancy. If fertilization does not occur, the released egg and thickened lining of the uterus along with its blood vessels are shed off. This causes bleeding in women which is called Menstruation. It is nature's wonderful phenomena.

At 45 to 50 years of age, the menstrual cycle stops. Stoppage of menstruation is termed 'menopause'.

Menstruation occurs once in about 28-30 days. In some cases, initially menstrual cycle may be irregular. It takes some time to become regular. If it remains irregular for over a year, then there is a need to consult a doctor (gynecologist).

People and myths

Some sections of people in our society believe that during the period of menstruation woman are untouchable. So, they are asked to keep a distance from others. During this time girls may be restricted from taking bath, cooking food or going to school. In that case they may

lag behind in their studies. In some sections of the society even women are also forced to stay in the huts built at the outskirts of the village.



Think and Discuss

- In what way this kind of discrimination is harmful for girls and women?
- Several researches have been done to prove that all these are myths and there is no scientific reason behind these. The blood and egg that is discarded would give rise to a baby if fertilization took place.
- This a biological phenomena. So how can it be impure or unclean?
- During menstruation period proper care regarding health and hygiene is needed rather than following myths.

Child marriage – A social evil

Marriage is social and cultural practice to produce next generation in our country. Before reaching required age to get married is an unhealthy issue.

Child marriage is social evil which causes unwanted damage to in their lives. Let us read the story of Latha who fought against her marriage.

Latha was studying VIII class in Bigyaram village of Kodangal Mandal in Mahaboobnagar district. Her parents decided to get her married. She protested has much as possible.

But they did not agree. Teachers and local social workers and officials stopped this child marriage. Now she is studying in the school along with her friends.

- Discuss in your class why child marriage is a social sin. It should be avoided.
- Ask your teacher and write how child marriages cause damage to her health.

You might know that in our country, the legal age for marriage is 21 years for girls and 23 years for boys. This is because teenage mothers are not prepared mentally or physically for motherhood.

Early marriage and motherhood cause health problems for the mother and the child. It also curtails employment opportunities for the young woman and may cause mental agony, as she is not ready for responsibilities of motherhood.

Fast and frigid

Adolescence is the growing age where physical changes takes place. Apart from this we may observe some changes in behavior also. Adolescence are very fast in taking decisions. They do not want to be forced to do any work, behave sometimes fast and sometimes frigid

Activity-3

Read the following check list. Put tick (✓) mark, which points reflect your behaviour.

Check list:

Prefers to spend more time before the mirror and like to use perfumes	
Do not want to listen to parent's suggestions	
Feels only friends are correct not parents	
Searching for identity from teachers and peer groups	
Want more independence in taking decisions	
Feeling responsibility in work allotted at school, house	
Showing risk taking behavior	
Taking decisions by critical thinking	
Sometimes feel shy sometimes feel happy	
If try to get friendship with opposite sex	
Inclined towards unhealthy habits	
Having more self consciousness	
Show more sensitive towards others emotions	

Do you know why you behave like this. You know what is good what is bad. But you people are more inclined towards which attracts to you. To make your future in a right way, you need to know more about adolescence. For this here are some points to help.

- These are all common in the phase of adolescence. Interest towards body and self is natural. Attraction towards opposite sex is also a normal response. No one needs to worry.
- The mind of an adolescent is full of zealous acts and urge to find reasons of several things around. They develop abstract ideas as well.
- Emotionally they are in a turbulent state all the time they get new thoughts for their life activities.
- Adolescents behave in a different manner as compared to what they did during childhood with peers and elders.
- Adolescents are more independent in nature and very self conscious.
- An adolescent feel insecure while trying to adjust to the changes in the body and the mind. They seek company of friends to share their feelings even if they are of the opposite sex. This is normal. They need a lot of attention, love and care as well as answer to all their queries regarding their body and its developments.
- It is the first and foremost duty of every adult to prepare oneself to reveal to the adolescent the secrets of nature and the natural course of life as it is. Adolescent queries must never go unanswered

Hormones and adolescence

The following figure helps you to know more about hormones that influence on adolescence. This figure shows the position of a special group of glands called endocrine glands in the human body. These glands help in the regulation of the functioning of the human body by releasing some chemicals directly into the blood.

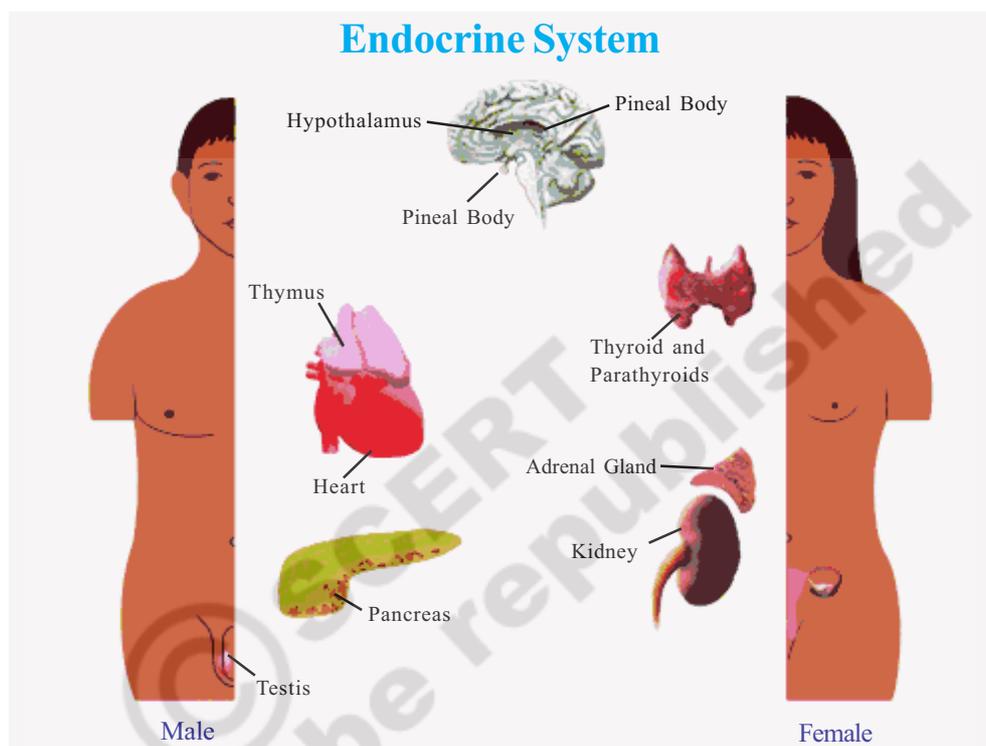


Fig-6 Position of some endocrine glands in the human body

The endocrine glands do not have specialized ducts to do so, they are called as ductless glands. The secretions of these glands are known as hormones. and directly released into blood. The endocrine hormones perform several functions in the body like; Hormones control the sugar levels, salt and calcium levels in the blood. Also control water levels of the body. Along with these endocrine glands play an important role in development of the

reproductive system. Physical changes during adolescence, starting of menses, pregnancy and menopause etc are largely under the control of these hormones.

The male hormone 'testosterone' begins to be released by the testes at the onset of adolescence which causes changes in boys. In girls ovaries begin to produce the female hormone 'estrogen' which brings about the development of breasts. Milk secreting glands or mammary glands develop inside the breasts.

Following table shows a list of some endocrine glands and some of the hormones produced by them.

S. No.	Gland	Hormone	Effect
1	Testis	Testosterone	Release of sperm, secondary sexual characters in male
2	Ovaries	Estrogen	Release of ovum, menstruation, secondary sexual characters in female
3	Pituitary	Pituitary hormones like growth hormone, follicle stimulating hormone (FSH) lutenising hormone(LH)	Brings about general growth, stimulates other endocrine glands. FSH directs estrogen for formation of ovum or eggs in uterus of females, while in males directs testosterone to stimulate sperm sacs to produce sperms. LH causes the egg to burst out and flow into the fallopian tubes
4	Adrenal	Adrenalin	Controls emotions

Adolescence and health

It is very important to be healthy and fit at any stage of life. For this, proper nutrition and hygiene is necessary. So far we have discussed that adolescence is the age when growth and development takes place at a faster rate. That is why it becomes more essential to be careful about health and hygiene in the adolescent period.

Balanced diet

Hunger levels of adolescents are very high. They need to eat different varieties of food. This is the stage of rapid growth and development, because the diet for an adolescent has to be carefully planned. Taking healthy and nutritive food is very important.

You already studied in the earlier classes

that the balanced diet includes proteins, carbohydrates, fats and vitamins in requisite proportions. Our Indian meal of *roti*/rice, *dal* (pulses) and vegetables is a balanced meal. Milk and Fruits are also useful for nourishment. Iron builds blood and iron rich food such as leafy vegetables, jaggery, meat, citrus, Indian goose berry (amla) are good for adolescents.

Because of this hunger, adolescents generally prefer to eat chips, packed or tinned snacks, road side foods appears to be very tasty, but they should never replaced the balanced diet. Eating them regularly may cause unwanted problems, like obesity. mouth and stomach ulcerations, increase in blood sugar levels and blood pressure etc. So adolescents you must say no to junk food.

Cleanliness

We have studied that sweat glands become more active in adolescents and give the body a distinctive odor. So it would be better to have a bath at least twice a day. All parts of the body and inner wears should be washed and cleaned every day. If cleanliness is not maintained, there are chances of having fungal, bacterial and other unwanted infections. Girls should take special care of cleanliness during the time of menstrual cycle. Making use of disposable napkins may reduce chances of infections.

- Under NPEGEL scheme girls are provided sanitary napkins in most of the schools of our state. Write down the programmes conducted by NPEGEL in your school.

Physical Exercise

Walking and playing in fresh air keeps the body fit and healthy. All young boys and girls should take a walk, exercise and play outdoor games. The physical activity leads to conditions of better health, sound sleep and thereby mental peace. Mental peace promotes happiness in day to day existence. Instead of playing outdoor games spending time by watching T.V. or working on computer leads to drowsiness. That is why you are not able to pay attention to your studies.

Adolescence is a period when many changes take place in the body. Because of these changes one may get tensed, confused or insecure. In this situation if anybody

suggests that you will get relief if you take some drugs, just say “NO”, unless prescribed by the medical doctor. In case of having any problems, insecurity or tensions it is better to discuss and take help of your elders, parents, teachers or doctors.

Do you know?

Consuming tobacco (gutkha, cigarettes, cigar, beedi, khaini) damages the internal organs of the body. The number of addicted people at the age of 15 or below is 57.57 lakhs (68%) in AP. When they reach 30 years of age their internal organ system becomes damaged, and this leads to several problems and sometimes, may cause death also. It is a dangerous trend in our country. So you should be aware of healthy habits.

A famous psychiatrist Stanly Hall stated that adolescence is the age of stress and strain. By getting proper guidance from teachers, parents and elders, you ultimately be able to lead a happy meaningful life.



Think and Discuss

- If young generation is trapped into such unhealthy habits, what will be the future of our country? What are its effects?

Are you participating in adolescent education programmes in your school? Do you have a membership in red ribbon club? List out the programmes held for the last three months in your school and also add your opinion.



Key words

Adolescence, Teenage, Larynx, Adam's apple, Maturity, Sweat glands, Sebaceous glands, Secondary sexual characters, Menstruation cycle, Menarche,



What we have learnt

Menopause, Pregnancy, Endocrine glands, Hormones, Testosterone, Estrogen.

- Adolescence is the period of reproductive maturity which lies usually between the ages of 10 to 18 years.
- During adolescence a child's body undergoes many changes physically as well as mentally.
- Voice of boys becomes harsh as chords of voice box get loosened and thickened during adolescence.
- Height gain in children during adolescence and stops after words.
- The onset of puberty or development of secondary sexual characters and maturity of reproductive parts are controlled by hormones that become functional at the onset of adolescence.
- Hormones are the secretions of endocrine glands without ducts which secretes them directly into the bloodstream.
- Pituitary glands secrete hormones which include growth hormones and other stimulating hormones that make other glands such as the testes, ovary, adrenals etc secrete hormones.
- Testosterone is the male hormone and estrogen is the female hormone that bring about development of several secondary sexual characters.
- The uterine wall in female prepares itself to receive the developing fertilized eggs. In case there is no fertilization, the thickened lining of the uterus wall breaks down and goes out of the body along with the blood. This is called menstruation.
- It is important to take balanced diet for overall growth and development during adolescence.



Improve your learning

1. How is adolescence different from childhood? (AS1)
2. Write short notes on the following. (AS1)
 - a) Secondary sexual characters
 - b) Adam's Apple.
3. List out the changes in the body that take place at the age of adolescence? (AS1)
4. Match the following: (AS1)
 1. Testes () a. Estrogen
 2. Endocrine gland () b. Pituitary
 3. Menarche () c. Sperm
 4. Female hormone () d. First menstruation
5. Write five suggestions to improve the performance of Red Ribbon club of your school? (AS 6)
6. Prepare a three minute speech on behavioural changes in adolescents. (AS6)
7. Why acne and pimples are common in adolescents? (AS1)
8. What can you suggest to your classmates to keep himself / herself clean and healthy?
9. 13 years old Swaroop always think of his height. Can he improve his height? What you do suggest him? (AS 7)
10. If you have chance to talk with a doctor, what questions you would ask about adolescent emotions and changes in the body? (AS 2)
11. Nature prepares human body to reproduce her generations. What do you think of it? (AS 6)
12. You know that early marriage is a social sin. Prepare some slogans to prevent this. (AS 6)
13. Some mobile phones have auditory meter to measure frequency of produced sound. By using this phone measure your friend's voice frequency one from each class VI to X. Report your findings. (AS 3)
14. Are you angry with your parents. What do you want your parents to be? (AS 7)
15. What are your expectations about your parents and teachers? (AS7)
16. Adolescence is the energistic stage. What health and good habits you want to develop? (AS 6)

DIFFERENT ECOSYSTEMS



In “Habitat” chapter of class VI you have studied many things related to habitat. Try to recall some of them.

- The dwelling place for plants and animals is called habitat.
- One habitat is shared by different types of plants and animals.
- There are different living and non living things in one habitat.

Try to add more such points to your list.

-
-

This type of doubt may arise in your mind as well. Let us try to understand how the term ecosystem came into existence and in what way ecosystem is different from habitat.



Fig-1

What is Ecosystem

The word ecosystem was first used in 1935 by A.G. Tansley (a British Botanist and Ecologist) to describe a basic unit of nature. Tansley coined the word as reduction of the term “Ecological system” to Ecosystem. According to him nature works as a system in which organisms and their communities are profoundly influenced by many non living environmental factors and vice versa.

Prior to Tansley many other ecologists had also worked on

understanding the relationship between living things and their environment using different terms like habitat, biome, ecological system etc.

Till the use of the term ecosystem, people were studying interrelationships in nature in separate units either at small level like habitat or at a larger level as biome. Tansley was the first person to look at all these as a functional system. Thus all interrelationships are studied as parts of the ecological system.

Do you know?

In Ecosystem we study about the changes occurring in the habitat like organisms moving away from the habitat or entering the habitat.

Now you would be able to understand that Venkatesh and Gayathri both are correct in their own ways. The habitat that Venkatesh talks about is a part of the larger ecosystem.

In the following section we will try to understand the structure and function of the ecosystem.

Lab Activity

Structure of the ecosystem

From the discussion related to Venkatesh and Gayathri's doubt, we can conclude that there are several ecosystems around us. A field, a pond or your school garden all are examples of the same.

Aim : Study an Ecosystem at your school/home garden to understand its structure. For this you will require the following material.

Material Required : Measuring tape string, small sticks, hand lens, hand trowel.

Procedure : To know about Structure of the ecosystem you have to follow the following procedure

1. Use a tape to measure a square area that is one meter long and one meter wide. It can be on grass, bare dirt or sidewalk.

2. Mark the edges of the square with the help of string/chalk as shown in figure.
3. Observe the study area (that has been marked). Look for plants and animals that live there. Use the hand lens.
4. Record all the living organisms you see. You can even dig to go deeper to find out other living organisms that may be present there.

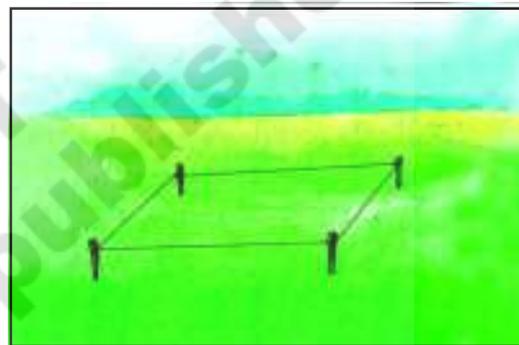


Fig-2 Marked area of 1 meter square.

Observations / Findings: (Note your Observations below)

-
-
-
-
-
-
-
-
-
-

Discussion :

- What living things did you find in your study area? Try to count them if possible.
- Which kind of living thing was most common in your study area?
- How was your study area different from those of other student groups?
- Other than the living organisms what other things can you record from your study area?

From the above activity we see that an Ecosystem is made up of groups of living things and their environments. The living things like plants, animals and micro organisms are known as biotic components of the ecosystem, where as others like, soil, water, sunlight etc are called as abiotic components of the ecosystem.

All these organisms live together and interact with one another in many ways.

Interdependence between the biotic components

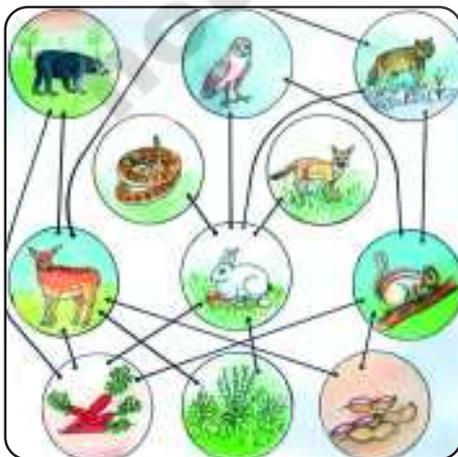


Fig-3

- What do the arrows in the figure indicate?
- Trace the path from grass to tiger. You may trace out other paths as well.
- On how many organisms is rabbit dependent? Write their names.
- How many organisms depend on rabbit? Write their names.

We know that there is a feeding relationship between plants and animals. Along with this we can see an interdependence between plants and animals for space, reproduction, shelter etc. as well.

- From where does plants get their food?
- What other things do animals need for their survival?

We find that not only the biotic components show interdependence among themselves but biotic and the abiotic components like air, water, soil, etc are also interdependent.

All the organisms in an ecosystem derive energy from food to live. The sun is the main source of energy for all living things. Plants trap this energy through photosynthesis. Animals do not get energy directly from the sun. Many animals eat plants, however, which use sunlight to make food. Animals that do not eat plants still depend on the energy of sunlight as they eat other plant eaters.

When scientists describe the way energy moves through ecosystems, they

used the term food chains. A Food chain has three levels.

Several plants, algae etc use sunlight to make their food and are called **producers**. **Consumers** eat other living things and get their energy from them.

The last level is made up of **Decomposers**. They feed on wastes, debris of plants and animals or on their remains after they die. They return nutrients to the soil for plants to use as the cycle begins again so they are also called **recyclers**.

Activity-2

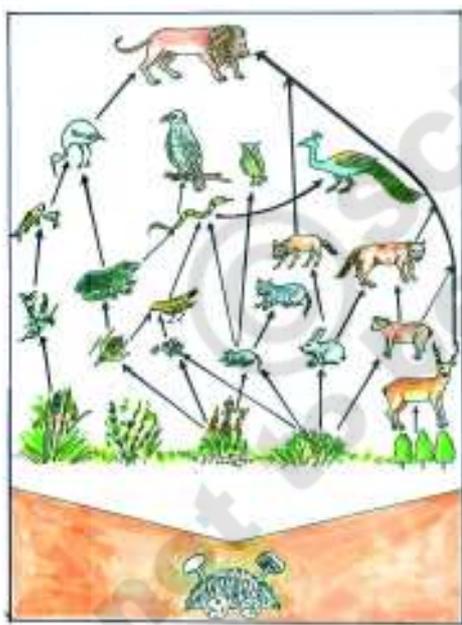


Fig-4

Observe the food web given above fig. ...

Now answer the following questions:

- Which are the producers in the food web?
- Which are consumers?
- Where does the food web start from?

- Name the organisms where the food web ends.
- What happens when plants and animals die in a food web?

Changes in the ecosystem

Organisms affect their environments to meet their needs. Usually the changes they cause are small and help in keeping the ecosystem stable.

Some changes affect other organisms. As animals eat plants or other animals, they reduce the number of organisms in their habitat.

For example, there are many insects in a bird's habitat. When a bird eats insects, it helps keep the number of insects from getting too large. This helps keep the bird's habitat and the whole ecosystem healthy and stable. But when there are too many birds eating insects, they reduce the insect's population quickly. In case of time, there will not be enough food for the birds. In this situation some birds leave the area or die and few younger birds will be born. This brings the ecosystem back into balance.

Ecosystem can also change quickly; powerful storms, tsunami, etc can destroy ecosystems very quickly.

Humans are also instrumental in bringing about changes in ecosystem.

Ecosystem can vary from a small plant to a dense forest. The biosphere is the largest ecosystem present on earth. It would be very difficult to study biosphere as a whole, hence ecologists classified

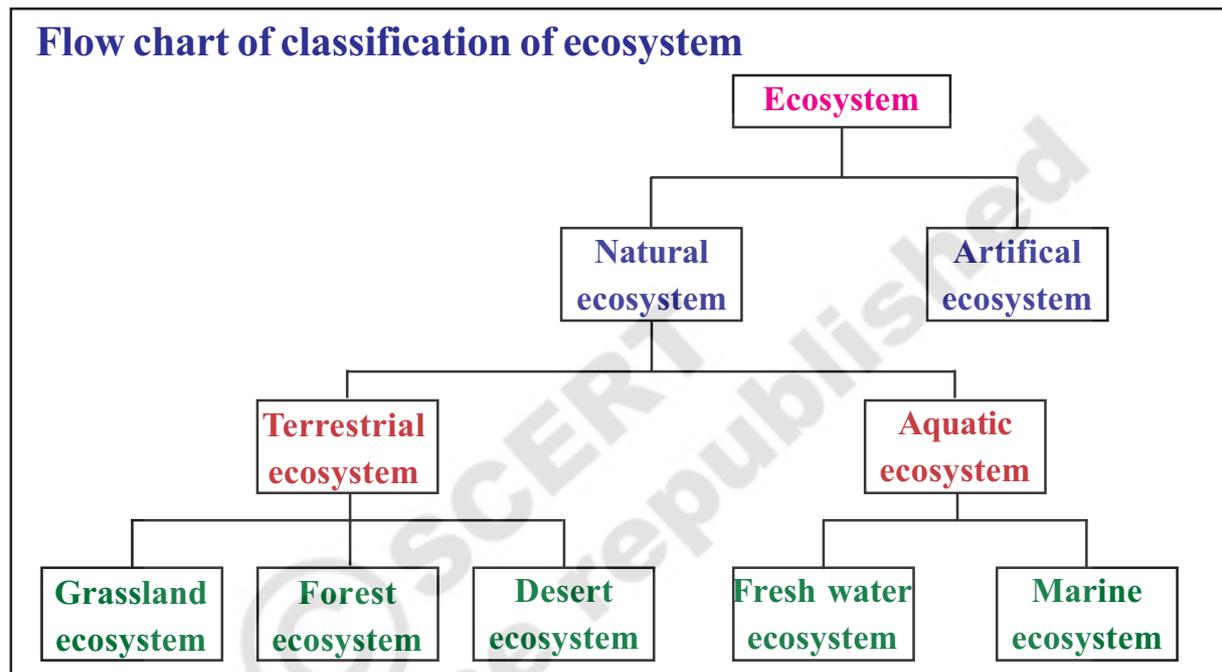
ecosystem based on various aspects. Some such classifications are artificial and natural, temporary and permanent.

Types of Ecosystem

Due to the Abiotic factors, different ecosystems develop in different ways.

These factors and their interaction between each other and with biotic components have resulted in formation of different types of ecosystems as explained below.

On the basis of human interference and its effect ecosystem has been classified as follows:



Mangrove ecosystem - Coringa

Mangroves are one of the most productive ecosystems on earth, deriving nourishment from terrestrial fresh water and tidal salt waters. Mangrooves are the forest that grow in back waters low depth areas of sea shore. Mangroves serve as important feeding, nursery and breeding grounds for a variety of commercially important organisms and also serve as protected areas for



Fig-4 View of mangrove in Coringa

endangered species.

Coringa mangrove is situated south of Kakinada Bay and is about 150 km south of Visakhapatnam. Coringa is named after the river Corangi. Coringa mangroves receive fresh water from Coringa and Gaderu rivers, tributaries of Gautami Godavari river and salt waters from Kakinada bay. Numerous creeks and canals travel in this ecosystem. Let us observe biotic and abiotic components of coringa ecosystem.

Biotic components

Producers - mangrove, spirogyra, euglena, oscillatoria, blue green algae, ulothrix, etc.

Consumers - shrimp, crab, hydra, protozoans, mussel, snails, turtle, daphnia, brittle Worm, tube Worm, etc.

Decomposers - Detritus feeding bacteria, etc.

Abiotic components - Salt and fresh water, Air, temperature, soil, etc.

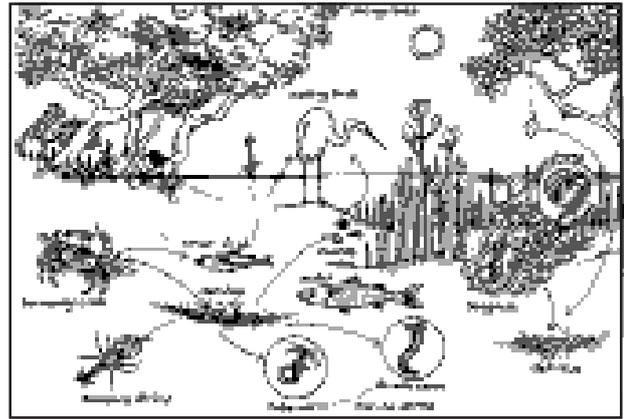


Fig-5 Food web in Coringa Ecosystem

? Do you know?

It is said that there are more micro organisms in the sea than there are stars in the universe. The world's oceans host 32 of the 34 known phyla on earth and ocean between 5,00,000 and 10 million marine species. Species diversity is as high as 1000 per square metre in the Indo-Pacific Ocean and new oceanic species are continuously being discovered.

We have studied that a living community cannot live in isolation. It lives in an environment which supplies its material and energy requirements and provides other living conditions. The living community, together with the physical environment forms an interacting system called the Ecosystem. An ecosystem can be natural or artificial, temporary or permanent. A large

grassland or a forest, a small tract in a forest or a single log, an edge of a pond, a village, an aquarium or a manned spaceship can all be regarded as ecosystem. An ecosystem can thus be defined as a functional unit of nature, where living organisms interact among themselves and also with the surrounding physical environment.

Collect Brochure of CoP-11, Biodiversity Conference, Hyderabad, 1-19, Oct, 2012. Discuss about ecosystems in your class.

The Desert Ecosystem

The desert occupies about 17% of the land and occurs in the regions with an average rainfall of less than 23mm per year. Due to extremes of temperature, the species composition of desert ecosystem is much varied and typical. The various components of a desert ecosystem.





Fig-6 Animals in Desert Ecosystem

1. Producers – The shrubs, bushes, grasses and some trees are the main producers in deserts. The shrubs have extensive and much branched root system with the stems and leaves variously modified. Some succulent cacti are also found in desert. These store water in their stem to be used during the time of water scarcity. Some lower plants such as lichens, xerophytes mosses and blue green algae are also found there.

2. Consumers – Only a few animals are found in deserts. The most common animals are those reptiles and insects which are able to live under xeric conditions. Mammals and insects which are able to live under xeric conditions. Mammals are represented by a few species of nocturnal rodents. Some birds are also present. The camel, called the ship of desert, feeds on tender

shoots of the plants and is to store large quantities of water in its stomach. The larger animals including carnivores are scarce. The desert animals have various morphological and physiological adaptations which enable them to live in such extreme environment.

3. Decomposers – Due to poor vegetation and less amount of dead organic matter, decomposers are few. They are thermophilic fungi and bacteria. Why should we appreciate the role of decomposers.

Forest eco system

Activity-3

All of your classmates are divided into four groups. Collect the information on forests of Andhra Pradesh and write the flora and fauna and fill up the following table. Collect more information from internet or from school library.

Name of the forest

Flora		Fauna	
Trees		Herbivores	
Shrubs		Carnivores	
Creepers		Rodents	
Mass and fungi		Birds	
Add other plants		Insects	

Display your observations on wall magazine of your class and compare with the other groups.

Investigations:

1. Do all forests have same type of vegetation?
2. Are producers of forest ecosystem higher than its consumers?
3. Do all the forests have same type of animals?



Fig-7 Flora and Fauna

Flora: These are mainly trees that show much species diversity and greater degree of stratification. The trees are of different kinds depending upon the kind of the forest formation. Besides trees there are also present shrubs and a ground vegetation.

Fauna: It includes herbivores like animals feeding on tree leaves as ants, flies, beetles, leafhoppers, bugs and spiders etc., and larger animals grazing on shoots / fruits of tree. Elephant, Nilgai deer, moles, squirrels, shrews. Flying foxes, fruit bats, mongooses. Also carnivores like snakes, birds, lizards, fox etc., Top carnivores like Lion, tiger also live in forest feeding on animals.

Decomposers: These includes wide variety of micro organisms those live on

Forest eco systems have unique environment and are categorized based on the type and ages of trees, climate and soil. They impact the environment at scales ranging from local to regional by influencing climate, nutrients dynamics and water movement. Forests are found all over the world and they provide valuable economic and environmental services.

dead bodies of flora and fauna including fungi and bacteria.

Energy flow in an ecosystem

The existence of living world depends upon the flow of energy and circulation of materials through the ecosystem. The energy is required for the performance of all the life activities.

The main source of this energy is sun. The solar energy enters the space in the form of light rays. Approximately 57% of solar energy is absorbed in the atmosphere and scattered in space. About 36 percent is expended in heating water and land and in evaporating water. Nearly 8 percent of light energy strikes the plants, of which 80-85 percent is absorbed, and only 50 percent of it is utilized in photosynthesis.

This energy is captured by plants and is stored in the form of potential energy in foodstuffs. These are known as *producers* and represent the first trophic level in the ecosystem. The energy stored by plants is passed through the community or ecosystem in chain. A food chain consists of four steps-the producers, primary

consumers, secondary consumers and tertiary consumers. The energy flows from the producers to consumers. At each transfer a large proportion (80 to 90 per cent) of potential energy is dissipated as heat produced during the process of respiration and other ways. To know more details about energy flow see annexure.



Key words

Habitat, Ecosystem, Food Web, Producers, Consumers, Decomposers, rodents, flora and fauna, thermophill, mangroves, energy flow, nocternals, biotic components, abiotic components.



What we have learnt

- The word ecosystem was coined by A.G. Tansley.
- Interrelationship between biotic and abiotic factors can be studied as a part of an ecosystem.
- Living things like plants, animals and microorganisms are the biotic components of the ecosystem.
- Abiotic components of an ecosystem constitute soil, water, sunlight etc.
- Several ecosystems exist around us.
- Food chains/food webs explain interdependence between biotic and abiotic components in the form of nutrient and energy.
- Food chains have three level- producers, consumers, decomposers.
- The producers trap the sunlight to produce food for themselves as well as for others.
- Consumers get energy by eating either producers or other plant eaters.
- Decomposers/recyclers feed on the wastes of plants and animals or remains of plants and animals after they die.



Improve your learning

1. Define an ecosystem. Explain it with a suitable example. (AS 1)
2. Explain how diversity of living organisms helps in enriching any ecosystem. (AS 1)
3. An ecosystem that had mice. What happens if more cats were added to it? (AS 2)
4. In grassland ecosystem, rabbit eats only plants. They eat plants faster than the plants can grow back. What must happen to bring the ecosystem into balance? (AS 6)
5. What happens when two animals having similar habits share one ecosystem? (AS 1)
6. What is the difference between habitat and ecosystem? (AS 1)
7. Who am I? (AS 1)
 - I am the base of food chain.
 - I depend on plants for food.
 - I break down the remains of dead plants and animals.
8. Which of the following is a producer? and why? (AS 1)

(a) fox (b) fungus (c) chicken (d) grass
9. plant, tiger, rabbit, fox, hawk

Did you find any connection among the above list of things. If we remove Rabbit from the list what will happen? (AS 6)
10. List out producers (Plants, Bushes, Trees). Consumers (herbivores, carnivores) and Decomposers that you observed in your agriculture field or school garden. (AS 4)
11. What do you understand by food web?

Describe your own food web with the help of a diagrammatic representation.(AS 1)
12. What do you understand by inter-dependency of animals and plants? How do you appreciate? (AS 6)

WHAT WE ARE DOING TO THE FORESTS OF THE WORLD IS BUT A MIRROR REFLECTION OF WHAT WE ARE DOING TO OURSELVES AND TO ONE ANOTHER

-Mahatma Gandhi



Energy flow in ecosystem

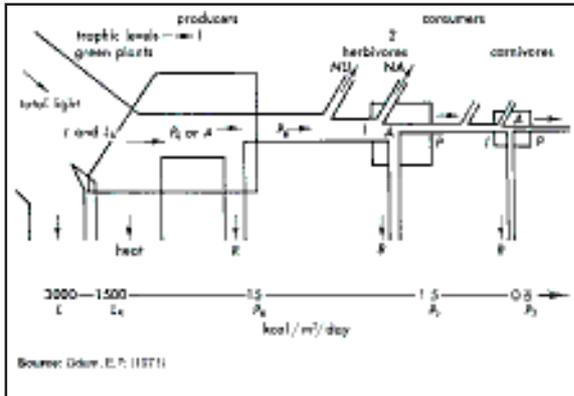


Fig of Energy flow in an ecosystem

Fig. Diagrammatic representation of energy flow through a food chain of ecosystem. The boxes represent biomass or population mass and the pipes show the path of flow of energy between living units. The relative size of block suggests the quantity of energy flowing through each pipe.

- L = Total energy input;
- LA = Light absorbed by plants;
- P_G = Primary gross production;
- A = Total assimilation;
- P_N = Net primary production;
- P = Secondary production;
- NU = Energy not used;
- NA = Energy not assimilated by consumers;
- R = Respiration.

The energy flow through an ecosystem can be represented

diagrammatically in a simplified manner. In fig. the boxes and out at each level. Only about half the average light energy impinging upon the green plants is absorbed in the photo synthetic process, out of which 1 to 5 per-cent is converted into food energy and the rest of it passes out as heat into the atmosphere.

Energy accumulated by plants or the producers in an ecosystem is called primary production. The total energy produced during photo synthesis is the Gross primary production. And is represented by P_G or A and energy left after respiration and stored as organic matter in the producers is the Net primary production represented by P_N . Net primary consumers actually represent food potentially available to primary production which feed upon plants. The primary consumers, therefore, take in chemical potential energy in the form of plant food. Most of it dissipates in the form of heat (produced during the respiration) and is lost out of ecosystem. Only a small part of energy is fixed in the form of chemical potential energy in the protoplasm. The same process is repeated at the secondary consumers or primary carnivorous level and so on. Therefore at each step in the transfer of energy from one trophic level to another a large amount of energy is degraded in to heat and never returns ecosystem.

Food Production from plants

Methods of Management



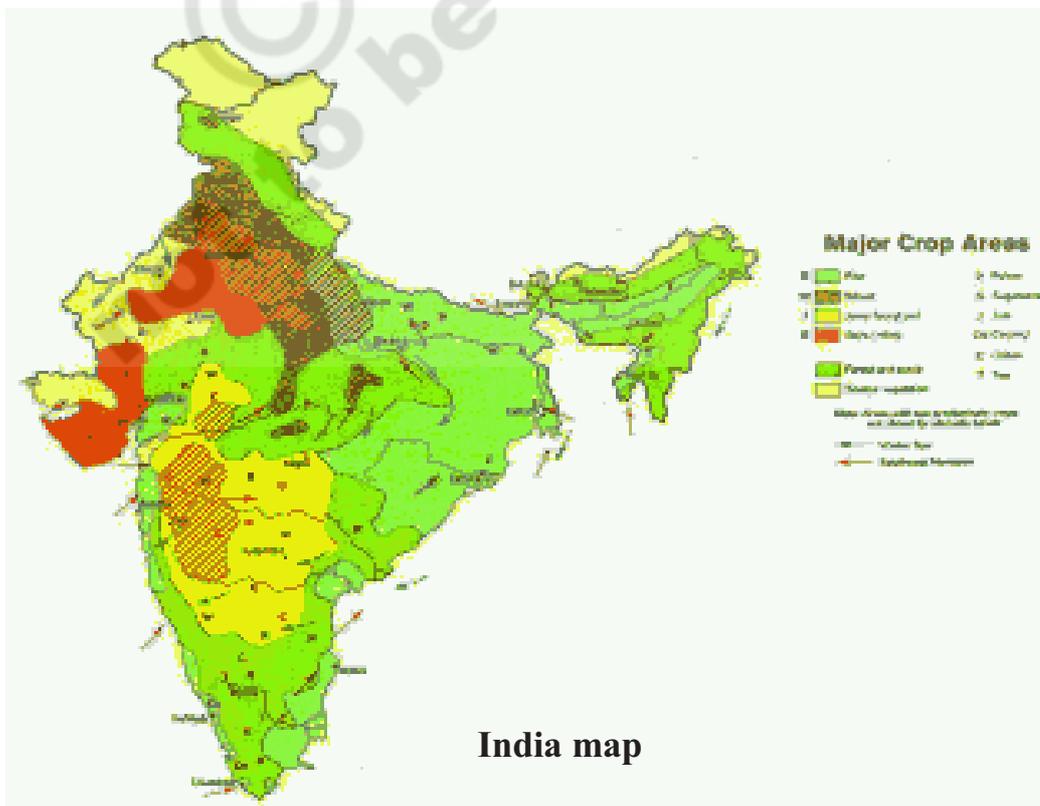
Naveen has come to his uncle's village for enjoying his holidays. On his way home, his uncle showed him his fields. Curiously, Naveen enquired his uncle, what crops are grown in the village? Uncle said Maize, paddy, wheat, Raagi etc., are being grown in the fields.

Activity-1

Crops in India

Observe the following map (India). List out the crops that are grown in our country.

- Are there many crops that are grown in most of the parts of our country? What are they?



- Why such crops are grown all over the country?
- From the above list, which of them are grown in your village?

Go through your social studies text book or in library, make comparative statements showing crops largely grown in the country.

a. Country _____

b. State _____

c. District _____

d. Your village _____

But don't forget to add your observations at the end of the table.

Is time period for all crops the same?
Which crop needs more duration?

We are mainly dependent on Agriculture for our food. Most of our food products are obtained from plants. The plants which are grown in large number to get useful food products are known as 'crops'. The process of growing crops is called 'Agriculture'.

Activity-2

Duration of crop

How many days are required for getting the crops?

Collect information from the farmers of your village about the period taken to grow different crops. Write the information in the table.

Name of the Crop	Duration of the crop

Some crops like jowar, red gram takes a minimum of 180 days or more for harvesting. Such crops are called “**Long term crops**”.

Based on the above list or the discussion with farmer give some more examples for long term crops.

.....

Some crops like green gram, black gram takes 100 days for harvesting and such crops are called “**short term crops**”.

Based on the above list or the discussion

Season	Vegetables	Fruits	cereals	Pulses
Rainy				
Winter				
Summer				

- In which season do you find more varieties of vegetables in the market? Why?
- Generally, farmers grow varieties of vegetables during rainy season. Can you guess the reason?

You know water is essential for growing of crops. In rainy season ponds, wells, rivers, ditches are pooled with water. Hence, farmers grow varieties of crops in this season. Did you know any name for the crops that grown in rainy season? The crops grown in the rainy season are termed as “**Kharif**”.

with farmer give some more examples for short term crops.

.....

.....

Activity-3

When do crops are grown

We eat different fruits and vegetables. Are all the vegetables and fruits available throughout the year? In a particular season some are mostly available and some are less in number. Some are not at all available. Discuss in groups and make a list of these things for the following table.

Now revisit activity-3. What are the vegetables, fruits, cereals and pulses you have written in the table. These crops are widely grown in winter season. Are these crops require water like Kharif crops? The crops that are grown only in winter season are generally called Rabi. We will learn more about these crops.

Why farmers cultivate different crops in Rabi and Kharif season?

Crop production is based on flowering of plant. After conducting so many experiments. Scientists invented those main reasons for flowering of plant.

1) The flower will come out from the plant after certain growth. In some plants flowering takes place after growing certain height, branches, nodes and after producing 7-9 leaves.

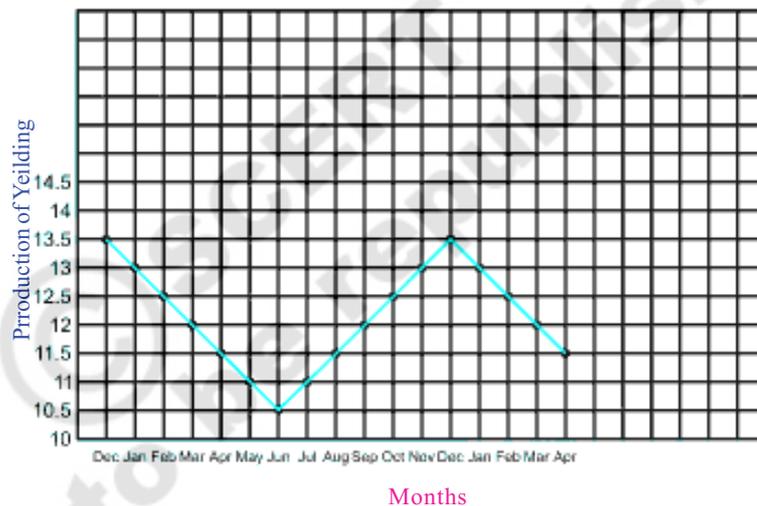
2) Flowering of plants also depends upon the duration of night. The effect of night duration in flowering plants differs from plant to plant. In some plants when the night duration is 12 ½ hours the flowering will be more. For example

Wheat plants flowering takes place only in long night durations.

Plants like maize, cotton flowering will be more when the night duration is more than 12 ½ hours.

3) In some plants night duration is not at all the reason for flowering. They can give flowers any time during the year ex: soyabean

Now observe the graph and answer the following questions.



- Why farmers cultivate Wheat crop in Rabi season?
- What happens if it is cultivated in the month of September?
- Why farmers does not cultivate it in Kharif season?

If we cultivate wheat crop in the month of July it takes 8-10 weeks for growing. After that flowering will take place. By that time it would be October. Then the night duration extends more than 12 ½ hours.

The flowering does not take properly at that time.

- If we cultivate wheat in the month of the November what will happen?
- Heat is essential for ripening and development of grains in the plants. Then when do we get more heat?

We get hot climate from February onwards. It is suitable for maturing the grains. That is the reason wheat is cultivated in the Rabi season only.

By keeping this in mind farmers cultivate some crops in Rabi and some crops in Kharif season. You know paddy is cultivated in both Rabi and Kharif seasons. Is there any difference in production and quality of seeds grown in both seasons?

Activity-4

Production of Paddy

Go to your nearest farmer and collect the information for the following table.

Paddy growing season	Paddy Production Per hectare	Quality of seeds	
		Size	Weight
Rabi			
Kharif			

(One hectare is equals to 2.4 acres.)

- In which season farmers get more benefits?
- Is there any crops which are grown in both Kharif and Rabi Seasons
- In which seasons farmers generally get good quality of seeds.
- The quantity of grains is higher in Kharif, lower in Rabi. Do you agree this? Give your reasons.
- Do you know about third crops. Some of the places in our state growing 3rd crop also.

Ask your teacher about which crops are generally grown as 3rd crop. Think why it is not practised in all areas of our state.

Growing paddy and Agricultural practices

Rice is the prime, most essential and important staple food crop. 'It is also called global grain'. Rice was cultivated in the late Mesolithic period (9000-8000 B.C) and in the Harappan civilization (2300 B.C). It is grown as a Kharif or a Rabi crop from Rajasthan to Arunachal Pradesh and from Kerala to Jammu and Kashmir. Although a crop of the warm tropical wet lands, it also grows in the cooler temperature regions of China, Japan and Australia. Of all countries in the world India has the largest area of land under rice cultivation. Though the production per hectare is low when compared with China and Japan.

Country	Land under rice cultivation millions of hectare	Total production Million metric tones	Production per area Kg/ hectare
India	40	79	1975
China	37	130	3534
Japan	2.5	16	6250

Let us discuss the following questions :

- What is the reason for high production in Japan?
- What is the reason for low production in India?

For understanding these issues we have to know more details about the cultivation of paddy.

- How paddy grown in fields?

Let us know about the agricultural practices for paddy.

The paddy growing field is divided into so many plots (Kayyalu or Madulu). Why they do like this? Leveling the land and providing water for the crop is easy within these plots (Kayyalu).

To obtain better yield farmers prepare a plan before hand. While planning they take into account the nature of the soil, humidity, rainfall and temperature into consideration, because they vary from time to time and place to place. They cultivate the crops accordingly. In general farmers starts agricultural works before monsoon reaches (May, June months). At that time farmers celebrate festivals like Eruvaka. Ask your parents about this.

Rice growing is a seasonal task and associated with many festivals. The sowing and transplanting is associated with Akshaya Trithiya and harvesting associated with Pongal and Onam. Indian cultures are often described in stories and songs. Agricultural tasks are carried out to the tune and rhythm of

certain songs. Do you sing such songs? Collect those songs from your village and sing them in your School Theatre day.

Sowing to storing

The cultivation of paddy involves a series of activities. Did you know these practices? Write in your note book. Let us study the practices that are followed as follows.

1. Preparing the Soil
2. Sowing of seeds
3. Applying manure
4. Facilitate water(Irrigation)
5. Weeding
6. Crop harvesting
7. Storage

Agriculture practices are carried out either using manpower or through special tools. The above practices are common for Kharif, Rabi and third crop also. These practices are not only for paddy growing but also for other crops.

1. Preparing the soil

You know that supply of air and water to the plants through the roots is important. To germinate the seeds properly, and for uniform supply of water, soil should be prepared well. For this ploughing and leveling are done.

a) Ploughing and applying manure

Farmers make the nursery in so many plots by bounds. Then the nursery is first harrowed and ploughed. Plough and soil plank being pulled by a pair of bullocks. The nursery might be first covered with manure

and then flooded. Flooding submerges the old weeds and stubble which decompose releasing nutrients and also making a soft seed bed.

- Are you find any relation between nail length and sowing?
- Do all crops cultivated like this way? Is there any difference in the way the soil is prepared ?
- Can you say what the advantages of ploughing are?



Fig-1 Wooden plough

Before growing crops ploughing the soil properly is necessary. Ploughing loosens the soil and it helps in easier transportation of air and water.

- Water is stored deeply for a long time as the soil is soft.
- Roots penetrate in the deep and can respire well as the air enters easily into the soil.
- Friendly micro organisms and earth worms can grow well when the soil is soft.

- Some Foe Micro organisms die due to the sunrays.

Plough

This tool is used for ploughing. This is made up of Iron and wood. The shape of plough is like T. It is also used for weeding.



Fig-2 Iron plough

At the end of the plough a sharp chisel like iron nail is attached, which helps in penetrating the soil.

How many nails does a wooden plough have? How much depth farmer plough his field? Go to a nearby farmer measure the length of nail of the plough. If he used tractor measure its plough nail's length.

The 'V' shaped ridges are formed while ploughing. Think, why these ridges are 'V' shaped only? This helps for better watering the crops.

b) Leveling the soil

The fields have a lot of ups and downs even after ploughing. So, a leveler is used for leveling the soil. By leveling the soil water and nutrients can be reached to every



Fig-3 Iron leveller & Preparing field for sowing

part of the land. It also helps in sowing seeds and planting.

The leveler is made of a log and iron blade. This is tied to bullocks with a rope.

2. Sowing the seeds

Sowing of seeds in the field is an important task. Farmers are aware of seeds. Production of crop is mostly dependent on quality of seeds.

Selection of seeds is an important step in agriculture. Ask your elders where they buy seeds for crops?

Before sowing, farmers select the seeds. The healthy seed gives healthy crop. After harvesting the farmers select wrinkle free, round shaped and more weighing seeds and store them for future use. This is called selection. The rest of crop either they will sell or use as food.

- In olden days farmers preserved their own seeds. How did they preserve? Discuss with your teacher in your classroom. After that collect information about their own seeds from your elders.

Do you know how to select or separate good seeds?

Drop seeds into a bucket of water. Some seeds float on water. Remove all the floated seeds and soak the remaining seeds in water for a day and dry and keep to sprout in warm, moist and dark place.

Did you ever eat sprouts salad? Ask your friends how to make sprouts to eat in their home?

Why some seeds float on water? Why we remove the floated seeds from the water? Why do we soaking seeds in water for a day?

? Do you know?

The name Oryza for paddy- which was named by Linnaeus. Thousands of varieties of paddy are available throughout the world. Oryza sativa is cultivated in Asia. Oryza glaberrima is cultivated in Africa. Oryza glumaepatula is cultivated in America. In our state we have hundreds of varieties of paddy. Molagolukulu is the traditional good variety which is grown in coastal areas of Nellore. Amrita Sari, Bangaru Teega, Kolleti Kusuma, Potti Basangi, Sona masuri are some of our traditional varieties.

Activity-5

Selection of Seeds

Take some water in glass. Drop a fist of seeds in it. You can observe some seeds floating on water. Collect those seeds and observe with hand lens and compare with seeds sink under the water. Write your observations in the table.

Seed character	Sank seed	Floated seed
Good colour		
Wrinkled and rough shaped		
Smooth and round shaped		
More weight		
Less weight		

- What are the differences you observed in both seeds?
- Do you know why the floated seeds are light in weight?

Activity-6

Germination and selection

Sow both the seeds in different pots and provide water uniformly, observe the growth of the plants in two pots and make a report.

- Which seeds germinate well? Why?
- Which seeds do not germinate properly? Why?
- Were all seeds tested like this?
- Do you know how the paddy seeds germinate?

There are different stages in sprouting of the soaked rice seeds before it is planted.

Observe a sprout of paddy. Can you say which part becomes root? Which part become shoot in the picture?

Seed crisis

Farmers in our state generally purchase seeds in the nearby market. The grains that are available in the packets play vital role in agriculture. Sometimes the rate of germination of the seeds is not up to the mark, which was labeled on the packet. Sometimes never germinate too. At times grow into plants, but they may be sterile. Some multinational companies sell genetically modified seeds. Every year farmers are imposed to purchase seeds from the companies only, because the seeds produced by the plants may again be sterile. National Seed Development Corporation of India preserves and promotes different varieties of seeds. Now-a-days our traditional varieties are almost disappearing. Think why does this kind of situation take place? How to get sustainability in seed availability at the level of farmers? While dependency of farmers on seeds from market.

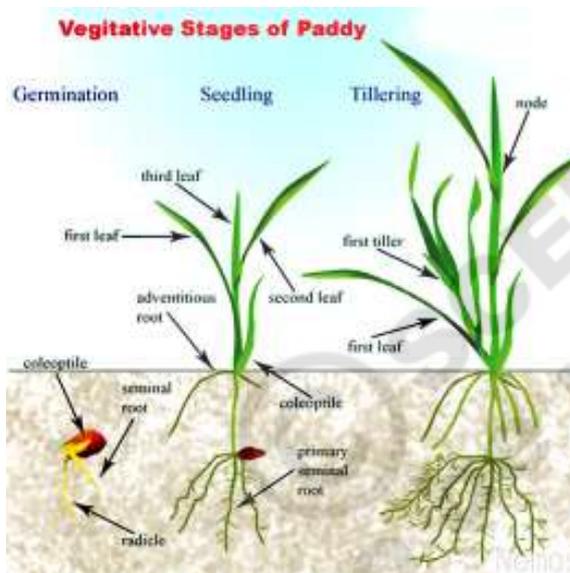


Fig-4 Sprouting paddy seeds

Selection of seeds free from pests is also important issue in agriculture. Sometimes farmers wash seeds with chemicals to protect from pests.

Can you guess the answer? Discuss with your friends and teachers and write the reasons in your note book.

Medication is done to keep seeds away from the harmful micro organisms like bacteria, fungus etc. So, generally farmers medicate seeds before making them to germinate.



Fig Fungicides

- What are the major practices in your village before sowing paddy seeds? Write in your note book.

Types of Seeding

The medicated, germinating seeds of paddy are sprinkled on the paddy fields. This is one of the practice in some places of our state. Are all the seed dispersed like this? Most of the time farmers develop seeds beds to grow paddy plantlets (naru). These grown plantlets are uprooted and planted throughout the field (naatlu).

- Discuss with your friends and make a list of crops that we cultivate by sowing plantlets.

Different types of sowing of seeds

Some seeds are directly sowed by seed drill. And some seeds sowed with hands.

Activity-7

Seedings Methods

Collect information from the nearby farmers and fill the table.

Seeding by dispersal	Sowing with hands	Seeding with seed drill



Fig-5 Broad casting

The method of dispersing seeds by sprinkling is called broadcasting.

Seed drill

Seed drill is an instrument used to sow seeds in the soil. There is a funnel like device on the top of the seed harrow. Farmers pour the seeds in the funnel. They travel through pipes helping the seeds to be sowed uniformly in the land. Generally there are three pipes in the seed drill. Based on the roots and distance between plants, farmers select 3 to 6 piped seed drills. After that farmers cover the seeds with soil.

Did you find any disadvantages with this? Think, how to solve this and discuss with your nearby farmers about your findings. How will your ideas help them?

Do you know how many kilograms of paddy grains are required for an acre to plant? Is it equal for all varieties of paddy? Ask your elders, collect information and discuss in your class.

- Can you say why seeds were covered with soil? Discuss with your teacher.

Modern seed drill



Fig-6 Modern tractor seed drill

Now a days farmers use the sophisticated seed drill used with the help of tractor.

This seed drill is attached to a tractor and helps to sow seeds in 5 or 6 rows. It also covers the sown seeds with soil immediately with the help of a blade attached to it. It is time saving and easiest way of sowing the seeds.

Seeds that are broadcasted in a plot will grow. The growing seedlings need to have their roots constantly submerged in water. When the seedlings have grown 4 – 5 leaves they can readily be transplanted.

This stage might have taken from 14 to 40 days depending on the type of rice, temperature and availability of water. In the meanwhile the remaining plots are leveled, ploughed and manured.

Removing seedlings from the nursery plot

When the plants grow to certain height, farmers pick out the seedlings from the plots and make bundles. Some farmers purchase these bundles to replant in their fields also. Do you know how many bundles of plantlets are required for one acre? Paddy plants are sown in proper distances. This is called transplanting. (Naru etlu)

The paddy variety ‘Sri Vari’ requires much gap between the plants. Ask your elders, how many plantlets are planted at one place? Is it one or 5 to 6 plants as a group?

- Why the seedlings are replanted at proper distances?
- Do all the crops grow when replanted? Why not?

See annexure for more details about sri vari in the chapter challenges in agriculture in class IX.



Fig-7 Transplantation

Do you know, what a Paddy planter is? Observe this picture



Fig-8 Paddy planter

This is paddy planter. It is useful for farmers those who cultivate paddy in large areas. it is easy to maintain proper distance sowing the seedlings. It is time saving and money saving process.

3. Applying manure and pesticides:

The growing rice crop is attractive food for moth caterpillars, paddy beetles and their larva, paddy grasshoppers and aphids. Some eat the leaves others bore through the root and stem or suck the juice from the tender rice grain. To control these pests, pesticides might be dusted or sprayed on the crop.



Fig-9 Diseases in paddy

Activity-8

Crops and diseases

Form a group with 4 to 5 of your classmates, visit nearby field, discuss with farmers about diseases effected by, and how to control them. If you do not know the name of the disease, write its local name or its characters.

S. No.	Name of the farmer	Crop grown	Observed diseases	Name of the pesticides used	Results	Remarks

- Do all the farmers use the same pesticides for the same crop?
- Is there any disease that you find in all fields?
- Where do they buy pesticides?
- What are the appliances used to spray pesticides?
- Did you find any other living organisms dying along with pests due to pesticides What are they?

Crop protection management.

Pests damage the crops

Do you agree that plants also fall ill like us? In agriculture along with weeds, pests also damage the crops. Almost all crops are generally effected by pests. Sometimes caterpillars suddenly appear on the leaves of the plants and eat them.

Activity-9

Identification of pests

Observe the plants in a nearby field or in your school garden. Closely observe the leaves and stems to collect the following information.

Name of the plant/crop :

Place :

Leaves		Stem	
Twilted		Scars	
Rolled		Beetles	
Spots appear		Spots appear	
Colour		Colour	
Fleshy spots		Fleshy spots	
Powdery spots		Powdery spots	
Caterpillars		Caterpillars	
Scars		Wilting	
Others		Others	

Do all the leaves of plant have spots?

Draw the leaf with those spots.

- What is your reason for the leaves which have cutting edges?
- Do you find any twilted leaves with insects? How are they?
- Are the scars on the stems are same as spots on leaves?
- Collect powdery substance of the spots on leaves and observe under microscope. Write down your observations.

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Do you think there is some relation between these spots and caterpillars? These infections are caused by different viruses, bacteria and fungi.

Wheat, paddy and sugarcane are generally affected by fungal diseases. The leaves and stems of these plants have spots and scars on them.

Particularly in groundnut all leaves of the affected plant have powdery spots. The whole plant becomes wilted. This fungal disease is called Tikka disease. If you uproot the plant you will notice that the roots have rotted and emit a foul smell. Do you think there is a connection in spreading disease from root to leaf?

Collect and observe leaves and fruits of lemon tree which contains spots on them. How are they? Is there any powdery like substance? These are because of virus. Sometimes we see white brown colour spots on fruits and leaves. This is because of bacteria. Along with these diseases leaf miner, citrus butterfly, epids, mites can be seen on lemon plants. They are the carriers of disease causing virus, bacteria and fungi. How can these pests can be controlled.

Controlling pests:

Observe the following pest controlling practices.

- A farmered removes the affected leaves from the plant and puts them under that plant only.
- A farmer removes the affected leaves from the plant and puts them aside in the field.
- A farmer removes the affected leaves from the plant and puts them in a dump and covers with soil.

- A farmer remove the affected leaves from the plant and burnts them.

Which of the above practices is good? Why do you think so? Discuss with your classmates.

A farmer used pesticides Dithane M-45 and Eldrine. He sprayed both of them by a sprayer on the plant. Why did he use two pesticides at a time? That year pests were controlled. Next year he also used the same. But the pests are not controlled. Why does this happen?

If we use pesticides unwisely, pests become resistant to the pesticides. What will we do to solve this problem?

Activity-10

Pest controlling practices

In your village farmers control pests by using different pesticides and insecticides for different crops. For this they use different practices. Ask your elders the names of pesticides that they use in the following pest controlling practices.

1. Spraying
2. Dusting.....
3. Put in the soil.....
4. Burning, picking are also the practices where they use these.....
5. Bio pesticides

Small holes and tears in leaves are evidence of damage caused by insects, often

caterpillars. A wart or swelling may hold insects inside it. A crumpled or twisted leaf might show that aphids have been sucking its juice. A fungal infection is usually seen as white, black, yellow, brown spots or a fluffy or powdery coating on leaves. Some discolouration also could be caused by bacteria or viral infections. Root infections like boring worms, insects or fungus are not seen above the ground. But they lead to wilting of plants.

Every plant has characteristic insects and other living things depending on it. Some of these associations might be useful or harmful for the plants. For example these helps in pollination, wasps and lady bugs eat more harmful insects. In small number even the pests may not cause much harm. In the wild they might actually serve to keep in check the plant population. But the large numbers of these pests cause immense harm. In farms and plantations the large numbers of the same kind of plants

are grown in one place, making it easy for pests to spread from one plant to the another, multiply further into large number and thus destroy the crop.

Insects are the most common agricultural pests. They multiply rapidly when food is plenty. At other times they stay dormant or their numbers small. For example the desert locust occurs in India in regular cycles. The Deccan wingless grasshopper is seen only in the Kharif season. Many pests are abundant in the monsoons. At the end of the season they lay their eggs in the soil to hatch only in the next monsoon. Do you know, why farmers plough the field and leave it for sometime under the sun.

Some insects like aphids and the white fly besides sucking plant sap also carry viral infections. Other crop pests might be carried by mammals like rats, bats, monkeys, rabbits and squirrels etc. and even round worms mites, crabs, millipedes, snails and slugs.



Aphids

Virus

Tikka Disease

A wide variety of agricultural and garden pesticides are available. A few derived from plants like neem, tobacco and chrysanthemum are less dangerous to other

living things. Others are inorganic pesticides like compounds of arsenic, zinc, sulphur, phosphorous and fluorine. A wide variety of organic synthetic pesticides are

commonly used. DDT (Dichloro diphenyl trichloro ethane), BHC (Benzene hexa chloride), Chlordane, Endrin, Aldrin, Endosulfan and Diazinon pesticides are usually dusted or sprayed on crops while some types are put in the soil.

Some pesticides act on particular species of pests, but most are also harmful to other harmless useful animals.

? Do you know?

In 1960 Rachael Carson wrote a book called 'silent spring' in which she pointed out the dangers of pesticides. Pesticides get into the bodies of microscopic plants and animals in the soil and water. When these plants and animals are eaten by fish the pesticides get into their bodies. Even if the fish are not seriously poisoned with each successive meal pesticides buildup inside their bodies.

A bird that eat these fish might get a concentrated lethal dose. DDT also accumulates in the egg shells weakening them and making the shells break before hatching. There are just two out of the numerous ways that pesticides are eaten, passed down the food chain, and accumulate in the bodies of higher animals including human beings causing sickness and sometimes death. Think, how dangerous the pesticides are...!

How do farmers get high yield?

In addition to control pests and diseases proper manuring is also an important activity in agriculture.

Why do we supply manure?

We know that plants require nutrients to grow which are obtained from soil. Our present agricultural lands have been used since long time. Guess, what would happen if a farmer grows same type of crop, in the same field every year?

If you do so, the nutrients of the soil decrease and becomes infertile. In order to overcome this problem, farmers add manure to the soil. Manure is needed for healthy growth of the plants. Manure contains Nitrogen, Phosphorous, Potash etc.

- Farmers add manure to the soil.
What they used to add?
- Do you have a compost pit in your school / house?

Manure is of two types

1. Natural Manure (Bio fertilizers)
2. Artificial Manure (Chemical fertilizers)

Natural Manure

This is also called Bio Fertilizers.

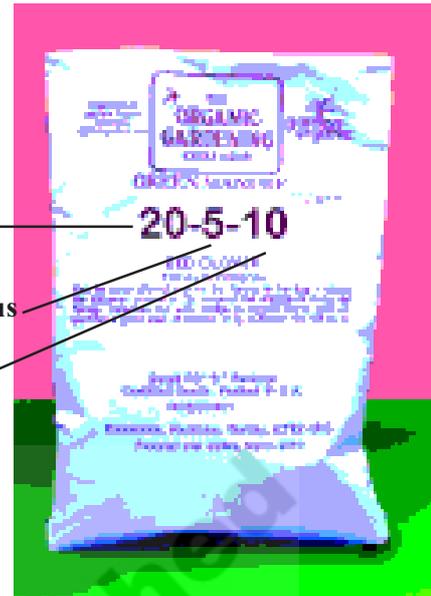
These fertilizers are formed by decomposing plant and animal wastes. In rural areas farmers keep these plant and animal wastes outside the village in open space. Some bacteria like Azatobacter, Nitrobacter decompose and it becomes manure which contain nutrients. Wherever the manure is added to the soil, there it provides nutrients to the plants.

Artificial Manure/Chemical fertilizers:

These are prepared in factories. These are also called chemical fertilizers. These are sold in the market by the names Urea, D.A.P, Superphosphate, Potash, which are enriched with Nitrogen, Phosphorus and Potash.

Discuss – Have you ever heard or read in the newspapers of fighting for fertilizers. Why this happens? Why farmers want to get more bags of fertilizers? Do you have any solution for this? Make a note on your ideas about this and display in the Wall Magazine.

Look at the picture given below and write the constituents in it?



Nitrogen ————— 20-5-10

Phosphorus —————

Potash —————

Nitrogen (%)

Phosphorus (%)

Potash (%)

Which manure is better?

Let us compare chemical, natural fertilizers, which manure is beneficial?

Chemical fertilizers	Natural fertilizers
1. These are made up of inorganic salts	1. These are made by the decomposition of plants and animal (organic) wastes.
2. These are prepared in factories	2. These are prepared in open places.
3. No humus can be found.	3. Deposits of humus layer is found in the soil.
4. More amount of Nitrogen, Phosphorus and Potash deposits in the soil.	4. Less amount of Nitrogen, phosphorus and Potash deposits in the soil.

Observe the table carefully, discuss with your teacher and conclude which fertilizer is best to the farmers and why?

What would happen if over dosage of manure is added to soil?

Generally, farmers should use fertilizers keeping in view the nature of the soil and the crops he wants to grow. Some times in order to get more quantity of crops he uses more amounts of fertilizers. In turn, this leads to soil pollution and water pollution. After some time soil becomes either acidic or alkaline. Thus it brings only grief to the farmers.

Irrigation

The process of watering crop plants in the field is known as irrigation. The source of water should be at a higher level. So that each and every part of the field gets water. Wells and canals are common sources of water. Farmers irrigate their fields either manually using bullocks or by using pumps. There are three methods of irrigation which are commonly practised in our country.

Furrow Irrigation

In this method of irrigation, the water is allowed to enter the field through channels or furrows made between two rows of crop.



Fig-10

Which crops were irrigated in this method? Discuss with your friends and write in your note book.

Basin Irrigation

In this method of irrigation the field is just filled with water as in the case of paddy. Canals, tanks and wells are the water resources in most of the areas of our state. Farmers dig small canals from tank to fields to supply water.

Preparing of canal bunds and removing of water flow barriers like Pistia plants is a major job in irrigation. Do you know about 'Saagu Neeti Sahakara Sangham' in your village?

- Ask your village elders about the activities taken up by the Water users association in your village and make a report on it.



Fig-11

Sometimes field gets excess water which the soil is unable to absorb. This condition is called water logging. Water logging is harmful to most crops as it does not allow the roots to breathe. Therefore provision should be made for draining the excess amount of water from the fields.

Farmers learn from experience as to when and how many times to irrigate a field.

- When do farmers irrigate the land?
- List out the water resources of your village.
- Are they useful to your farmers?
- In what way the farmers of your village get water to the fields?

Why water is essential for plants?

Have you ever observed the plants blossom if you water them properly? Why?

The nutrients in the soil should be

transported to the plants properly. For this it should be dissolved in water. When nutrients dissolved, they can easily be transported to the plants with the help of its roots. That's why farmers water their field after adding manure to it.

Activity-11

When should farmers irrigate the field?

Consult the farmers and fill the table with the information to how and when they provide water to various crops.

Name of the crop	Stages of providing water

- Are all the crops provided with equal amount of water ?

Providing water to fields in different stages is called irrigation. Irrigation should be done according to nature of the soil, and the type of crop to be grown.

Do you know?

Paddy requires high quantity of water. That is why paddy grown in areas where plenty of water is available. Because of marketing and supporting price, paddy is grown all over the country irrespective of water availability. For this farmers dig bore wells and use ground water wherever water is not sufficient.. There is a need to shift to those crops which require less water. In some areas, recently farmers grow fishes in paddy growing fields.

Why does the farmers do provide more water to the summer crops?

Observe the following pictures

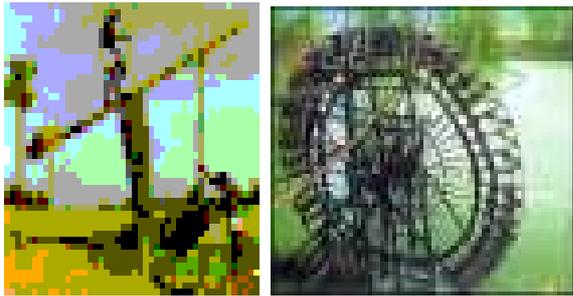


Fig-12 Ancient irrigation techniques

In the Ancient practices of agriculture, farmers used to cultivate lands by using mota, yatam, chain pump etc.

The Water available in wells, lakes and canals is lifted up by different methods in different regions, for taking it to the fields. Cattle or human labour is used in these methods. So, these methods are cheaper, but less efficient.

Nowadays pumps are commonly used for lifting water. Diesel, Bio gas, electricity are used to run these pumps.

What are the ways that the farmers of your place supply water to the fields?

3. Modern methods of Irrigation:

During irrigation large amounts of water absorbed by the canal soil before reaching to the plant. Do you have any idea to protect this water loss? A modern device of watering plants is called “Sprinkler”.



Fig-13 Sprinkler

It is used for conserving water in Agriculture in the areas where water is scarcely available, these sprinklers are handy to use. It provides uniform watering all over the field. It works on the principle of force of water. Observe a sprinkler if possible or ask your teacher, How does it works? It is beneficial in the way that every drop of water reaches to every plant in a field. It is mainly beneficial in sandy soil. Government encourage sprinklers, drip irrigation systems by giving huge subsidy.

Drip irrigation:

This method is employed when the availability of water is poor. As the water reaches the plants drop by drop this is called Drip irrigation. A long tube followed by small tubes attached to a motor. Holes are made in the tubes. So, that water comes out from the holes. The holes are arranged in such a way that it provide water exactly at the place where plant roots could receive water.



Fig-14 Drip irrigation system

Activity-11

Visit a nearby nursery and observe sprinklers and drip system. Prepare your own report. This should contains apparatus, instruments used, water supplying process, water resource, investment and maintenance, merits and demerits. For this project you need to talk with the farmer.

5. Weeding:

If you observe a groundnut field with a standing crop of ground nut plants you will find that some other plants growing there side by side. These are undesirable plants, called Weeds. They should be removed immediately.

- Why they should be removed?

The weeds compete with the primary crops for nutrients, water and light. Because of these plants the prime plants may not grow properly. Hence, they should be removed.

Besides competition for food, light and water they also work as carriers for different diseases. They also serve as a host for different pests. Some weeds disperse pollen grains to air which in turn cause respiratory diseases.

Parthenium harmful to environment

See the picture. Have you seen such plants in your surroundings? Do you know that some of your friends may have got allergy because of the pollen grains of this plant. Incidentally, this weed has been imported along with wheat from Australia long before.



Fig-15 Parthenium

Can you name any weed that you see in paddy field? Generally some weeds commonly grow with some crops.

Garika, Wanza, Varipilla Gaddi, Sukha Bhogi, Dharaka, Buradha Thung grow along with paddy.

We can see plants like Gunugu, Gaddi Chamanthi, Jeeluga are in vegetable crop weeds.

Pogaku Malle in tobacco, Puli Chinta in Mirchi and Cotton fields are the common weeds.

Activity-12

Ask your nearby farmers and know the weeds that grow in different crops. Make a table in your notebook.

How is weeding done?

Weeding is done by different methods by the farmers. Most of the weeds are uprooted at the time of tilling or ploughing. Those which still remain after tilling are manually uprooted. It is better to root out the weeds before flowering. Why?



Fig-16 Weed harrow

Sometimes weeds are removed with the help of weed harrow. Dante or Guntaka is

generally used by the farmers to remove weeds from the fields. Do you know, why farmers keep weight (stone) on it? Draw the diagrams of the material used by the farmers to remove the weeds in your village? Do not forget to write their names.

When the crop is fully grown the above methods may not be suitable for uprooting weeds. So, farmers use weedicides like 2-4D (2-4 Di Chloro Phenoxy acetic acid) to control the weeds. But these weeds do not work on monocotyledons.

By spraying weedicides, weeds are killed, but not the crop plants why?

6. Harvesting:

How do farmers harvest the crop?

This is the most important task in agriculture. Collecting grains from the crop by cutting the matured plant is called Harvesting. During harvesting crops are either pulled out or cut close to the ground. After cutting they are dried in the sunlight. After the moisture has evaporated farmers collect the seeds. Harvesting is done either manually or by using machines.

Harvesting of paddy

For a paddy crop harvesting can be done by hand, using a sickle. After cutting, the grain is sent out to dry in the field for 2 to 3 days.

- If the paddy is not dried well enough. What will happen?
- Why farmers go for machinery for harvesting crops?

First crop for best friends.

Before harvesting, paddy farmers particularly young children in the family, collect riped grain (Pachi Kankulu). They make a bundle and hang it at the roof of the varanda. Do you know, for whom is this? Yes- this is for farmer's family friend 'sparrow'. The little bird sparrow makes a nest in the roof and eats those grains. And say thanks to the family by its chirping. That is the way the farmers love the nature. Think, how nice all the actions of those people?

? Do you know?

To meet the food requirement of growing population there should be an increase in the cultivated land. But now a days parts of the agriculture land in rural areas remain uncultivated land because of non availability of seeds, power, water supply, market problems. Farmers thinking that agriculture is a non profitable task.

Actually agriculture is the flesh and blood of our country. So young generation should develop more passion towards agriculture which would be the only beneficial profession in near future.



Fig-17

Threshing

The dry plants stocks are beaten on a hard surface to remove the grain. Threshing is also done with the help of bullocks, which trample the grain.



Fig-18

Winnowing

In winnowing the grains are poured out of a basket or tray held high up the wind blows the chaff, dust and lighter seeds aside while the heavy grains collect below.



Fig-20 Winnowing

Modern harvesting Machine (Harvester)

Now a days it is a common practice to harvest the crop with the help of a harvester. After the collection of seeds farmers separate the grain and chaff by the method called winnowing. For this they use a

manual winnower by using chaata and fan or winnowing machine.



Fig-19 Modern Harvester

- Have you ever seen farmers harvesting the crops on the roads?

In some villages farmers used to harvest their crops on the roads insted of using bullocks. It is a dangerous practice. Some times accidients may occur.



Fig-21 Harvesting on roads

- Where do farmers harvest the crops in your village ?
- Is harvesting same for all crops?

Harvesting is also an important task in agriculture. Farmers generally used traditional methods to harvest.

Activity-13

Find out the methods of harvesting in and around your village and fill in the table.

Name of the crop	Type of harvesting	Tools used

7. Storage of grains:

Where does your mother store rice, Bengal gram, jowar wheat etc.? How does she store them?

Usually in our houses the grains are stored in a tin after drying them in hot sunlight. Storage of grain is an important task, because we do not consume the entire crop at a time. Farmers store the food and wait for the reasonable market price.

How do farmers store the grain?

There are different storage practices in our state. Naturally food produce can be damaged by fungi, pests, rats and bacteria. If moisture is also there in the grains it helps to develop moulds (fungi). Such grains neither germinates nor suitable to eat.



Fig-22 Cold storage unit

To overcome this problem farmers dry the grains for 2 to 3 days in sun. After drying they keep the grains in a jute bags and preserve them in a godown.



Fig-23

Few decades back, farmers used to store the grains in metallic and bamboo bins. Now a days, specific chemical treatments are employed for storage of grains in order to protect them from pests and micro organisms.

It is a Cold Storage Unit . Here the vegetables, fruits, tamarind, chillies and other products that are usually damaged and decoloured within a short time are stored. As the temperature is very low here, the vegetables and fruits can be kept for a longer time in the cold storage units.



Key words

Crop, Agriculture, crop production, long term crops, short term crops, Kharif season, Rabi season, Night duration, Global grain, Ploughing, plots, leveling, Sowing, selection, seed crisis, sprouting, seed dispersal, broadcasting, seed drill, nursery plot, Manure, pesticides, paddy planter, Bio fertilizers, chemical fertilizers, Irrigation, Furrow irrigation, Basin Irrigation, sprinklers, Drip irrigation, weeding, weedicides, Harvesting, threshing, winnowing, cold storage units, godowns.



What we have learnt

- Crops that take 180 days and above for harvesting are called long term crops.
- Crops that take 100 days and below for harvesting are called short term crops.
- The crops grown in the rainy season are termed as Kharif. It starts from June to October.
- The crops grown in winter season are called Rabi. It starts from November to April.
- In some plants flowering depends on the duration of night. When the night duration is more than 12½ hours, flowering will be better.
- In some plants night duration is not at all a reason for flowering. They can flower any time during the year.
- Preparation of soil is fundamental practice in Agriculture.
- Ploughing makes soil loosen and soft, so that air and water can be transported easily.
- Levelling the soil is useful for irrigation of fields.
- Farmers sow the seeds after testing and treating with fungicides.
- Manure is of 2 types. 1. Natural manure (Bio fertilizers) 2. Artificial Manure (Chemical fertilizers).
- Sprinklers and Drip irrigation techniques are used in drought prone areas.
- Weeding increases crop yield. 2-4 Di Chloro phenoxy acetic acid is used for removing Dicot weeds.
- Proper storage of grains reduces the damage of grain by bacteria, fungi, pests, rats, etc,



Improve your learning

1. Wheat is cultivated in Kharif season only. Can you tell the reasons? (AS 1)

2. Ramaiah's field is flattened. Somaiah's field has many up and downs. Who will get more crop? (AS 1)
3. What are the advantages of ploughing? (AS 1)
4. Treating with fungicides before sowing the seed is necessary. Why? (AS 1)
5. Rajendar cultivated cotton crop in his field. He did not get sufficient yield. Can you guess the reasons. (AS 2)
6. What do you observe in the experiment of dropping a fist of Bengal gram seeds in water? (AS 3)
 - What are the differences you observed in the both seeds?
 - Do you know why the floated seeds are lighter in weight?
 - Which seeds germinate well? Why?
 - Which seeds would not germinate properly? why?
7. How do you appreciate the irrigation systems used in the drought prone areas?(6)
8. I am a plant. I grow in crop fields. Farmers pluck me. I do not know the reason. Can you tell who am I? (AS 2)
9. Why do farmers dry the paddy crop after cutting them from fields? (AS 1)
10. Give some examples of plants that grow after replanting? (AS 1)
11. Rahim removed weeds in his crop field, but David did not. Guess who get more yield. Why? (AS 1)
12. Narendra sprayed over dose of pesticides on his cotton crop. Ramesh says it is a hazard to bio diversity and crop yield. Can you support Ramesh? How? (AS 7)
13. Venkatesh observed the irrigation method for paddy field. He wanted to follow the same practice for his Maize crop. What suggestions do you give him. (AS 7)
14. Go to your nearest fertilizer shop and collect the information about chemical fertilizers and fill the table. Copy the following table in your note book. (AS 4)

Name of the fertiliser	% of Nutrients			Name of the crops used
	N	P	K	

15. What is natural manure? How to prepare it and give two examples? (AS 1)

PRODUCTION AND MANAGEMENT OF FOOD FROM ANIMALS



We eat varieties of food in our daily life. Our food habits differ a lot. Some persons prefer to consume food obtained from plants and some from animals.

What are the food items that are obtained from animals? Does they obtained directly from animals or processing is required. We rear a number of animals for food.

Do we get our food only from domesticated animals? List out the foods is obtained from animals? Discuss in groups and tabulate your discussion in your note book.

Animal Husbandry:

Farmers adopt different methods of management for getting better yields in

agriculture. In the same way, care is required in the management of rearing animals also. Providing food, shelter, protection and breeding of animals is called 'Animal husbandry'.



Fig-1 Dairy form

Since long time, man used animals not only for obtaining food but also for agriculture, transportation etc. The early man realized this and domesticated the wild animals for his betterment.

Do you know the period from which wild animals were being tamed? See the following table.

Name of the animal	Period of Domestication
Dog	30,000 – 7000 BC
Sheep	11,000 – 9000 BC
Pig	9000 BC
Goat	8000 BC

- Why did early man domesticate only some of the animals?
- Why did not he domesticated animals like elephant, tiger, lion etc. or birds like eagle and owl?

Discuss in groups about things to be taken into consideration, while domesticating animals.

We domesticate only such of these animals which are helpful to us. Buffalo, cow etc are reared for milk. Hens, goats, sheep for meat and ox, horse, bulls, donkeys for agriculture and transportation.

We get food from plants. But food production from plants alone does not full fill all the needs of food requirement of the society. Can we get all nutrients required for our body by eating only plant food? So we need food from animals too. Production of food from animals is as important as agriculture in our country.

- Do all the persons who own agriculture fields also rear cattle?
- Is there any relation between agriculture and cattle rearing or animal husbandry?
- Collect the following information from your class.

No. of families in agriculture

 No. of families in agriculture along with animal husbandry
 No. of families in animal husbandry alone

In our country farmers believe that animal husbandry is part and parcel of agriculture.

Let us do:

Form a group with four or five students in your class. Discuss about the reasons- why does a farmers rear cattle?

.....

People living in rural areas used to domesticate animals like cows, buffaloes, bullocks, goats, sheeps, pigs, hens, etc. Supplying of nutritious food, accommodating clear and hygienic shelters for animals are very important issue in animal husbandry. Generally villages send their cattle to rear at the places where grass is easily available.



Fig-2 Cattle rearing

- Where do people rear their cattle in your village?
 Are there cattle rearers in your village. Have a talk with them and collect information about cattle rearing. For this

you need a questionnaire. Following questions are helpful to you. You can add some more questions as you wish.

- What are the cattle here?
- At which places fodder is available?
- What are the places where water is available?
- Are there any differences between rearing of cows, buffalos, goats and sheep?
- What are the major problem that cattle rearers generally face?

Generally one person is appointed for rearing of cattle. He is paid by the villagers. Recently this type of practice gradually disappeared in our villages. Some of the farmers keep their cattle in the sheds. They do not take their cattle to the fields. They supply fodder in those sheds. Rearing cattle like bulls, cows and buffalows in large scale is also the same in sheds. Bulls are mainly reared for use in agricultural practices like ploughing. Most of the farmers in our country are cultivating the land area of less than one hectare. Even though mechanization is increasing in agriculture, farmers use bullocks in ploughing and other agricultural practices.

- Make a list of agricultural practices by using bullocks and he buffalows.

Rearing of goats and sheep is also related to agriculture. Besides agriculture,

cattle rearing and sheep rearing is benifitial to farmers. Cattle rearers make fences in the fields at off crop seasons. They keep their sheeps and goats in the fenced enclosures.

- Think in which way this practice is helpful to the farmer as well as field crops.

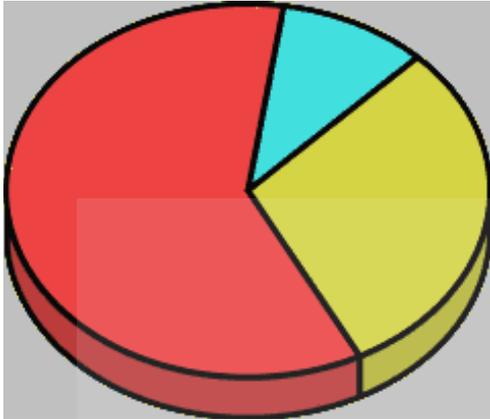
Taking care of animal health is also an equally important task in animal husbandry. Most of the time cattle sheds become unclean because of the remains of fodder, dung and urine. Dump these wastes away from the shed. Care should be taken to prevent the growth of lice and mytes on cattle's body. Galikuntu is a common and dangerous disease partially in cows and buffalows. Sheep and goats suffer from worm infections (Nattala Vyadhi).

Some parasitic diseases cause damage to liver intestine. Viral and bacterial diseases also effect on milk production. Particularly in rainy season, cattle are disturbed by mosquito bite. Cattle can be protected by covering mosquito nets. Veterinary doctors provide treatment and health care for these cattle.

- Where is veterinary hospital located in your area?
- Which employees are working there and what do they do?
- Meet a nearby veterinary doctor or animal husbandry assistant. Collect information about common diseases in cattle and prepare a note on them.

Milk Production:

Our government treats producing milk as an industry. We get milk from cattle. Let us observe the following pie diagram.



- Cows
- Buffalows
- Goat, Donkey, Camel

- From which animals we get maximum milk production?
- In which areas people use camel milk?
- Did you ever see people taking donkeys milk? Why it was preferred?

Generally farmers rear 1 to 5 cattle in small scale at their homes to produce milk. They supply fodder from their agricultural fields only.

- What are the types of fodder farmers generally feed the cattle with?
- How farmers preserve fodder for cattle after harvesting?

Let us observe the following graph. It Shows the rate of milk production in various countries. Observe the position of

our country. Discuss in your class, why we are lagging behind in comparison to other countries.

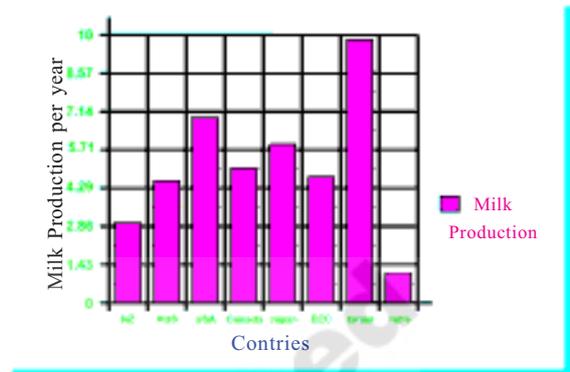


Fig-3 Milk production

Among cows, traditional species give 2 – 5 liters of milk per day. Murra, species are reared in most of the districts in our state. They give up to 8 liters of milk per day. Haryana, Jaferabad, Nagapuri are the traditional variety of cows which give good quantity of milk. Jersey (England) and Holstein (Denmark) are the Foreign varieties. They give 25 liters of milk per day. These foreign varieties are cross bred with our traditional local varieties. They give 8 to 20 liters milk per day. Cows play vital role in total milk production of our country.



Fig-4 Jersey



Fig-5 Holstein

Out of milk produced in our country 60% is used to prepare cheese, cova, ghee, curd, milk powder and other milk products. There are number of dairy forms in our state. The milk in dairy form is collected from households and pasteurized.

Pasteurization : Pasteurisation of milk ensures the destruction of disease producing organisms present in milk. In this process milk is heated at a particular temperature (62°) for a definite period time (30 minutes). Prior to this, the milk was being cooled to below 10°C .



Fig-6 Milk collection

- Is there a milk collecting centre in your village?
- How do they collect milk and export?
- Do you know how they decide cost of milk?
- Where is milk chilling center located in your area? (for this you need to

observe milk packets which are available in the market helps you)

There are private and government milk collecting and chilling centers in our state.



Fig-7 Chilling center

According to economical and statistical survey of India-2011, about 40 to 60 lakh liters of milk is produced every day in our state.

- Do you know in which month the rate of milk production is high? Why?

Milk production is higher particularly in some months compared with remaining year. Let us observe the graph showing milk production in our state.

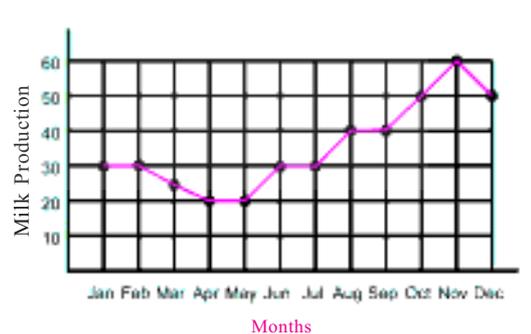


Fig-8 Monthwise milk production

- Why the milk production is higher during those months than remaining year? Discuss in your class and find out the reasons.

Prof. J.K. Korian, father of white revolution in India, worked a lot in increasing milk production through cooperative societies to fulfill the needs of our country. He proposed innovative activities in producing hybrid varieties of cows and buffalows, animal health, milk collection and preservation. There is a great improvement in production of milk under the scheme – operation flood.



60 to 70% of expenses in maintaining animals is for feeding them. Animals need food for two purposes. One is to maintain themselves healthy and other is for reproduction. We provide hay, green and dry grass, oil seed cakes of groundnut etc. used as fodder for cows and buffalows. These nutritious food helps to give good quality of milk.

Do you know?

? Milk is lacteal secretion of the mammary glands of animals. During the period following at least 72 hours after calving or until the milk is colostrum free, milk appears as white opaque fluid, in which fat is present as emulsion, protein and some other minerals, vitamin A, D and E and 80 to 90% of water. Nowadays cattle rearers and dairy farmers use hormone injections to get high quantity of milk. These hormones settle down in our body to cause various diseases like early reaching of puberty. Chemicals used in chilling centers to preserve milk also cause damage to our health.

Selection procedure:

Care should be taken while buying cattle for milk production. The following points should be kept in mind.

1. Select high milk producing varieties, either traditional or hybrid.
2. Observe 2 to 3 days for average milk production.
3. Number of yielding size, health, eating fodder.
4. Consult a veterinary doctor, an official of Director of animal husbandry.
 - Some of our rural people are experts in identifying high producing varieties. Ask those people how they identify and write a report on their experiences.

Practices in livestock keeping:

For having high milk producing varieties, livestock (The animals that are used for milk and agriculture are called livestock) keeping is very important. Traditional livestock are becoming depleted because of hybrid varieties. Let us read the following case study to know how local breeders conserve their livestock. Let us read the following case study.

I am Ramanayya. My family have been maintaining local breed of bullock called 'Kangayam'. It is suitable for drought areas. There are no other good bulls in our area. Kangayam is a strong and healthy local variety. These bulls have small or short horn, thin tail, short face, prominent eyes, large hooves, wider shoulder bone and larger lung. We select these calves and feed them to become bulls. One bull is able to serve 20 to 30 cows reproduction in a month.

The conceiving rate is more than 80%. Very few cows are brought for second time for servicing. We charge Rs.300 for servicing. We have three buffalows too. Now a days most of the villages are crossing their cows and buffalows by using injections at veterinary hospitals. Our income has become reduced. But people rearing with one or two cows took services from me only.



Do you know?

In Odisha traditional livestock – Chilka buffalows are reared. They take care to avoid cross breeding with Murra. They graze during night times in brackish water of Chilka lake. They return home in the morning give milk without any extra feed. This milk tastes a bit salty and kept up to 7 days without refridgiraiton.

In our country people believe that the cattle rearing is not the only economic source. Cattle are part and parcel of our culture. They treat them as their family members. During some festivals they decorate their cattle. What are the occasions where they decorate their cattle in your village? Some people call them by

names also. Do they respond when called by names? Do you have any such experience with your pets?

Did you ever see some persons collecting bones of dead animals. What do they do with these bones. Another side of cattle rearing is, getting leather which is used in the leather industry. Bones are used in fertilizer industries.



Fig-9 Bio gas

Biogas production is also a useful project in animal husbandry. Did you know, what is Biogas. Is there any biogas center in your village. Collect information about biogas productions from your school library or internet and write notes on biogas. Display it on wall magazine.

Meat processing from animals is another side of animal wealth. Production of meat in large scale takes place in slaughter houses (Kabela). Beef is from bulls and buffalows, pork is from pigs, mutton is from sheep and goats. These are the prominent meat varieties.

Poultry :

Production and rearing of hens on a large scale is generally called poultry. 50 billion hens are reared worldwide for eggs and chicken. We know that farmers rear cocks and hens in villages. Most of these are local varieties (Natukollu). We get 74% chicken and 64% of eggs only from poultry farms. Poultry has emerged as one of the major industries in last two decades. India achieved 4th position in the world by producing 41.06 million eggs per annum. And also placed in 5th position for production of meat about 1000 million kgs per annum.



Fig-10 Local varieties

- Are the hens reared in the poultry same as our traditional varieties reared by farmers in the villages?

Generally poultry farms are of two types. One is for production of eggs and other for meat. Broilers are commonly used variety in poultry. They are reared for meat.

Natural, wild varieties grow fully in 5 to 6 years. But broilers grow fully in just 6 to 8 weeks. This happens due to genetic modification in the hens.

- Think and discuss – Is genetically modified food useful or not?

New Hampshire, white Plymouth, Rhode island red, white leg horn, Anoka are the foreign varieties of meat giving species.



Fig-11 Broiler, Layer

- Do you know chicken-65. Why is this called so?

Layers are reared for production of eggs. Some hens are able to lay 300 to 350 eggs in their life span. But, one has to follow proper management techniques up to 21 to 72 weeks for getting eggs.

After a period, the capacity of laying eggs decreases. This is one of the reasons why people are more interested in rearing broilers.

Natural, country varieties are good for hatching purpose. Aseel, Kadaknath, Chittagang, Longshan, Bursa are the pure local varieties. But the rate of production of eggs is lower than hybrid varieties.

Aseel (Berisa kodi) the Indian traditional variety is meant for fighting because of its pugnacity, high stamina and majestic gait.



Fig-12 Aseel

- Have you heard about cock fight during some festival seasons. Think and discuss in your class about this type of practices which show human cruelty towards animals.

We are rearing hens for eggs and meat. Local chicken breeders rear both varieties of hen. By using incubaters chicken breeders produce chicken in large scale. Hatching of eggs is interesting job. Our rural practioners hatch eggs by placing them under broody hen.



Fig-13 Hatching

- Do you know how many days a hen spends to hatch its eggs?
- Prepare a detailed note on hatching eggs by observing at your village. If you need, please draw pictures also.



Fig-14 Poultry form

During January to April, egg prices are high. Do you know what is the reason? This is because of most of the eggs are used for hatching. In this period, rate of hatching is more. Hatchability of eggs generally is influenced by 37 to 38°C temperature. In poultry industry hen wastes (litter) is used as nutritional manure in agriculture.

Egg is a nutritious food. Collect information about various nutrients in egg and write a note on them in your note book.

Activity-1

Form 5 or 6 students as a group. Collect different types hens and find their characters. If you want to know more details, about you need to ask hen rearers or poultry farmers in your village. Do not forget to collect information about the feed and diseases, treatment by using local technology.

NECC

If you want to be a healthy person eat egg every day. This is the slogan of National Egg Co-ordination Committee. Egg is a good nutritious food which is easily available for all.



? Do you know?



Emu culture

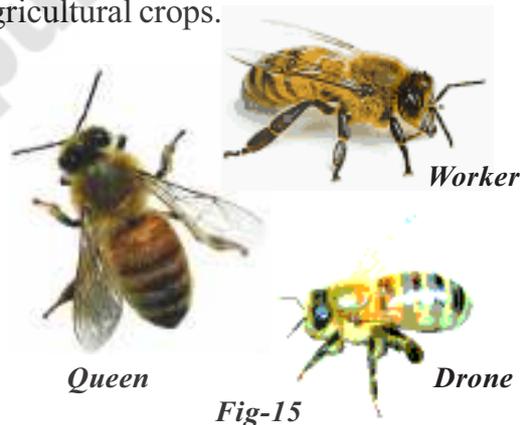
Emu is the flight less bird from Australia. It is the second largest bird in the world after Ostrich. This amazing bird weight nearly 50 kg. and run at 40 miles per hour. Emu farming is also a commercial practice like hen. Recently farmers of Adilabad, Medak, Nalgonda and some other Districts of Andhra Pradesh. Started Emu farming. meat, chicks, skin leather, oil, feathers eggs are the main products in Emu culture. Its meat and eggs are Costly. The Emu market is not so good present in our our state.

Emu egg



APICULTURE

Culture of honey bees (apis) is called Apiculture. It is most beneficial and eco friendly activity. Development of apiculture is not only for honey production but also very much useful for crop pollination. Honey bees are best pollinators of many agricultural crops.



- In what way honey bees are helpful in pollination?

There are five well recognized honey bees species in India. *Apis dorsata*, *Apis indica*, *Apis floera*, *Apis melipona*, *Apis prigona* are the species which are available in our surroundings. *Apis cerena*, an Indian honey bee, produces 3-10 kgs of honey from a colony per annum. *Apis mellifera*, an European honey bee produces 25-30 kgs of honey per annum.



Do you know?

Honey has probably been associated with man since very early days. The first proof of this association comes to life from the rock paintings made by the primitive man thousands of years ago. Man knows about the art of bee keeping in the regions of early civilization. The Egyptians were well acquainted with bee husbandry 4000 years ago they practised migratory beekeeping. The *Rigveda*, probably written between 3000 B.C. and 2000 B.C, contains many references to bees and honey. They named honey as a divine food.

It was during the Nineteenth century that bee keeping, as a result of scientific research, became a commercial activity.

Honey bee species are social insects like ants which lives in colonies. A honey bee colony consists of three types of bees. One queen, several thousands of workers and few hundreds of drones.

There is only one queen bee in a colony. The primary function of a queen is to lay eggs (800-1200 eggs per day). The life span of queen is two to three years, a worker has 5-6 weeks and the drone has 57 days. There are sterile females which are called Workers in the hive. These bees attend to indoor duties during first three weeks of their lives such as secretion of royal jelly, feeding of the brood. After three weeks they attend outdoor duties like collecting

nectar, pollen and water. Drones are the male members of the colony. They are very lazy and unable to gather food. Their main duty is participating in mating. Mating takes places in the open when the queen is in flight. The Drone dies during the act or immediately afterwards as its abdomen has to burst open to allow the genital organs to function.

Sources of nectar

Plants which contain nectar and pollen liked by bees are called bea flora.

The following are some of the more important plants either wild or cultivated. Fruit trees like citrus, apple, guava, tamarind; Cultivated field crops like mustered, gingelly, wheat, cotton, sunflower; Vegetable plants like beans, bendi, brinjal; Timber yielding trees like acacia, neem, sal and bushes, shrubs and natural and ornamental flower plants are all the sources of nectar. The bees of a colony sometimes rob another colony especially during drought period.



Fig-16 Bee hive

- Generally where do you find honey Bee hives in your surroundings?

- In which seasons we find honey Bee hives?
- Collection of honey from hive is a careful activity. Write a note on how people collect honey from hives. What did they do for this?

The bee wax and bee venom are other products in Apiculture. Bee venom is used for the preparation of 'Apis tincture'. It is used in Homeopathic treatment. The major uses of bee wax are production of polish cream, nail polish, etc.,

Production of honey in large scale is by providing artificial bee hives. The hive consists of floor board, brood chamber, super chamber, top cover, inner cover, frames and entrance rod. These parts can easily be separated.



Fig-17 Artificial bee hive

The hive may be double walled or single walled. These artificial hives are not similar to natural hives. Try to find out the differences between these two hives. To get more yielding of honey from the colonies,

a bee keeper has to follow some management techniques. Various pests and predators attack the honey bee colonies. Wax moths, wasps, robber flies, dragon flies attack honey colonies. King crow, Bee eater are more harmful during swamp period. Bee keepers should protect bee hives from the pests and predators.

- Ask your parents / teacher how a bear hunts bee hives for honey.

Fisheries:

Fish constitute an important and rich sources of high quality animal protein. India has a coast line of about 7500km and the total available area for fishing both inshore and offshore is nearly 0.48 million square meter. In addition there are extensive inland water areas comprising of numerous rivers, fresh water and brackish water lakes, reservoirs, tanks, ponds, swamps, etc.

Nowadays fish and prawn culture is a large scale industry in the coastal districts of our State. Most of the farmers convert their agricultural fields into prawn culture ponds. The marine water is the big source of fish. It is constituted by several groups of varying magnitude and importance. The sardines, mackerel, crustaceans, tunas, molluscs, catfish, ribbon fishes are some of the marine varieties. Besides these, the sea weeds may be included which form an important living source from the sea.

Prawns, lobsters, and crabs together constitute the crustacean fishery. Murrel(korramenu), katla(jalla), katrana(bochalu), rohu(mosu), seer (Vanjiram) are the local varieties.



Fig-18

Cultivating fish and prawn is a large scale industry in our state. Most of the coastal districts of our state are now cultivating fish and prawn by using sea water as well as pure water. They collect breed of fish suitable to water. Breeding and catching fish are important activities in fish culture.

- Write a list of fishes that are available in your surroundings. Just write local names only.
- Do you know how to catch fish in a pond?
- How to catch fish in a large scale?

Marine Fisheries:

India's marine fisheries sources include 7500km of coastal line and deep seas beyond it. Popular marine fish varieties include Macerel, Tuna, Saradines, and Mombay duck. Marine fish are caught using many kinds of fishing nets through fishing boats. With the introduction of synthetic fiber nets, there has been revolution in fishing gear material. Fishermen catch fish by using machines is

called mechanized fishing. They catch tons of fish everyday.



Fig-19 Mechanized fishing

- Think what will happen if mechanized fishing continue for a long run.

Some marine fishes of high economical value are also found in sea water. This include finned fish like Mulletts, Bhetki and Peral spots, shel fishes such as prawns, Mussels and Oysters as well as sea weed.

- Ask your teacher what are the uses of Oysters?
- Tuna is an important fish which is available in our marine area. Collect information about Tuna and in what way it is important?

Inland fisheries:

Fresh water resources include canals, ponds, reservoirs and rivers. Brackish water resources, where seawater and fresh water mix together, such as estuaries and lagoons are also important fish reservoirs. Fishing is also done in such inland water bodies, but the yield is not high.



Fig-20 Fish pond

More intensive fish farming can be done in composite fish culture systems. Both local and imported fish species are used in such systems.

In such a system, a combination of five or six fish species are used in a single fishpond. These species are selected so that they do not compete for food among them and have different types of food habits. As a result, the food available in all the parts of the pond is used. As Catlas are surface feeders. Rohus feed in the middle zone of

the pond, Mrigals and common carps are bottom feeders, and Grass Carps feed on the weeds. Together these species (Fig. 15.6) can use all the food in the pond without competing with each other. This increases the fish yield from the pond.

- What is blue revolution? What are its effects? Discuss in your class room.

Do you know?

Sea weeds constitute an important marine resource and are found along the Rocky intertidal and sub tidal regions of the coasts of India. The Sunderbans, the Chilka lake, the deltas of Godavari and Krishna, Gulf of Mannar, Plakbay, Gujarat coast and around Lakshadweep, Andamon and Nikobar Island are areas rich in sea weeds. They are used for human consumption, as cattle and poultry feed, as



manure and for industrial purposes as the sources of Phyco colloids like Agar-agar.

One problem with such composite fish culture is that many of these fishes breed only during monsoon. Even if fish seed is collected from the wild, it can be mixed with that of other species as well. So, a major problem in fish farming is the lack of availability of good quality seed. To overcome this problem, we have now been

worked out to breed these fish in ponds using hormonal stimulation. This has ensured the supply of pure fish seed in desired quantities.

Do you know? Estuaries are a part of the river systems. These are extremely interesting areas. The environmental conditions are in state of flux and the Fauna also is a combination of fresh and salt water species which can tolerate considerable variations in salinity.

Fish culture is sometimes practised in combination with a rice crop, so that fish are grown in the water in the paddy field. Growing fish in paddy field is also multi utilitarian practice. The reason for this is increasing use of inorganic fertilizers and insecticides in paddy fields which cause deleterious effects on fish and predation

for birds, snakes etc. Cultivating fish in paddy fields lower diseases like stem borers on paddy.

Fish is highly perishable. The processing of fish is very important in fish culture. There are several traditional methods of curing fish depending upon the local demands and export. Sun drying, semi drying, salting and drying, pickling and pit curing are some of the common methods employed in our State.

- Make list of food preservation practices in your area.

Animal husbandry, poultry, fish culture, bee culture etc. are the major practices in food production. Our government provides opportunities to improve animal food production to fulfill the food requirement of growing population.



Key words

Animal husbandry, livestock, jersy, Holstein, pasteurization, biogas, poultry, hatching, incubator, apiculture, honey bee hive, honey wax, queen bee, drone, aqua culture, marine fisheries, inland fisheries, breeding, food processing.



What we have learnt

- Providing food, shelter and protection of cattle to get milk, meat and other purposes collectively called animal husbandry.
- Rearing cattle in rural areas is a traditional practice.
- During the month of October and November milk production is higher than remaining year.
- Veterinary doctors helps the cattle rearers for artificial insemination.
- Broilers are meat yielding varieties whereas Layers are egg yielding varieties.
- Incubators are useful for hatching eggs artificially.

- Production of honey is otherwise called apiculture.
- Bee venom is used for preparation of apis tincture which is used in Hemeopathic medicine.
- Cultivating fish in fresh and salt water is called aqua culture.
- Because of aqua culture many agricultural lands turns into fish ponds in the coastal districts of Andhra Pradesh.
- Marine and inland fisheries meet the global food needs.



Improve your learning

1. Collect news from news papers about milk production and impurities in milk. Prepare a note and display it on wall magazine. (AS 4)
2. One honey bee hive consists of different types of bees. What are they? How they differ from each other? (AS 1)
3. Make a list of characters of local variety buffalows which gives good quantity of milk in your village? (AS 1)
4. Agriculture and animal husbandry are both sides of the same coin. How can you justify this? (AS 6)
5. Explain the process of hatching eggs under broody hen in rural areas? (AS 1)
6. Collect information about sea weeds, sea kelp from your school library and write a note with examples. (AS 4)
7. This fish is called Tuna. Collect information about availability catching and marketing of this partcular fish. (AS 1)
8. What is estuaries, how they are suitable for both marine and river fish to live. (AS 1)
9. Observe a dry honey bee hive and how the bees built it. Draw a picture. How does it look like? (AS 5)
10. How do you appreciate the uses of cattle? (AS 6)
11. Observe nearby poultry form and find out. How do they export eggs to market? What material is used for transportation? (AS 4)
12. If you have a chance to visit milk chilling center, what doubts would you like to clarify? Please list out them. (AS 2)
13. Conversion of agricultural lands into fish ponds lead food crisis and environmental pollution. Write your opinion to conduct a in debate on this issue. (AS 7)



NOT FOR DRINK NOT FOR BREATH



One day Akshay with his father Satyam went to Bazaar on Motor bike. A traffic constable stopped them and asked his father to show his driving license and other documents. He showed the driving license and other documents. Then the constable asked Satyam, to show the certificate of pollution check. He did not know what it was. The traffic constable fined him and asked him to go to any certified pollution check centre for pollution under control certificate or the pollution check certificate.

Satyam went to the pollution check up centre. There the emissions from his motor bike was checked and a pollution under control certificate was issued with details of amount of pollutants in the emissions.



Fig-1 Pollution checkup

In the evening when Satyam returned home, Akshay wanted to see the pollution under control certificate. You can also see that certificate. Here it is.



Fig-2 Pollution certificate

Observe this certificate try to find out answers for the following questions:

1. Which department issues the pollution under control certificate?
2. For how much time is it valid?
3. For which type of vehicle has it been issued?
4. What is emission test? What components are tested in the pollution check up center?
5. What will happen if Carbon monoxide (CO) and Hydrocarbons (HC) readings are higher than the permissible limits reading?

Discuss these issues in the class room.

- Think of why there is a need of “Pollution Under Control Certificate?”

With a rapid increase in the number of vehicles, the problem of automobile pollution has assumed greater significance. Since the emission of smoke from motor vehicles is a major source of air pollution, specific standards for the permissible limits for such emission have been prescribed in the Motor Vehicles Act 1988 and Central Motor Vehicles Rules 1989.

All vehicles which are in operation for more than a year should undergo emission tests every six months to obtain the certificate of pollution under control

The word pollution might not be new for us. Our elders talk about the blue sky, clean water and fresh air that was available in their times.

Now the media regularly reports on the falling quality of the environment. We ourselves feel the impact of the air and water pollution in our lives. Number of people suffering from diseases of the respiratory system, for example lung cancer, Asthma are steadily rising.

If we do not control pollution clean air and water may no longer be available! You have learnt about the importance of air and water in earlier classes.

Now, we will study about the harmful changes taking place in our surroundings and their effects on our lives.

What is Environmental Pollution

The environment is made up of systems, cycles, and specialized relationships between living and non-living elements. When everything is working the way it should be, all the living organisms within the environment, including humans, are healthy and thriving.

- What will happen if harmful organisms or substances enter your body? How do you feel?

In the same way if something harmful is introduced in to the environmental cycle, or part of the cycle is disrupted, it can cause a chain reaction of problems right through the rest of the system. These changes can really hurt the health and well being of living organisms. One of these negative changes is **pollution**, which is the result of unnatural elements entering the environment. Unfortunately, humans are usually at fault in this regard.

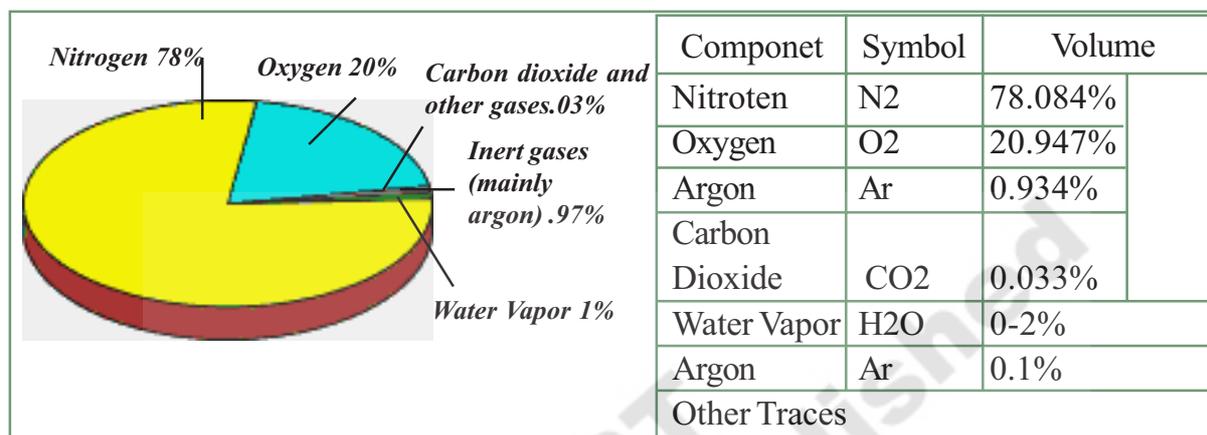
Anything that is harmful to the environment is pollution. Litter, car exhaust, motor oil, used tires, smoke, chemicals, disposed computer, mobile phone material etc., all of these can have an instant or a gradual impact on the health of our earth.

What is Air pollution?

- You know that air is a mixture of gases.
- List out the gases that you know present in the air.
 - What are the four major gasses in the air?

The composition of air in the atmosphere comprises four major gases namely nitrogen, oxygen, argon and carbon dioxide. Other substances are present in a very little amount and hence, they are

collectively known as trace components. Let us observe the composition of air in the atmosphere as shown in the diagram given below with composition in percentage.



The atmosphere contains about 21% of oxygen which is an essential element for survival of all living organisms.

Also, it is equally important for the process of combustion we already read in the physics chapter ‘Combustion, flame and fuels’. Carbon dioxide which is 0.033% is essential for the process of photosynthesis in plants.

All the other components have their own importance and all are in a naturally balanced state.

When this balanced state is disturbed either by some natural phenomena or by human activities, it is then called “Air-Pollution” and substances responsible disturbing this naturally occurring balance are said to be “Pollutants”.

Activity-1

Natural Disasters-Pollution

Some pollutants that enter the air by

natural disasters. For example, volcano eruptions, forest fires, and dust and sand from storms.

- Collect information from your school Library for the following natural disasters in the world.
 - ❖ Volcanic eruptions
 - ❖ Forest fires
 - ❖ Sand storms

These natural disasters leads to air pollution. But the majority of air pollutants come from things we do ourselves. So the maximum percentage of causes for air pollution is only because of human activities.

- If a person burnt out tires or dried leaves at a particular place. Where shall these smoke and ash goes.

Airborne pollutants make it tough to breathe and can even cause diseases like cancer. One problem is the way winds criss-cross the globe, picking up pollutants

and carrying them all over the world. This is how areas far away from where the actual pollution is created can become affected, too. Air pollution is not just a local concern.

Activity-2

Oil Paper Experiment

Take three square pieces of white paper of 5 X 5cm size dipped in oil. Hang these oil dipped paper at three different locations, say, your back yard, your school, near a park, or a parking lot, etc. Let it be there for 30 minutes. Observe and compare all three papers.

- What you found on those papers dipped in oil?
- Is there any difference observed for all the three locations?
- Try to find out the answer why this difference occurred?
- Do you know where the dust particles could have come from?

Pollutants

As we discussed above, Air pollutants arise from both man made and natural processes. But the effect of air pollution caused mainly by human activities.

Pollutants are also defined as primary pollutants resulting from combustion of fuels and industrial operations and secondary pollutants, those which are produced due to reaction of primary pollutants in the atmosphere.

Natural Activities:



Fig-3 Volcanic eruption

- Forest fires release carbon particles (ash) into the air and pollute the air.
- Volcanic eruption releases various gases and ash in to the atmosphere.
- Decay of organic matter releases Ammonia gas in to the air.
- Decay of organic matter lying under water releases Methane gas as air pollution.
- The pollen grains released by plants remain floating in the air and pollute it.

Human activities:

Burning fuels pollute the air producing pollutants like carbon monoxide, sulfur dioxide, smoke, soot and ash.

- Name of the fuels we burnt in our daily activities including rural and urban areas.



Fig-4 Burning fuel

Vehicles: exhaust gases emitted by motor vehicles pollute air by producing the harmful pollutants like sulfur dioxide, nitrogen dioxide, carbon monoxide, unburnt hydrocarbons, lead compounds and soot.

Industries: Various industries like granite, lime, cement etc., pollute air by releasing pollutants such as sulfur dioxide, nitrous oxide, chlorine, fly ash, dust, asbestos dust etc.

- Name of the factories at nearby your place. How they effect air and water?

? Do you know?

Most of the Granite factories are present at Chimakurthy of Prakasham district. Cement factories at Macharla, Limestone factories at Piduguralla are the most polluted areas because granite powder, cement dust, limestone dust is released into the air causing pollution. Thermal power plants of Parawada in Viskhapatnam, Krishnapatnam in Nellore districts are



releasing the pollutants like fly ash, Sulphur dioxide and radioactive substance causing the air, water and land pollution. Local people are suffering from lung cancer and skin allergies due to the pollution. The people living near the granite factory have faced several health problems like respiratory bronchitis and asthma. Thermal power plants pollute air by emitting sulphur dioxide, radio-active substances and fly ash.



❖ **Nuclear power plants:** The two problems of nuclear power are radioactive waste and the possibility of melt downs like **Tchernobyl**. The waste is dangerous because it can cause cancer and other health problems. The radioactive waste possess radio activity for at least one million years. The other problems are melt downs. Melt downs are provoked by too much heat in the power plant. During a melt down the power plant makes more Radioactive pollution.

The biggest meltdown of Nuclear power reactor in the world was Tchernobyl in Russia in 1986. After the melt down of Tchernobyl, there was a fire and formation of radioactive cloud. The cloud was made up of radioactive chemicals. Those chemicals cause the cancer of the thyroid gland in the neck and sensitive to radiations. 5 million Russians got the cancer and hundreds died. About 125,000km² of fields was unusable because of the radioactive clouds. The forest area was damaged by the radioactive clouds.

Activity-3

Power Generation Plants

There are a number of power generation plants in our country. Some produce power by using water (Hydro electric power plants), by using coal and gas (Thermal power plants), by using Radioactive elements like Uranium (Nuclear power plants). Go to your school library and collect information to make a list of these power generation plants and where they are located.

In addition to these there are so many small power plants in our country which emits pollutants into air.



Fig-5 Pesticides

Fertilizers and Pesticides: Use of fertilizers and pesticides in agriculture pollutes not only air but also land and water. You discussed about these issues in the chapter ‘production and management of food from plants’.

Deforestation: It is the destruction of forests and woods. It has resulted in the reduction of indigenous forests. Forests now cover only 19% of the earth’s land surface. Plants use carbon dioxide for the

process of photosynthesis. Due to lack of forests the level of carbon dioxide is increasing day by day resulting to global warming.



Fig-6 Deforestation

Chloro Fluoro carbons (CFC): CFCs are used in refrigerators, Air conditioners and aerosol sprays. Use of CFCs pollutes air by depleting the ozone layer as a result of which, harmful ultraviolet rays reach the earth.

Mining: Mining of coal and stone releases coal dust and stone dust that cause air pollution.



Fig-7 Mining

Let us read the table given in the next page about pollutants and their sources.

- Ask your teacher about secondary pollutants why they called so?

Common pollutants and their sources

Pollutants	Sources
Suspended Particulate Matter, (SPM)	Automobile, power plants, boilers, Industries requiring crushing and grinding such as quarry, cement.
Chlorine	Sea-salt production, de-chlorination, biomass burning and pulp & paper mills.
Fluoride	Fertilizer, aluminum refining
Sulphur dioxide	Power plants, boilers, sulfuric acid manufacture, ore refining, petroleum refining.
Lead	Ore refining, battery manufacturing, automobiles.
Oxides of nitrogen, NO, NO ₂ (NOX)	Automobiles, power plants, nitric acid manufacture, also a secondary pollutant
Peroxy acetyl nitrate, PAN	Secondary pollutant
Formaldehyde	Secondary pollutant
Ozone	Secondary pollutant
Carbon monoxide combustion.	Automobiles, incomplete fuel
Hydrogen sulphide	Pulp and paper, petroleum refining.
Hydrocarbons	Automobiles, petroleum refining
Ammonia	Fertilizer plant, degradation of dead animals.

Let us understand the effects of air pollution not only to human beings but also historical monuments. For this we need to study about Taj Mahal. Do you know the currently cars and buses are not allowed to

drive to the Taj Mahal but battery run buses or horse-drawn carriages are allowed to reach the monument. The Archeological department of India declared that 2½km around Taj Mahal is no drive zone .

Case Study: The TAJ MAHAL

The Taj Mahal one of the seven wonders of the world is located in Agra. It is made of white marbles. The effect of pollutants on it has become a matter



of concern for archeologists and environmentalists.

Motor vehicles and the industries located in and around Agra for rubber processing, Chemicals, Iron foundries, Mathura oil refinery have been responsible for producing pollutants like SO_2 , NO_2 , smoke, dust, soot etc.

These gases react with the rain to form acid rain. Acid rains corrode the marble of the Taj Mahal. Suspended Particulate Matter (SPM), such as the soot particles emitted by Mathura oil refinery has turned the marble from white to yellow.

Taking this in to account, the Supreme Court of India has suggested several steps to save the Taj. These are:

- Switch over to cleaner fuels like CNG and LPG.
- Use unleaded petrol in vicinity of Taj Mahal.
- Shift polluting industries to the outside of Agra city.

Bhopal – Unforgettable human sin:

Industries are the symbols of development. But other side of the coin is lack of safety measures and irresponsibility of emitting pollutants. On second December 1984 about 3000 human beings died, about 5000 were paralyzed and thousands of cattle, birds, dogs and cats died in just one night at Bhopal. This mass death was due to the leakage of Methyl Isocyanate (MIC) into the air from an insecticide factory managed by Union Carbide. Thousands of lives helplessly, crushed under the cruel foot of in human activity. This is the unforgettable industrial tragedy towards air pollution.

What are the effects by air pollution?

Air pollution continues to evoke a great deal of interest worldwide due to its negative impacts on human health and welfare. It causes certain diseases including shortness of breath, sore throat, chest pain, nausea, asthma, and bronchitis and lung cancer. Extreme effects of air pollution include high blood pressure and cardiovascular problems.

The World Health Organization states that 2.4 million people die each year from causes directly attributable to air pollution (WHO, 2007).

In addition to its negative health impacts, air pollution is known to cause injuries to animals, forests and vegetation, and aquatic ecosystems. Its impacts on

metals, structures, leather, rubber, and fabrics include cracks, soiling, deterioration, and erosion.

Some of the negative effects caused by these pollutants are discussed below.

The various harmful effects are:

- ❖ **Particulate Matter:** Dust and smoke spoil our cloths, reduce visibility and affect the buildings; dust and smoke get deposited on the leaves of the plants. Thus affects the rate of photosynthesis and transpiration. They also cause Bronchitis, Asthma in human beings. Particles of lead oxide present in automobile exhaust can cause Anemic, Brain damage and even death. Particles of mercury cause Minimata disease which affect the nervous system and can cause death.
- ❖ **Hydrogen Sulphide:** Tarnishes silver objects and blackens lead paints and painting. It has a smell like Rotten Eggs. It causes head ache in humans when inhaled in a large quantity.
- ❖ **Carbon monoxide Poisoning** is a poisonous gas combines with hemoglobin of our blood and forms a stable compound called carboxy hemoglobin. Due to the formation of this compound Hemoglobin is unable to carry oxygen to various parts of our body. This leads to respiratory problems. It causes suffocation and may cause even death.

- ❖ Air pollution causes ozone depletion, Green House effects, Global warming and Acid rain. We will read these effects in higher classes.



Think and Discuss

When we go on a busy road in the evening a lot of smoke is spread in the surroundings. We get cough and feel uneasy even when we close the nose with napkins.

- Why this type of symptoms we observe? Think about it.
- If these symptoms will continue, what happens?

Air pollution is like a slow poison. The effects of air pollution are not seen immediately. But over a long period of time, the pollutants present in air damage our health and property.

Activity-4

Field visit

Visit nearby factory, industry (boiled rice mill, Brick making keln, oil mill, food processing mill, etc) present in your area and observe,

- ❖ what way they are polluting air and water?
- ❖ there any green belt around the factory? Name the trees they are growing.
- ❖ Which type of precautions they are taking to prevent pollution?

- ❖ Are you also facing this type of problems in your area? Can you explain reasons behind?

In the previous class we have already discussed about water, its usage, and

sewage water treatment. Let us take class VII Science Textbook. Just go through the chapter 'Water too little to waste'. Now we will discuss about the water pollution, its causes and effects.

A CASE STUDY OF PATANCHERU

Patancheru is a suburban mandal headquarters in Medak district, located about 25km from Hyderabad. It is a major industrial hub of the State. It is one of the most polluted areas in India where nearly 14 villages were badly affected by pollution related diseases like cancer, respiratory diseases and heart diseases caused by "cocktail of poisons in air, water and on land."

The presence of pharmaceutical and chemical industries, pesticide units, steel rolling industries, distilleries releasing the pollutants like various dangerous gases like Chlorine, Hydrogen sulphide which are entering in to the Atmosphere. Most of the agricultural lands became barren. The lives of people there depend on agriculture and animal husbandry. They became helpless. Most of the people converted themselves as workers in the factories.

By observing all situations, for the sake of people and environment, the Supreme Court of India has released Interim orders as follows:

1. Stoppage of effluent flowing into air & water bodies immediately.
2. Provide drinking water to the affected villages.
3. Rectification of CETP.
4. Medical care to pollution victims.
5. Sustained continuous vigilance in discharge of effluents.
6. Discharge of treated effluents in to sewage line.

Lab Activity: Pollutants

Aim: Observation of pollutants in local available water samples.

Material: Glass tumblers, water samples from tap, pond, river, well, lake, Red, Blue litmus papers, soap.

Procedure: Collect water samples from a tap, pond, river, well and lake. Pour each into separate glass containers. Compare these for smell, color, P^H and hardness.

- ❖ p^H of water samples can be determined by using litmus paper . If blue litmus paper turns to the red color, that water sample is acidic in nature and if red litmus turns to blue, water sample is basic in nature
- ❖ Hardness of water can be determined using soap. If water produces lesser foam, it is referred as hard water.

Observations and findings: Record your observation in the following table.

Water Sample	Smell	color	pH		Hardness of water	
			Acidic	Basic	More	less
Tap water						
Pond water						
River water						
Well water						
Lake water						
Drinage water						



Think and Discuss

- Do you find any relation between P^H and hardness of water?
- Which water sample is colorless?
- Which water sample is suitable for drinking and why?
- Change in colour and smell of water in some water samples? What are your reasons?
- Which water sample of your collection is basic in nature?
- Are there any visible pollutants in the water sample?

Precautions: While conducting the experiment you need to follow the following precautions. Observe carefully change in the colour of litmus paper. Wash your hands each time. Don't taste any water sample. (If you have any more precautions please add to the list.)

What do we mean by water pollution?

Water is a unique substance, because it

can naturally renew and cleanse itself, by allowing pollutants to settle down (through the process of sedimentation) or break down, or by diluting the pollutants to a point where they are not in harmful concentrations. However, this natural process takes time, and is difficult when excessive quantities of harmful contaminants are added to the water. And humans are using more and more materials that are polluting the water sources that we drink from. Thus, the contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, industrial wastes etc. is called water pollution and the substances that pollute water are called water pollutants.

Normal water is colorless without any smell or any unwanted substances. Thus, water suitable for drinking is called potable water.

Most of the water resources like rivers, tanks and canals are being polluted by adding various pollutants from factories and by adding garbage. River with great historical background and good resource

for drinking and agriculture are now becoming water stagnated dumping garbage. Let us read about the sad story of river Moosi.

Sad Story of River Moosi

As Hyderabad has grown in size and is emerging as a global mega city, its growing water requirements have been met by under taking long distance water projects over the years. These projects are dependent on Musi River. Thousands of people depend on it for their daily needs and livelihood. The Musi has been polluted for many years. The people living near the Musi River throw large quantities of garbage, untreated sewage, industrial waste, dead bodies, polythene bags, hot water and statues of deities and many other materials directly in to the river .

The ‘Musi reservoir action plan project’ was undertaken to reduce the pollution level in the river. Pollution control activities include under the project are.

- *Solid waste management.*
- *Installation of sewage treatment plant.*
- *Provision of low cost sanitary facilities.*
- *Development of River front.*
- *Efforts to develop public awareness*

Although we still have a long way to cover to make Musi River absolutely free from pollution, this programme helped in reducing Musi river pollution to a significant extent.

Activity-5

Visit your nearby pond/ lake or river and find out the material being discharged in it. Prepare a Biography on it.

Where is all of this pollution coming from?

There are two main sources of water pollution; definite sources and non-definite



Fig-8 Polluted water stream

sources. Definite source pollution is due to discharges from a single source, such as an industrial site. It includes factories, wastewater treatment facilities, septic systems, and other sources that are clearly discharging pollutants into water sources. Non definite-source pollution involves many small sources that combine to cause significant pollution. For instance, the movement of rain or irrigation water over land picks up pollutants such as fertilizers, herbicides, and insecticides and carries them into rivers, lakes, reservoirs, coastal waters, or groundwater. Non-definite sources are more difficult to identify, as they cannot be traced back to a particular location. Landfills can also be a non-definite source of pollution, if substances leach from the landfill into water supplies.

Water pollutants thus can be divided into the following categories:

Biodegradable waste: This consists mainly of human and animal waste. The biodegradable waste enters a water supply and thus pollute water. The waste provides an energy source (organic carbon) for bacteria. Organic carbon is converted to carbon dioxide and water, which can cause atmospheric pollution and acid rain; this form of pollution is far more widespread and problematic than other forms of pollutants as a large supply of organic matter in the water provides an opportunity for oxygen-consuming (aerobic) bacteria to multiply quickly, consume all available oxygen, and kill all aquatic life.

- Ask your teacher about aerobic bacteria and write a note on it with some examples.

Plants nutrients: Phosphates and nitrates – chemical fertilisers from agriculture run-off due to rain and industrial waste enter into water through sewage and pollute the water. It helps algae to bloom, weeds to grow and bacteria is spread. As a result water turn green and cloudy and smell bad. Decomposing plants use up the oxygen in water, disrupting aquatic life, reducing biodiversity and even killing aquatic life. Thus, this enrichment of water by nutrients leading to excessive plant growth and depletion of oxygen is known as ‘**Eutrophication**’ This affects aquatic life badly.

- Do you know oil slog on sea water? In what way it is dangerous to aquatic life?

Heat: It can be a source of pollution in water. As the water temperature increases, the amount of dissolved oxygen decreases.

Thermal pollution can be natural, in the case of hot springs and shallow ponds in the summertime is also a reason for increasing temperature in water. The discharge of water that has been used to cool power plants or other industrial



Fig-9 Chemical pollutants

equipment is another reason. Fish and plants require certain temperatures and oxygen levels to survive. So thermal pollution often reduces the aquatic life diversity in the water.

Sediment: It is one of the most common sources of water pollution. Sediment consists of mineral or organic solid matter that is washed from land into water sources. Sediment pollution is difficult to identify, because it comes from non-definite sources such as constructional, agricultural, logging, flooding, and city runoff. Sediment can cause large problems, as it can clog municipal water systems,

smother aquatic life, and cause water to become increasingly turbid. Turbid water can cause thermal pollution, because it absorbs more solar radiation.

Hazardous and toxic chemicals: These are usually human-made materials that are not used or disposed of properly. The industrial waste contains a large

number of harmful chemicals like acids, alkali and metals such as arsenic, lead, mercury and cadmium leading to toxicity. Domestic and personal use of chemicals also significantly contribute to chemical pollution. Household cleaners, dyes, paints and solvents are also toxic, and can accumulate when poured down drains or flushed down the toilet. In fact, one drop of used motor oil can pollute 25 litres of water! And, people who use pesticides in their gardens and lawns tend to use ten times more pesticide per acre than a farmer would!

Pharmaceuticals: Pharmaceuticals and personal care products including medications, lotions and soap, are being found in increasing concentrations in lakes and rivers causing water pollution.

Hazardous substances like fluorine mixed in ground water cause dangerous diseases called fluorosis see annexure for more details.

Prevention And Controlling of Water Pollution

Water pollution can be prevented or minimized by adopting following measures.

- Toxic industrial wastes should be treated chemically to neutralize the harmful substances present in it before discharging into rivers and lakes.
- The sewage should not be dumped in to the rivers directly. It should first be treated at the sewage treatment plant to remove the organic matter from it in the form of manure.
- The use of excessive fertilizers and

pesticides should be avoided.

- The use of synthetic detergent should be minimized or biodegradable detergents should be used.
- Dead bodies of human beings and animals should not be thrown in to rivers.
- The excreta and other garbage should be treated in a biogas plant to get fuel as well as manure.
- The water of rivers, streams, ponds and lakes should be purified or cleaned. This can be done both by the industries and the govt. For example Ganga action plan lunched by the Indian Government.
- Trees and shrubs should be planted along the banks of the rivers.
- There should be general awareness among the masses regarding the harmful effects of water pollution and the ways of prevention. Waste paper, plastics, waste food materials and rotten food and vegetables should not be thrown in to open drains.
- Follow 3R's principles to reduce pollution and recover resources.
- Reduce the usage of the materials to the extent possible. Go for the alternate energy resources that can replenish themselves without affecting our environment.
- Once the materials are used for their primary purpose, reuse them for some secondary purpose. e.g if you have got your print outs on a plain white paper, you can use the other side of the paper once the project is over and the papers

are no longer needed for printing. In this manner you can save considerable amount of trees to be cut down to meet the demand of papers.

- Recycling is the next stage of reuse. Most of the materials can be recycled for use and recycled again and again till their properties are useful and are not degraded to an extent that can prevent

their effective use.

Natural resources are the divine gift for us by nature. We can use these resources in a meaningful way which will help us. If we destroy these resources human life become an unsolvable puzzle. We should keep these resources clean and healthy not only for us but also future generations.



Key words

Pollution, air pollution, pollutants, volcanic eruption, thermal power plants, chloro fluoro carbons (cfc), water pollution, potable water, toxic industrial wastes, fertilizers & pesticides, eutrophication, biodegradation, reduce, reuse, recycle suspended particulate matter (spm)



What we have learnt

- Pollution is any undesirable change in physical, chemical or biological characteristics of air, water or soil.
- Air pollution is the contamination of air by impurities which may have harmful impacts on the living organisms and the non-living components of the environment.
- Pollutants are the substances which contaminate the environment. Main pollutants are suspended particulate matter, Carbon monoxide, excess carbon dioxide, oxides of sulfur and nitrogen, CFCs and heavy metals.
- Causes of Air pollution: Burning of fuels, vehicles, industries, thermal power plants, Nuclear power plants, Fertilizers and pesticides, deforestation, CFCs and mining.
- Air pollution causes various diseases like respiratory diseases, cancer, etc.
- The contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, and industrial waste is known as water pollution.
- Industrial wastes, sewage waste, fertilizers, and pesticides are releasing pollutants that cause water pollution.
- Water borne diseases like typhoid, cholera, dysentery, jaundice, and diarrhea are some of the effects of water pollution.
- Environmental pollution can be controlled taking preventive measures like using 3R's principles.



Improve your learning

1. What is air pollution? Make a flowchart to describe its causes and effects. (AS 5)
2. Sudheer is a traffic constable. What do you think about his health. Give some suggestions to protect his health during duty period. (AS 2)
3. Does what air pollution lead to water pollution? (AS 1)
4. 'Use Bicycle – Avoid motor bikes and cars. This slogan is prepared by Sravani. You also prepare some slogans on pollution. (AS 7)
5. Clear and transparent water is always fit for drinking. Comment. (AS 6)
6. If our monument like Taj Mahal is effected by air pollution, what is your advise to protect it? (AS 6)
7. What steps can be taken up to control air pollution and water pollution? (AS 1)
8. Write a short note on the effects of water pollution in your village or nearby area(AS1)
9. Why does the increased level of nutrients in the water affect the survival of aquatic organisms? (AS 1)
10. Reshma going to talk about controlling measures of soil pollution. Please prepare write up for her. (AS 6)
11. Road side plants cannot grow properly - Find your own reasons and explain with your argument. (AS 1)
12. Visit a pollution check centre. Observe the process of conducting a pollution check and record your findings. You may consider the following areas for your record:
Average number of vehicles checked in a certain time period, Time taken to check each vehicle, Pollutants checked for, The process of testing, Permissible limits of emission of various pollutants, Measures taken if the emitted gases are above the permissible limits. (AS 4)
13. Organize a field visit to a pond / lake / river present in or near to your village with the help of your teachers. (AS 4)
Observations followed by discussion could focus on... The history of the pond or lake or river, Water resources available other than that river/ pond/ or lake, Cultural traditions, Pollution concerns, Source of pollution, Effects of pollution on the people living by the river side as well as those living far away.
14. To conduct a quiz program on air and water pollution, prepare five thought provoking questions. (AS 6)
15. If you are a general manager of a chemical industry what precautions you would take to control air and water pollution. (AS 7)



ANEXURE

What is fluorosis?

Look at this picture. Do you know how and why? He is looking so. Yes, he is suffering a dangerous disease called fluorosis, which is caused by intake off fluorinated food and water. Most of the places of Nalgonda, Prakasham, Medak, Khammam and Nellore districts of our state affected by fluorosis.



Fluorosis Disease

Fluorosis is a disease caused by excessive ingestion of fluoride through water and or food. The upper limit of optimum fluoride level in drinking water for a tropical country like India is 0.5 PPM or 0.5 Mg/l. It is the total daily intake through water and food that determines the development of fluorosis.

Endemic skeletal fluorosis was identified in Podili, Darsi and Kanigiri areas of Andhra Pradesh in 1937. Yellareddyguda, Naibai and Yedavalli villages of Nalgonda district are known to have a very high (2.0 to 7.5ppm) incidence of fluorosis. Fluoride in take came from food.

Fluorosis diseases are of four forms dental, genu valgum, skeletal and neurological. Low endemicity is those villages, which have only cases of dental fluorosis. In addition if there are cases of Genu valgum, Skeletal and Crippling forms, they should be considered as the

villages with high endemicity. Low endemicity cases only need calcium and vitamin supplementation to children and adolescents to prevent Genu valgum deformities occurring.

All children living in endemic areas of fluorosis consuming water containing more than 1.5 PPM of fluoride would develop dental fluorosis. Permanent teeth are affected which become rough, opaque and chalky white. Pitting and chipping of the teeth are also same. Brown, black or yellow pigmentation is deposited on the teeth.

Genu valgum is the deformities of limb bones, which are notably seen in weight bearing lower limbs in children in endemic areas of fluorosis. These occur only in poorly nourished children whose diet is low in calcium intake.

Bony changes occur due to excessive ingestion of fluoride over a long period of time. This becomes crippling in people in endemic regions beyond the age of 30 years. In these places river water is good for drinking than well or borewell water.

These deformities are to be prevented by providing adequate diet containing optimum amounts of calcium in growing children. Milk is a good source of calcium but it is expensive. There are many vegetables which are rich of source of calcium, magnesium and vitamin C like Thotakura, Chamakura, Ragi, Agathi, Amaranth, Colacasia leaves, Curry leaves, Poppy seed, Jagary, Gingelly seeds, Jowar, Cummin, Amla, Green chilly, etc. School children are provided milk and leafy vegetables in their midday meal.



Gram panchayat wrote some slogans about healthy habits on walls. Let us read that wall writings.

- Why local Panchayats display such instructions on the wall?
- What do we come to know from such instructions?
- What would happen who would not follow the instructions?
- In which season do we generally find more mosquitoes? How do they affect us?

Drinking boiling water, avoiding fly infections and avoiding mosquito bites will help us to remain healthy. But what is health and when do we fall sick?

Health and its Failure

The significance of 'Health'

We have heard the word 'health' being used quite frequently. We use it ourselves as well, when we say things like 'my grandmother's health is not good'. Our teachers use it when they scold us saying 'this is not a healthy attitude'. What does the word 'health' mean? If we think about it, we realise that it always implies the idea

Drink boiled water only.

Use mosquito nets.

Keep your surroundings neat and clean.

Do not left water to stagnate.

Eat food when it is hot

Wash hands before eating food.

Wash hands after toilet.

Use toilets only, not deficate in open.

Keep lids on food vessels.

Wash vegetables before cooking.

of 'being well'. We can think of this well-being as effective functioning. For our grandmothers, being able to go out to the market or to visit neighbours is 'being well', and not being able to do such things is 'poor health'.

Being interested in following the teaching in the classroom so that we can understand the world would be called a 'healthy attitude'; while not being interested would be called the opposite.

'Health' is therefore a state of being well enough to function physically, mentally and socially with optimum efficiency.

Personal and community issues, both matter for health

If health means a state of physical, mental and social well-being, it cannot be something that each one of us can achieve entirely on our own. The health of all organisms will depend on their surroundings or environment. The environment includes the physical environment. For example every one's health is at risk in a cyclone. But even more importantly, human beings live in societies. Our social environment, therefore, is an important factor in our individual health. We live in villages, towns or cities. In such places, even our physical environment is decided by our social environment. Consider what would happen if no agency is ensuring that garbage is collected and disposed. What would happen if no one takes responsibility for clearing the drains and ensuring that water does not collect in the streets or open spaces? So, if there is a great deal of garbage thrown in our streets, or if there is open drainwater lying stagnant around where we live, the possibility of ill health. Therefore, public cleanliness is important for individual health.

Activity-1

- Find out what provisions are made by your local authority (panchayat/municipal corporation) for the supply of clean drinking water.
- Are all the people in your locality able to access this?

Activity-2

- Find out how your local authority manages the solid waste generated in your neighbourhood.
- Are these measures adequate?
- If not, what improvements would you suggest?
- What could your family do to reduce the amount of solid waste generated during a day/week from your house?

We need food for health, and this food will have to be earned by doing work. For this, the opportunity to do work has to be available. Good economic conditions and jobs are therefore needed for individual health. We need to be happy in order to be truly healthy, and if we mistreat each other and are afraid of each other, we cannot be happy or healthy.

Social equality and harmony are therefore necessary for individual health. We can think of many other such examples of connections between community issues and individual health.

Distinctions between 'Healthy' and 'Disease free'

If this is what we mean by 'health', what do we mean by 'disease'? The word is actually self-explanatory – we can think of it as 'disease' – disturbed ease. Disease, in other words, literally means being uncomfortable. However, the word is used in a more limited meaning. We talk of disease when we can find a specific and

particular cause for discomfort. This does not mean that we have to know the absolute final cause; we can say that someone is suffering from diarrhoea without knowing exactly what has caused the loose motions. We can now easily see that it is possible to be in poor health without actually suffering from a particular disease. Simply not being diseased is not the same as being healthy. 'Good health' for a dancer may mean being able to stretch his body into difficult but graceful positions. On the other hand, good health for a musician may mean having enough breathing capacity in his/her lungs to control the notes from his/her flute. To have the opportunity to realise the unique potential in all of us is also necessary for real health. So, we can be in poor health without there being a simple cause in the form of an identifiable disease. This is the reason why, when we think about health, we think about societies and communities. On the other hand, when we think about disease, we think about individual sufferers.

- State any two conditions essential for good health.
- State any two conditions essential for being free of disease.
- Are the answers to the above questions necessarily the same or different? Why?

Disease and its causes

What does disease look like ?

Form a group with five students list

out some diseases and its symptoms. Let us now think a little more about diseases. In the first place, how do we know that there is a disease? In other words, how do we know that there is something wrong with the body? There are many tissues in the body, as we have seen in Chapter 6. These tissues make up physiological systems or organ systems that carry out body functions. Each of the organ systems has specific organs as its parts, and it has particular functions. So, the digestive system has the stomach and intestines, and it helps to digest food taken in from outside the body. The musculoskeletal system, which is made up of bones and muscles, holds the body parts together and helps the body move.

When there is a disease, either the functioning or the appearance of one or more systems of the body will change for the worse.

These changes give rise to symptoms and signs of disease. Symptoms of disease are the things we feel as being 'wrong'. So we have headache, cough, loose motions and wound with pus; these are all symptoms.

These indicate that there may be a disease, but they do not indicate what the disease is. For example, a headache may mean just examination stress or, very rarely, it may mean meningitis, or any one of a dozen different diseases.

Signs of disease are what physicians will look for on the basis of the symptoms. Signs will give a little more definite indication of the presence of a particular disease. Physicians will also get laboratory

tests done to pinpoint the disease further.

Acute and chronic diseases

The manifestations of disease will be different depending on a number of factors. One of the most obvious factors that determine how we perceive the disease is its duration. Some diseases last for only very short periods of time, and these are called acute diseases. We all know from experience that the common cold lasts only a few days. Other ailments can last for a long time, even as much as a lifetime, and are called chronic diseases. An example is the infection causing elephantiasis, which is very common in some parts of India.

Activity-3

- Survey your neighbourhood to find out:
 - 1) How many people did suffer from acute diseases during the last three months?
 - 2) How many people did develop chronic diseases during this same period?
 - 3) And finally, what is the total number of people suffering from chronic diseases in your neighbourhood?
- Are the answers to questions (1) and (2) different?
- Are the answers to questions (2) and (3) different?
- What do you think could be the reason for these differences? What do you think would be the effect of these differences on the general health of the population?

Chronic diseases and poor health

As we can imagine, acute and chronic diseases have different effects on our health. Any disease that causes poor functioning of some part of the body will affect our general health as well. This is because all functions of the body are necessary for general health. But an acute disease, which is over very soon, will not have time to cause major effects on general health, while a chronic disease will do so.

As an example, think about a cough and cold, which all of us have from time to time. Most of us get better and become well within a week or so. And there are no bad effects on our health. We do not lose weight, we do not become short of breath, we do not feel tired all the time because of a few days of cough and cold. But if we get infected with a chronic disease such as tuberculosis of the lungs, then being ill over the years does make us lose weight and feel tired all the time. We may not go to school for a few days if we have an acute disease. But a chronic disease will make it difficult for us to follow what is being taught in school and reduce our ability to learn. In other words, we are likely to have prolonged general poor health if we have a chronic disease. Chronic diseases therefore, have very drastic, long-term effects on people's health as compared to acute diseases.

Causes of diseases

What are the causes for diarea, T.B.? What causes a disease? When we think about causes of diseases, we must remember that there are many levels of such

causes. Let us look at an example. If there is a baby suffering from loose motions, we can say that the cause of the loose motions is an infection with a virus. So the immediate cause of the disease is a virus.

But the next question is – where did the virus come from? Suppose we find that the virus came through unclean drinking water. But many babies must have had this unclean drinking water. So, why is it that one baby developed loose motions when the other babies did not?

One reason might be that this baby is not healthy. As a result, it might be more likely to have disease when exposed to such risk, whereas healthier babies would not. Why is the baby not healthy? Perhaps because it is not well nourished and does not get enough food. So, lack of good nourishment becomes a second level cause of the disease the baby is suffering from. Further, why is the baby not well nourished? Perhaps because it is from a household which is poor.

It is also possible that the baby has some genetic difference that makes it more likely to suffer from loose motions when exposed to such a virus. Without the virus, the genetic difference or the poor nourishment alone would not lead to loose motions. But they do become contributory causes of the disease.

Why was there no clean drinking water for the baby? Perhaps because the public services are poor where the baby's family lives. So, poverty or lack of public services become third-level causes of the baby's disease.

It will now be obvious that all diseases will have immediate causes and

contributory causes. Also, most diseases will have many causes, rather than one single cause.

Infectious and non-infectious causes

As we have seen, it is important to keep public health and community health factors in mind when we think about causes of diseases. We can take that approach a little further. It is useful to think of the immediate causes of disease as belonging to two distinct types. One group of causes is the infectious agents, mostly microbes or micro-organisms.

Diseases where microbes are the immediate causes are called infectious diseases. This is because the microbes can spread in the community, and the diseases they cause will spread with them.

- Do all diseases spread to people coming in contact with a sick person?
- What are the diseases that are not spreading?
- How would a person develop those diseases that do not spread by contact with a sick person?

On the other hand, there are also diseases that are not caused by infectious agents. Their causes vary, but they are not external causes like microbes that can spread in the community. Instead, these are mostly internal, non-infectious causes.

For example, some cancers are caused by genetic abnormalities. High blood pressure can be caused by excessive weight and lack of exercise. You can think of many other diseases where the immediate causes will not be infectious.



Peptic ulcers and the Nobel prize

For many years, everybody used to think that peptic ulcers, which cause acidity-related pain and bleeding in the stomach and duodenum, were because of lifestyle reasons. Everybody thought that a stressful life led to a lot of acid secretion in the stomach, and eventually caused peptic ulcers.

Then two Australians made a discovery that a bacterium, *Helicobacter pylori*, was responsible for peptic ulcers. Robin Warren (born 1937), a pathologist

from Perth, Australia, saw these small curved bacteria in the lower part of the stomach in many patients. He noticed that signs of inflammation were always present around these bacteria. Barry Marshall (born 1951), a young clinical fellow, became interested in Warren's findings and succeeded in cultivating the bacteria from these sources.

In treatment studies, Marshall and Warren showed that patients could be cured of peptic ulcer only when the bacteria were killed off from the stomach. Thanks to this pioneering discovery by Marshall and Warren, peptic ulcer disease is no longer a chronic, frequently disabling condition, but a disease that can be cured by a short period of treatment with antibiotics.

For this achievement, Marshall and Warren (seen in the picture) received the Nobel prize for physiology and medicine in 2005.

The ways in which diseases spread, and the ways in which they can be treated and prevented at the community level would be different for different diseases. This would depend a lot on whether the immediate causes are infectious or non-infectious.

- List any three reasons why you would think that you are sick and ought to see a doctor. If only one of these symptoms were present, would

you still go to the doctor? Why or why not?

- In which of the following case do you think the long-term effects on your health are likely to be most unpleasant?
 - a. if you get jaundice,
 - b. if you get lice,
 - c. if you get acne.

Why?

Infectious Diseases

Infectious agents

We have seen that the entire diversity seen in the living world can be classified into a few groups. This classification is based on common characteristics between different organisms. Organisms that can cause disease are found in a wide range of such categories of classification. Some of them are viruses, some are bacteria, some are fungi, some are single-celled animals or protozoans. Some diseases are also caused by Multicellular organisms, such as worms of different kinds.

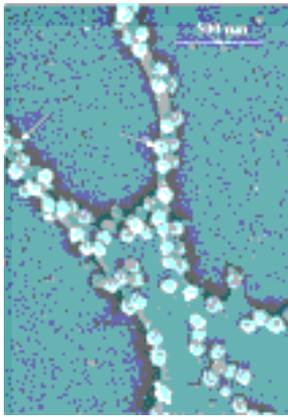


Fig-1(a) Picture of SARS viruses coming out (see arrows for examples) of the surface of an infected cell. The white scale line represents 500 nanometres, which is half a micrometre, which is one thousandth of a millimetre. The scale line gives us an idea of how small the things we are looking at are.
Courtesy: *Emerging Infectious Diseases*, a journal of CDC, U.S.

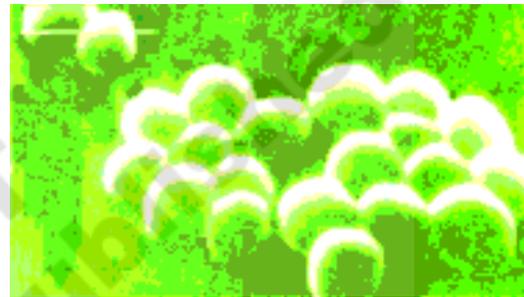


Fig-1(b) Picture of staphylococci, the bacteria which can cause acne. The scale of the image is indicated by the line at top left, which is 5 micrometres long.



Fig-2(a) Picture of Trypanosoma, the protozoan organism responsible for sleeping sickness. The organism is lying next to a saucer-shaped red blood cell to give an idea of the scale.



Fig-2(b) Picture of Leishmania, the protozoan organism that causes kala-azar. The organisms are oval-shaped, and each has one long whip-like structure. One organism (arrow) is dividing, while a cell of the immune system (lower right) has gripped on the two whips of the dividing organism and is sending cell processes up to eat up the organism. The immune cell is about ten micrometres in diameter.



*Fig-2(c) Picture of an adult roundworm (*Ascaris lumbricoides* is the technical name) from the small intestine. The ruler next to it shows four centimetres to give us an idea of the scale.*

Common examples of diseases caused by viruses are the common cold, influenza, dengue fever and AIDS. Diseases like typhoid fever, cholera, tuberculosis and anthrax are caused by bacteria. Many common skin infections are caused by different kinds of fungi. Protozoan microbes cause many familiar diseases, such as malaria and kala-azar. All of us have also come across intestinal worm infections, as well as diseases like elephantiasis caused by different species of worms.

Why is it important that we think of these categories of infectious agents? The answer is that these categories are important factors in deciding what kind of treatment to use. Members of each one of these groups – viruses, bacteria, and so on – have many biological characteristics in common.

All viruses, for example, live inside host cells, whereas bacteria very rarely do. Viruses, bacteria and fungi multiply very quickly, while worms multiply very slowly in comparison. Taxonomically, all bacteria are closely related to each other than to viruses and vice versa. This means that many important life processes are similar in the bacteria group but are not shared with the virus group. As a result, drugs that block one of these life processes in one member of the group is likely to be effective against many other members of the group. But the same drug will not work against a microbe belonging to a different group.

As an example, let us take antibiotics. They commonly block biochemical pathways important for bacteria. Many bacteria, for example, make a cell-wall to protect themselves. The antibiotic penicillin blocks the bacterial processes that build the cell wall. As a result, the growing bacteria become unable to make cell-walls, and die easily. Human cells do not make a cell-wall anyway, so penicillin cannot have such an effect on us. Penicillin will have this effect on any bacteria that use such processes for making cell-walls. Similarly, many antibiotics work against many species of bacteria rather than simply working against one.

But viruses do not use these pathways at all, and that is the reason why antibiotics do not work against viral infections. If we have a common cold, taking antibiotics does not reduce the severity or the duration of the disease. However, if we also get a bacterial infection along with the viral cold, taking antibiotics will help. Even then, the antibiotic will work only against the bacterial part of the infection, not the viral infection.

Activity-4

- Find out how many of you in your class had cold/cough/fever recently.
- How long did the illness last?
- How many of you took antibiotics (ask your parents if you had antibiotics)?
- How long did they suffer who took antibiotics ill?

- How long did they suffer who did not take antibiotics ill?
- Is there a difference between these two groups?
- If yes, why? If not, why not?

Means of spread

How do infectious diseases spread? Many microbial agents can commonly move from an affected person to someone else in a variety of ways. In other words, they can be ‘communicated’, and so are also called communicable diseases.

Such disease-causing microbes can spread through the air. This occurs through the little droplets thrown out by an infected person who sneezes or coughs. Someone standing close by can breathe in these droplets, and the microbes get a chance to start a new infection. Examples of such diseases spread through the air are the common cold, pneumonia and tuberculosis.

We all have had the experience of sitting near someone suffering from a cold and catching it ourselves. Obviously, the more crowded our living conditions are, the more likely it is that such airborne diseases will spread.

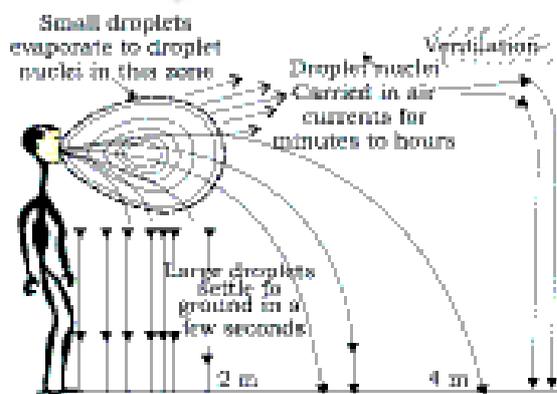


Fig-3

Fig. 2 Air-transmitted diseases: The closer we are to the infected person the easier to catch air-transmitted diseases. However, in closed areas, the droplet nuclei recirculate and pose a risk to everybody. Overcrowded and poorly ventilated housing is therefore a major factor in the spread of airborne diseases.

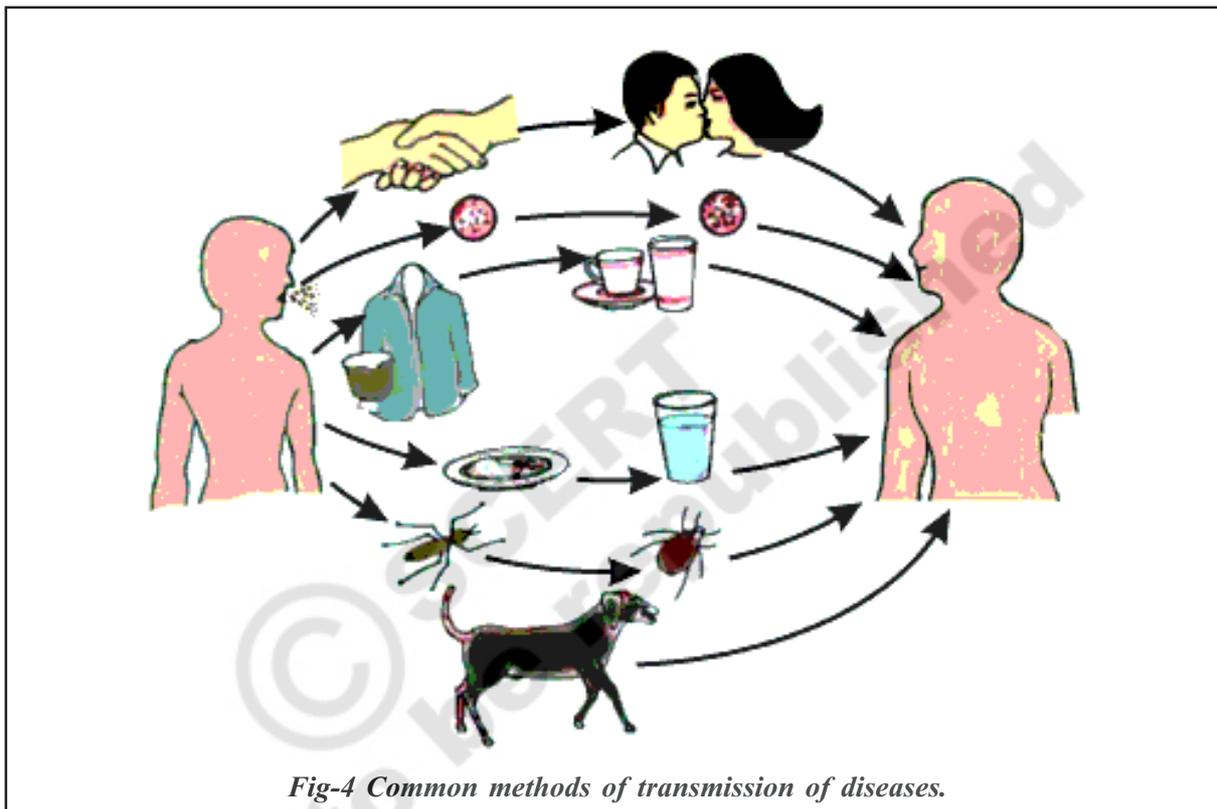
Diseases can also be spread through water. This occurs if the excreta from someone suffering from an infectious gut disease, such as cholera, get mixed with the drinking water used by people living nearby. The cholera causing microbes will enter new hosts through the water they drink and cause disease in them. Such diseases are much more likely to spread in the absence of safe supplies of drinking water.

The sexual act is one of the closest physical contact two people can have with each other. Not surprisingly, there are microbial diseases such as syphilis or AIDS that are transmitted by sexual contact from one partner to the other. However, such sexually transmitted diseases are not spread by casual physical contact. Casual physical contacts include handshakes or hugs e.g. sports, like wrestling, or by any of the other ways in which we touch each other socially. Other than the sexual contact, the AIDS virus can also spread through blood-to-blood contact with infected people or from an infected mother to her baby during pregnancy or through breast feeding.

We live in an environment that is full of many other creatures apart from us. It is inevitable that many diseases will be

transmitted by other animals. These animals carry the infecting agents from a sick person to another potential host. These animals are thus the intermediaries and are called vectors. The commonest vectors we all know are mosquitoes. In many species

of mosquitoes, the females need highly nutritious food in the form of blood in order to be able to lay mature eggs. Mosquitoes feed on many warm-blooded animals, including us. In this way, they can transfer diseases from person to person.



Organ-specific and Tissue specific manifestations

The disease-causing microbes enter the body through these different means. Where do they go then? The body is very large when compared to the microbes. So there are many possible places, organs or tissues, where they could go. Do all microbes go to the same tissue or organ, or do they go to different ones?

Different species of microbes seem to have evolved to home in on different parts of the body. In part, this selection is

connected to their point of entry. If they enter from the air via the nose, they are likely to go to the lungs. This is seen in the bacteria causing tuberculosis. If they enter through the mouth, they can stay in the gut lining like typhoid causing bacteria. Or they can go to the liver, like the viruses that cause jaundice.

But this need not always be the case. An infection like HIV, that comes into the body via the sexual organs, will spread to

lymph nodes all over the body. Malaria-causing microbes, entering through a mosquito bite, will go to the liver, and then to the red blood cells. The virus causing Japanese encephalitis, or brain fever, will similarly enter through a mosquito bite. But it goes on to infect the brain.

The signs and symptoms of a disease will thus depend on the tissue or organ which the microbe targets. If the lungs are the targets, then symptoms will be cough and breathlessness. If the liver is targeted, there will be jaundice. If the brain is the target, we will observe headaches, vomiting, fits or unconsciousness. We can imagine what the symptoms and signs of an infection will be if we know what the target tissue or organ is, and the functions that are carried out by this tissue or organ.

In addition to these tissue-specific effects of infectious disease, there will be other common effects too. Most of these common effects depend on the fact that the body's immune system is activated in response to infection. An active immune system recruits many cells to the affected tissue to kill off the disease-causing microbes. This recruitment process is called inflammation. As a part of this process, there are local effects such as swelling and pain, and general effects such as fever.

In some cases, the tissue-specificity of the infection leads to very general-seeming effects. For example, in HIV infection, the virus goes to the immune system and damages its function. Thus,

many of the effects of HIV-AIDS are because the body can no longer fight off the many minor infections that we face every day. Instead, even small cold can become pneumonia. Similarly, a minor gut infection can produce major diarrhoea with blood loss. Ultimately, it is these other infections that kill people suffering from HIV-AIDS.

It is also important to remember that the severity of disease manifestations depend on the number of microbes in the body. If the number of microbes is very small, the disease manifestations may be minor or unnoticed. But if the number of the same microbe is large, the disease can be severe enough to be life-threatening. The immune system is a major factor that determines the number of microbes surviving in the body. We shall look into this aspect a little later in the chapter.

Principles of treatment

What are the steps taken by your family when you fall sick? Have you ever thought why you sometimes feel better if you sleep for some time? When does the treatment involve medicines?

Based on what we have learnt so far, it would appear that there are two ways to treat an infectious disease. One would be to reduce the effects of (or control) the disease and the other to kill the cause of the disease. For the first, we can provide treatment that will reduce the symptoms. The symptoms are usually because of inflammation. For example, we can take

medicines that bring down fever, reduce pain or loose motions. We can take bed rest so that we can conserve our energy. This will enable us to have more of it available to focus on healing.

But this kind of symptom-directed treatment by itself will not make the infecting microbe go away and the disease will not be cured. For that, we need to be able to kill off the microbes.

How do we kill microbes? One way is to use medicines that kill microbes. We have seen earlier that microbes can be classified into different categories. They are viruses, bacteria, fungi or protozoa. Each of these groups of organisms will have some essential biochemical life process which is peculiar to that group and not shared with the other groups. These processes may be pathways for the synthesis of new substances or medication.

These pathways will not be used by us either. For example, our cells may make new substances by a mechanism different from that used by bacteria. We have to find a drug that blocks the bacterial synthesis of pathway without affecting our own. This is what is achieved by the antibiotics that we are all familiar with. Similarly, there are drugs that kill protozoa such as the malarial parasite.

One reason why making anti-viral medicines is harder than making antibacterial medicines is that viruses have few biochemical mechanisms of their own. They enter our cells and use our machinery

for their life processes. This means that there are relatively few virus-specific targets to aim at. Despite this limitation, there are now effective anti-viral drugs, for example, the drugs that keep HIV infection under control.

Principles of prevention

All of what we have talked about so far deals with how to get rid of an infection in someone who has the disease. But there are three limitations of this approach to dealing with infectious disease. The first is that once someone has a disease, their body functions are damaged and may never recover completely. The second is that treatment will take time, which means that someone suffering from a disease is likely to be bedridden for some time even if we can give proper treatment. The third is that the person suffering from an infectious disease can serve as the source from where the infection may spread to other people. This leads to the multiplication of the above difficulties. It is because of such reasons that prevention of diseases is better than their cure.

How can we prevent diseases? There are two ways, one general and one specific to each disease. The general ways of preventing infections mostly relate to preventing exposure. How can we prevent exposure to infectious microbes?

If we look at the means of their spreading, we can get some easy answers. For airborne microbes, we can prevent exposure by providing living conditions that

are not overcrowded. For water-borne microbes, we can prevent exposure by providing safe drinking water. This can be done by treating the water to kill any microbial contamination. For vector-borne infections, we can provide clean environments. This would not, for example, allow mosquito breeding. In other words, public hygiene is one basic key to the prevention of infectious diseases.

In addition to these issues that relate to the environment, there are some other general principles to prevent infectious diseases. To appreciate those principles, let us ask a question we have not looked at so far. Normally, we are faced with infections every day. If someone is suffering from a cold and cough in the class, it is likely that the children sitting around will be exposed to the infection. But all of them do not actually suffer from the disease. Why not?

This is because the immune system of our body is normally fighting off microbes. We have cells that specialise in killing infecting microbes. These cells go into action each time infecting microbes enter the body. If they are successful, we do not actually come down with any disease. The immune cells manage to kill off the infection long before it assumes major proportions. As we noted earlier, if the number of the infecting microbes is controlled, the manifestations of disease will be minor. In other words, becoming exposed to or infected with an infectious microbe does not necessarily mean developing noticeable disease.

So, one way of looking at severe infectious diseases is that it represents a lack of success of the immune system. The functioning of the immune system, like any other system in our body, will not be good if proper and sufficient nourishment and food is not available. Therefore, the second basic principle of prevention of infectious disease is the availability of proper and sufficient food for everyone.

Activity-5

- Conduct a survey in your locality. Talk to ten families who are well-off and ten who are very poor (in your estimation). Both sets of families should have children who are below five years of age. Measure the heights of these children. Draw a graph of the height of each child against its age for both sets of families.
- Is there a difference between the groups? If yes, why?
- If there is no difference, do you think that your findings mean that being well-off or poor does not matter for health?

These are the general ways of preventing infections. What are the specific ways? They relate to a special property of the immune system that usually fights off microbial infections. Let us cite an example to try and understand this property.

These days, there is no smallpox

anywhere in the world. But as recently as a hundred years ago, smallpox epidemics were not at all uncommon. In such an epidemic, people used to be very afraid of coming near someone suffering from the disease since they were afraid of catching the disease.

However, there was one group of people who did not have this fear. These people would provide nursing care for the victims of smallpox. This was a group of people who had had smallpox earlier and survived it, although with a lot of scarring. In other words, if you had smallpox once,

there would be no chance of suffering from it again. So, having the disease once was a means of preventing subsequent attacks of the same disease.

This happens because when the immune system first “recognises” an infectious microbe, it “responds” against it and then “remembers” it specifically. So the next time that particular microbe, or its close relatives enter the body, the immune system responds with even greater vigour. This eliminates the infection even more quickly than the first time around. This is the basis of the principle of immunisation.



Immunisation

Traditional Indian and Chinese medicinal systems sometimes deliberately

rubbed the skin crusts from smallpox victims into the skin of healthy people. They thus hoped to induce a mild form of smallpox that would create resistance against the disease.

Famously, two centuries ago, an English physician named Edward Jenner, realized that milkmaids who had had cowpox did not catch smallpox even during epidemics. Cowpox is a very mild disease. Jenner tried deliberately giving cowpox to people (as he can be seen doing in the picture), and found that they were now resistant to smallpox. This was because the smallpox virus is closely related to the cowpox virus. ‘Cow’ is ‘vacca’ in Latin, and cowpox is ‘vaccinia’. From these roots, the word ‘vaccination’ has come into our usage.

We can now see that, as a general principle, we can ‘fool’ the immune system into developing a memory for a particular infection by putting something, that mimics the microbe we want to vaccinate against, into the body. This does not actually cause the disease but this would prevent any subsequent exposure to the infecting microbe from turning into actual disease.

Many such vaccines are now available for preventing a whole range of infectious diseases, and provide a disease-specific means of prevention. There are vaccines against tetanus, diphtheria, whooping cough, measles, polio and many others. These form the public health programme of childhood immunisation for preventing infectious diseases.

Of course, such a programme can be useful only if such health measures are available to all children. Can you think of reasons, why this should be so?

Some hepatitis viruses, which cause jaundice, are transmitted through water. There is a vaccine for one of them, hepatitis A, in the market. But the majority of children in many parts of India are already immune to hepatitis A by the time they are five years old. This is because they are

exposed to the virus through water. Under these circumstances, would you take the vaccine?

Activity-6

Rabies virus is spread by the bite of infected dogs and other animals. There are anti-rabies vaccines for both humans and animals. Find out the plan of your local authority for the control of rabies in your neighbourhood. Are these measures adequate? If not, what improvements would you suggest?

- Why we are normally advised to take bland and nourishing food when we are sick?
- What are the different means by which infectious diseases are spread?
- What precautions can you take in your school to reduce the incidence of infectious diseases?
- What is immunisation?
- What are the immunization programmes available at the nearest health centre in your locality? Which of these diseases are the major health problems in your area?



Key words

Health, disease, acute disease, chronic disease, infective disease, non infective disease, manifestation, immunization.



What we have learnt

- Health is a state of physical, mental and social well-being.

- The health of an individual is dependent on his/her physical surroundings and his/her economic status.
- Diseases are classified as acute or chronic, depending on their duration.
- Disease may be due to infectious or non-infectious causes.
- Infectious agents belong to different categories of organisms and may be unicellular and microscopic or multicellular.
- The category to which a disease-causing organism belongs decides the type of treatment.
- Infectious agents are spread through air, water, physical contact or vectors.
- Prevention of disease is more desirable than its successful treatment.
- Infectious diseases can be prevented by public health hygiene measures that reduce exposure to infectious agents.
- Infectious diseases can also be prevented by using immunisation.
- Effective prevention of infectious diseases in the community requires that everyone should have access to public hygiene and immunisation.



Improve your learning

1. How many times did you fall ill in the last one year? What were the illnesses? (7)
 - a) Think of one change you could make in your habits in order to avoid any of/most of the above illnesses.
 - b) Think of one change you would wish for in your surroundings in order to avoid any of/most of the above illnesses.
2. A doctor/nurse/health-worker is exposed to more sick people than others in the community. Find out how she/he avoids getting sick herself/himself. (AS 1)
3. Conduct a survey in your neighbourhood to find out what the three most common diseases are. Suggest three steps that could be taken by your local authorities to bring down the incidence of these diseases. (AS 7)
4. Differentiate the infective and non infective diseases? (AS 1)
5. Ramu was effected with small fox. What advice to you give Ramu for not spreading disease? (AS 6)
6. Why acute disease become chronic disease? (AS 1)
7. Draw the figure of leishmania and trypanosome? (AS 5)
8. How did you appreciate for role of vaccine in preventing disease? (AS 6)
9. Prepare a questionnaire to collect the information from your local health worker about spreading of diseases? (AS 6)