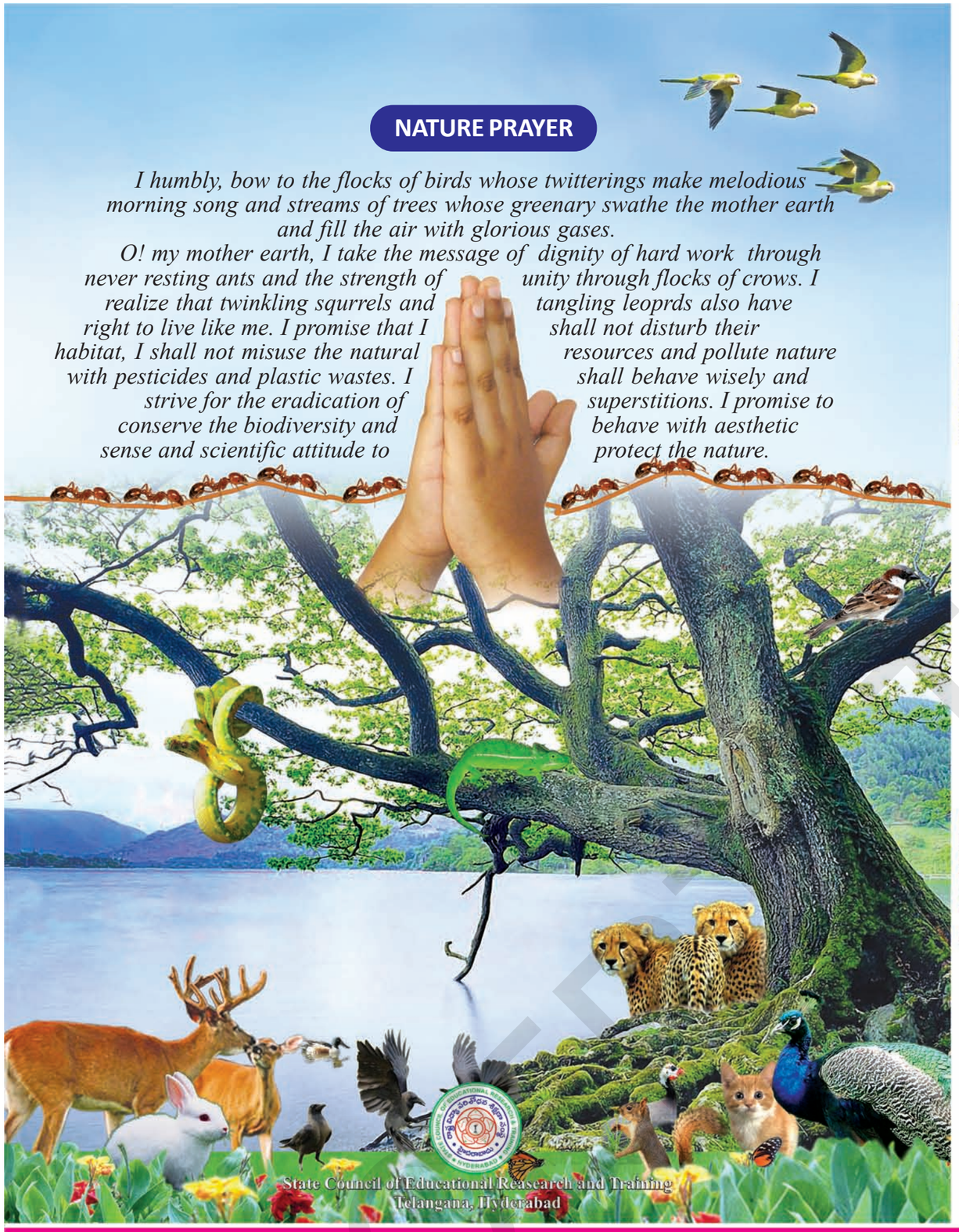
NATURE PRAYER

I humbly, bow to the flocks of birds whose twitterings make melodious morning song and streams of trees whose greenary 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 squrrels and tangling leoprds 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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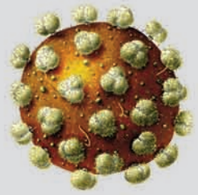

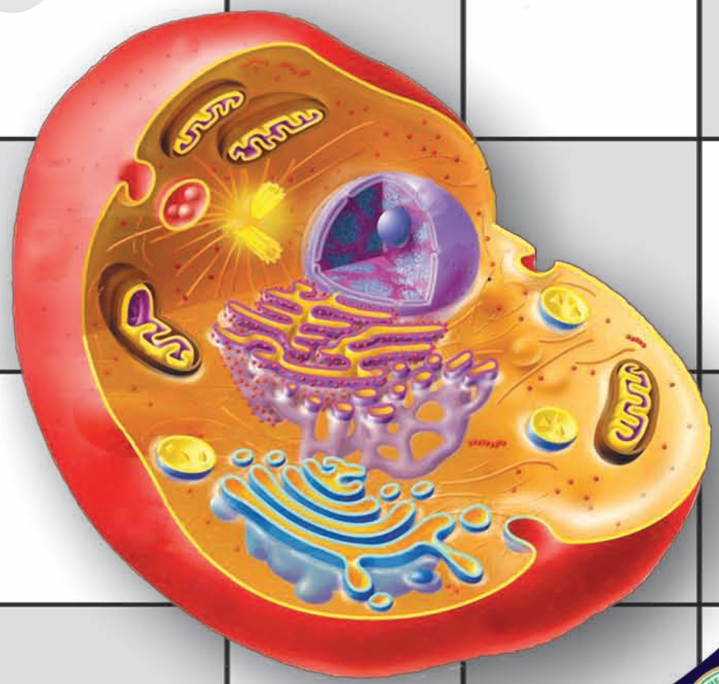

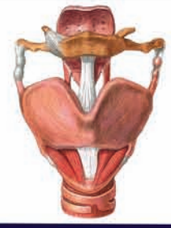

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Use your mobile phone or tablet or computer to see interesting lessons, videos, documents, etc. linked to the QR code.

Step	Description
A.	**Use Android mobile phone or tablet to view content linked to QR Code:**
1.	Click on **Play Store** on your mobile/ tablet.
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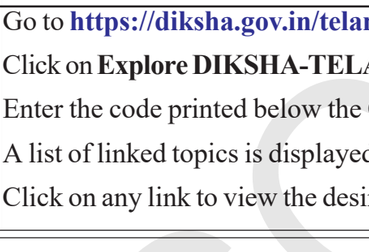
3.	 will appear on your screen.
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6.	Choose your prefered Language - Click **English**
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8.	Select **Student/ Teacher** (as the case may be) and Click on **Continue**
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11.	Click on any link to view the desired content
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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...

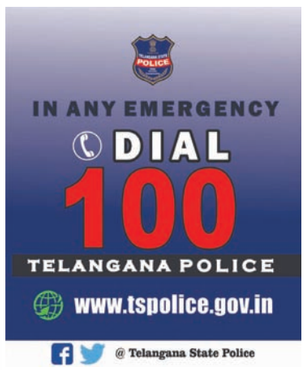
- Attract intelligent students towards sciences
- Identifying intelligent students and encourage them to study science from early age
- Develop complex human resources to promote scientific, technological development and research

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.



BIOLOGY

CLASS VIII

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Intro ...

The nature is life source for all living organisms. Rocks, water, hills and valleys, trees, animals etc. embedded in it... each of them are unique by themselves. Everything has its own prominence. Human being is only a part of the nature. The aspect which distinguishes the humans from all other organisms and exclusive for them is their extraordinary thinking power. Thinking transforms a person as a unique entity from rest of the nature. Though it usually appears simple and normal, the intricacies of the very nature often challenges us to untie the tough knots of its hidden secrets, day in and day out.

The human being intuitionally contemplates and searches solutions for all the critical challenges, all around,relentlessly. Curiously, the questions and answers are concealed in the nature itself. The role of science, in fact, is to find them out. For this sake, some questions, some more thoughts, and some other investigations are quite necessary. Scientific study is to move on systematically in different ways, until discovering concrete solutions. Essence of the investigations lies in inquiring i.e. identifying questions, asking them and deriving adequate and apt answers. That is why, Galileo Galilei, the Italian astronomer,emphasized that scientific learning is nothing but improving the ability of questioning. The teaching of science has to encourage children to think and work scientifically. Also, it must enhance their love towards the nature. Even it should enable them to comprehend and appreciate the laws governing the nature in designing tremendous diversity found around here and everywhere. Scientific learning is not just disclosing new things. It is also essential to go ahead with deep understanding of the nature's intrinsic principles;without interrupting the harmony of interrelation and interdependence in the nature.

It is also necessary to step forward without interrupting the interrelationship and interdependency along with understanding of the nature's intrinsic principles.High School children possess cognitive capacity of comprehending the nature and characteristics of the transforming world surrounding them. And they are able to analyze abstract concepts.

At this level, we cannot quench their sharp thinking capability with the dry teaching of mere equations and theoretic principles. For that, we should create a learning environment in the classroom which provides an opportunity for them to apply the scientific knowledge, explore multiple alternatives in solving problems and establish new relations. Scientific learning is not just confined to the four walls of classroom. It has a definite connection to lab and field as well. Therefore, there is a lot of importance to field experience/ experiments in science teaching.

There is a great need for compulsory implementation of instructions of the National Curriculum Framework- 2005 which emphasizes linking of the science teaching with local environment. The Right to Education Act- 2009 also suggested that priority should be given to the achievement of learning competencies among children. Likewise, science teaching should be in such a way that it would help cultivate a new generation with scientific thinking.The key aspect of science teaching is to make the children understand the thinking process of scientists and their efforts behind each and every discovery. The State Curriculum Framework- 2011 stated that children should be able to express their own ideas and opinions on various aspects.All the genuine concepts should culminate into efficacious science teaching, make the teaching-learning interactions in the classroom, laboratory and field very effective and really become useful for the children to face the life challenges efficiently.

We thank the Vidya Bhawan Society, Rajasthan, Dr. Desh Panday Rtd Prof. College of Engineering Osmania University and Sri D.R. Varaprasad former Lecturer ELTC Hyderabad for their cooperation in developing these new text books,the writers for preparing the lessons, the editors for checking the textual matters and the DTP group for cutely composing the text book.

Teachers play a pivotal role in children's comprehensive use of the text book. We hope, teachers will exert their consistent efforts in proper utilization of the text book so as to inculcate scientific thinking process and inspire scientific approach in the children.

Energized Text Books facilitate the students in understanding the concepts clearly, accurately and effectively. Content in the QR Codes can be read with the help of any smart phone or can as well be presented on the Screen with LCD projector/K-Yan projector. The content in the QR Codes is mostly in the form of videos, animations and slides, and is an additional information to what is already there in the text books.

This additional content will help the students understand the concepts clearly and will also help the teachers in making their interaction with the students more meaningful.

At the end of each chapter, questions are provided in a separate QR Code which can assess the level of learning outcomes achieved by the students.

We expect the students and the teachers to use the content available in the QR Codes optimally and make their class room interaction more enjoyable and educative.

25-02-2020
Hyderabad

Director,
SCERT, Hyderabad

Dear teachers...

New Science Text Books are prepared in such a way that they develop children's observation power and research enthusiasm. It is a primary duty of teachers to devise teaching- learning processes which arouse children's natural interest of learning things. The official documents of National& State Curriculum Frameworks and Right to Education Act are aspiring to bring grass root changes in science teaching. These textbooks are adopted in accordance with such an aspiration. Hence, science teachers need to adapt to the new approach in their teaching. In view of this, let us observe certain **Do**s and **Don't**s:

- Read the whole text book and analyze each and every concept in it in depth.
- In the text book, at the beginning and ending of an activity, a few questions are given. Teacher need to initiate discussion while dealing with them in the classroom, attempt to derive answers; irrespective of right or wrong responses, and so try to explain concept.
- Develop/Plan activities for children which help understand concepts presented in text.
- Textual concepts are presented in two ways: one as the classroom teaching and the other as the laboratory performance.
- Lab activities are part and parcel of a lesson. So, teachers must make the children conduct all such activities during the lesson itself, but not separately.
- Children have to be instructed to follow scientific steps while performing lab activities andrelevant reports can be prepared and displayed.
- In the text some special activities as boxed items- 'think and discuss, let us do, conduct interview, prepare report, display in wall magazine, participate in Theatre Day, do field observation, organize special days' are presented. To perform all of them is compulsory.
- 'Ask your teacher, collect information from library or internet'- such items must also be considered as compulsory. (A.S. indicates academic standerds in improve your learning.)
- If any concept from any other subject got into this text, the concerned subject teacher has to be invited into the classroom to elucidate it.
- Collect info of relevant website addresses and pass on to students so that they can utilize internet services for learning science.
- Let there be science magazines and science books in the school library.
- Motivate every student to go through each lesson before it is being actually taught and encourage everyone to understand and learn independently, with the help of activities such as Mind Mapping and exciting discussions.
- Plan and execute activities like science club, elocution, drawing, writing poetry on science, making models *etc.*to develop positive attitude among children environment, biodiversity, ecological balance *etc.*
- As a part of continuous comprehensive evaluation, observe and record children's learning abilities during various activities conducted in classroom, laboratory and field.
- Teaching learning strategies and the expected learning outcomes, have been developed class wise and subject-wise based on the syllabus and compiled in the form of a Hand book to guide the teachers and were supplied to all the schools. With the help of this Hand book the teachers are expected to conduct effective teaching learning processes and ensure that all the students attain the expected learning outcomes.

We believe, you must have realizedthat the learning of science and scientific thinking are not mere drilling of the lessons but, in fact, a valuable exercise in motivating the children to explore solutions to problems all around by themselves systematically and preparing them to meet life challenges properly.

Dear Students...

Learning science does not mean scoring good marks in the subject. Competencies like thinking logically and working systematically, learned through it,have to be practiced in daily life. To achieve this, instead of memorizing the scientific theories by rote, one must be able to study them analytically. That means, in order to understand the concepts of science, you need to proceed by discussing, describing, conducting experiments to verify, making observations, confirming with your own ideas and drawing conclusions. This text helps you to learn in that way.

What you need to do to achieve such things:

- Thoroughly go through each lesson before the teacher actually deals with it.
- Note down the points you came across so that you can grasp the lesson better.
- Think of the principles in the lesson. Identify the concepts you need to know further, to understand the lesson in depth.
- Do not hesitate to discuss analytically about the questions given under the sub-heading 'Think and Discuss' with your friends or teachers.
- You may get some doubts while conducting an experiment or discussing about a lesson. Express them freely and clearly.
- Plan to implement experiment/lab periods together with teachers, to understand the concepts clearly. While learning through the experiments you may come to know many more things.
- Find out alternatives based on your own thoughts.
- Relate each lesson to daily life situations.
- Observe how each lesson is helpful to conserve nature. Try to do so.
- Work as a group during interviews and field trips. Preparing reports and displaying them is a must.
- List out the observations regarding each lesson to be carried through internet, school library and laboratory.
- Whether in note book or exams, write analytically,expressing your own opinions.
- Read books related to your text book, as many as you can.
- You organize yourself the Science Club programs in your school.
- Observe problems faced by the people in your locality and find out what solutions you can suggest through your science classroom.
- Discuss the things you learned in your science class with farmers, artisans *etc.*

ACADEMIC STANDARDS

S.No.	Academic Standard	Explanation
1.	Conceptual understanding	Children are able to explain, cite examples, give reasons, compare and write differences, explain the process of given concepts in the textbook. Children are able to develop their own brain mappings.
2.	Asking questions and making hypothesis	Children are able to ask questions to understand, to clarify the concepts and to participate in discussions. They are able to make hypothesis on experimental results and given issues.
3.	Experimentation and field investigation.	To understand given concepts in the textbook, children are able to do experiments on their own. They are able to arrange the experimental materials, note their observations, collect alternate expermental materials, take precautions, participate in field investigation and make reports on them.
4.	Information skills and Projects	Children are able to collect information (by using interviews, checklist, questionaire) and analyses systematically. They are able to conduct their own project works.
5.	Communication through drawing, model making	Children are able to explain their conceptual understanding by drawing figures labelling, describing the parts and making models. They are able to plot graphs by using given information or collected data.
6.	Appreciation and aesthetic sense, values	Children are able to appreciate man power and nature, and have aesthetic sense towards nature. They are also able to follow constitutional values.
7.	Application to daily life, concern to bio diversity.	Children are able to utilize scientific concept to face their daily life situations. They are able to show concern towards bio diversity.

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OUR NATIONALANTHEM

- Rabindranath Tagore

Jana-gana-mana-adhinayaka, jaya he
Bharata-bhagya-vidhata.
Punjab-Sindh-Gujarat-Maratha
Dravida-Utkala-Banga

Vindhya-Himachala-Yamuna-Ganga
Uchchhala-jaladhi-taranga.
Tava shubha name jage,
Tava shubha asisa mage,
Gahe tava jaya gatha,

Jana-gana-mangala-dayaka jaya he
Bharata-bhagya-vidhata.
Jaya he! jaya he! jaya he!
Jaya jaya jaya, jaya he!!

PLEDGE

- Pydimarri Venkata Subba Rao

"India is my country. All Indians are my brothers and sisters.
I love my country, and I am proud of its rich and varied heritage.

I shall always strive to be worthy of it.

I shall give my parents, teachers and all elders respect,
and treat everyone with courtesy.

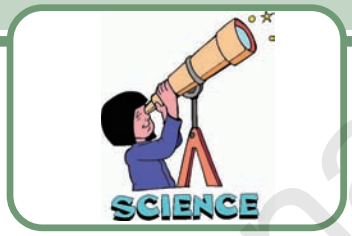
To my country and my people, I pledge my devotion.

In their well-being and prosperity alone, lies my happiness."

Chapter

1

What is Science?



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It is amazing to think of the facilities available today when compared to primitive era. Computers, mobile phones, internet, space shuttles, robotics, hybrid food grains, medicines, etc are all the result of ideas which originated in some human brains. They are 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 many phenomenon in nature around us which sprout up doubt in our minds. Ofcourse they may be problems. Let us observe the following experiences, you too can add your observations to enrich the list.

1. Why do leaves fall down from the tree after turning yellow?
2. How do ants identify sweets kept in a tin?
3. Why can't we see stars during day time?
4. Pickles do not spoil, but sambar gets spoiled soon. Why?
5. Farmers are afraid of unseasonal rains and uncontrolled pests. How to solve these problems?
6. How are diseases caused and how to prevent and cure them?

Consider some examples. An ecologist observes the behaviour of different organisms living in different habitats like crows on trees, tigers in forests, fish in water and earthworms in the soil and a

geologist studies the distribution of fossils and minerals in the Earth's crust. Both the scientists are making observations in order to find out patterns in natural phenomena. Observations and research done by these people enlighten the general public. An Astrophysicist photographs stars, planets and distant galaxies and a climatologist draws data from weather balloons. Similarly there are other scientists making observations.

The examples above are of observational science. There is also experimental science. A chemist observes the rate of one chemical reaction at different temperatures and a nuclear physicist records the results of angular momentum of a particular particle in the circular path. Both the scientists are performing experiments to discover consistent patterns. A biologist observing the reaction of a particular tissue to various stimulants is likewise experimenting to find patterns of behavior. When few scientists investigate on the causes of a disease while others may investigate on the prevention of it. So the findings of a scientist are used as a base for the other scientists. These scientists 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 works in the broadest sense. We'll study 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 replace them with new ideas instead to explain about nature in a better way.

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

What does that really mean? Science refers to a system of acquiring knowledge. This method 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 method. Less formally, the word science often describes any systematic field of study or the knowledge gained from it.

Why science?

The individual perspective

(Why do people conduct experiments? what are they doing?) In most of the above 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 problem previously not explained, or that overturns some previously accepted idea.

The Societal Perspective

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

One realm of answers lies in the desire to improve the life of people. Geneticists trying to understand how certain characters are passed from generation to generation and biologists tracing the pathways by which diseases are transmitted are clearly seeking information to 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 people to avoid the hardships that have plagued humanity for centuries. (Any society concerned about the welfare of its people, will support efforts like these for betterment of their lives.)

Another realm of answers lies in a society's desires for economic development. Many earth scientists devote their work in finding more efficient or more effective ways to discover or recover natural resources like petroleum and ores. Plant scientists seeking strains or species of high yielding fruit plants and crops are ultimately working to increase the agricultural output that nutritionally and economically 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, can take support of such science as an investment to their economic future.

Science and Change

If scientists are constantly trying to make new discoveries (or) trying 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 atleast modified with 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

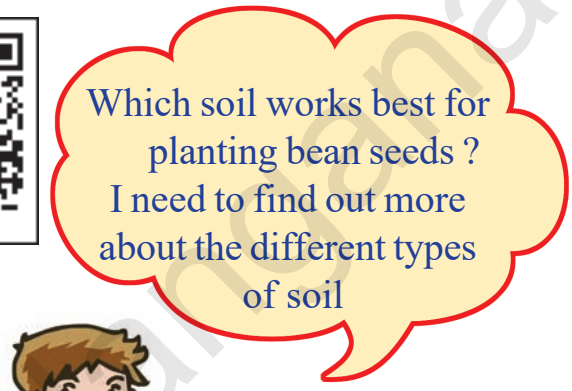
How scientists work - Scientific Method

Planning an investigation

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

1) Observe and ask questions
2) Form a hypothesis
3) Plan and experiment
4) Conduct the experiment
5) Draw conclusions and communicate the results

5KT751



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

Step 1 Observe, and ask questions.

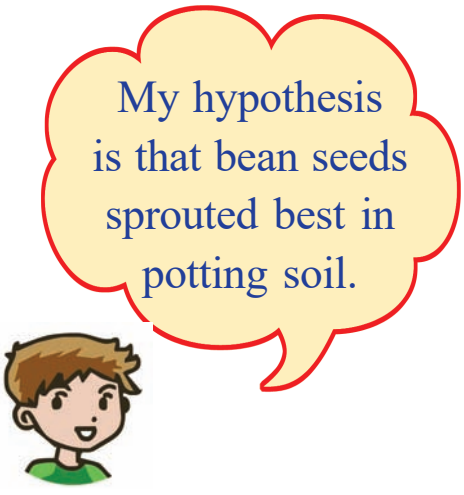
- Use your senses to make observation.
- Record **one** question that you would like to answer.
- Write down what you already know about the topic of your question.
- Decide what other information you need.
- Do research to find more information about your topic.

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.



Step 3 Plan an experiment.

- Decide how to conduct a fair test of your hypothesis by controlling variables.

  Variables are factors that can affect the outcome of the investigation.
- Water, light are fixed variables. Soil is the changing variable.
- Write down the steps you will follow to do your test.
- List the equipment you need.

- Decide how you will gather and record your data

I'll put identical seeds in three different kinds of soil sandy, clay, potting soils. Each flowerpot will get the same amount of water and light. So, I'll be controlling the variables of water and light.

Step 4 Conduct the experiment.

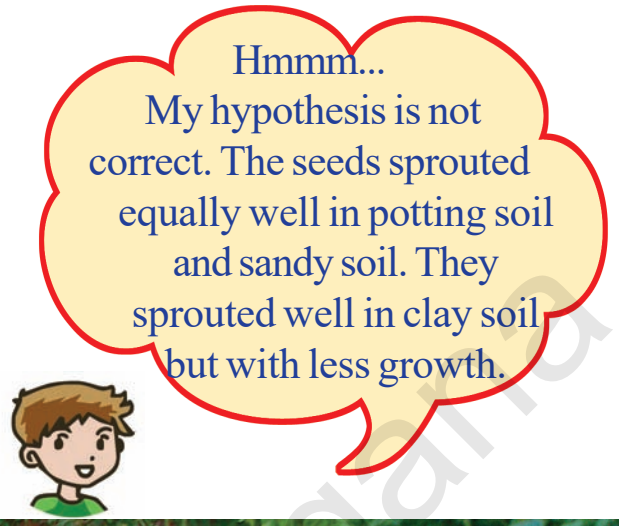
- Follow the steps you have written.
- Observe and measure carefully.
- Record everything that happens.
- Organize your data so that you can study it carefully.

I'll measure each plant every 3 days. I'll record the results in a table and then make a bar graph to show the height of each plant 21 days after I planted the seeds.

Day.	Height of the plant		
	Sandy	Clay	Potting
3	1.8 cm	1.5 cm	1.8 cm
6	2 cm	1.7 cm	2 cm
9			

Step 5 Draw conclusions and communicate results.

- Analyze the data you gathered.
- Make charts, tables, or graphs to show your data.
- Write a conclusion. Describe the evidence you used to determine whether your test supported your hypothesis.
- Decide whether your hypothesis is correct or not.



Investigate Further

If your hypothesis is correct…

You may want to pose another question about your topic that you can test.

If your hypothesis is incorrect…

You may want to form another hypothesis and do a test of a different variable.

Do you think Aravind's new hypothesis is correct? Plan and conduct a test to find it!

Using science process skills

When scientists try to find an answer to a question or do an experiment, they use thinking tools called process skills. You use many of the process skills whenever you speak, listen, read, write, or think.

Think about how these students use process skills to help them answer questions, do experiments, and investigate about the world around them.

What Saketh plans to investigate?

Saketh collects seashells on his visit to the beach. He wants to make collection of shells that are alike in some way. He looked for shells of different size and shape.

How Saketh uses process skills

He **observes** the shells and **compare** their size, shape, and colours. He **classify** the shells first into groups based on their sizes and then into groups based on their shape.

Process Skills

Observe – use the senses to learn about objects and events.

Compare – identify characteristics of things or events to find out how they are alike or different.

Classify – group or organize objects or events in categories based on specific characteristics.

What Charitha plans to investigate

Charitha is interested in learning what makes the size and shape of a rock change. She plans an experiment to find out whether sand rubbing against a rock will cause pieces of the rock to flake off and change the size or shape of the rock.

How Charitha uses process skills

She collects three rocks, **measures** their mass, and put the rocks in a jar with sand and water. She shakes the rocks every day for a week.

Then she measure and **records** the mass of the rocks, the sand, and the container. She interprets her data and concludes that rocks are broken down when sand rubs against them.

Process Skills

Measure – Compare the attributes of an object, such as mass, length, or capacity to a unit of measure, such as gram, centimetre, or litre. Gather, Record, Display, and Interpret the Data

- Gather data by making observations that will be useful for inferences or predictions.
- Record data by writing down the observations in the form of table or graph in a note-book.
- Display data by making tables, charts, or graphs.
- Interpret data by drawing conclusions about what the data shows.

What Aravind plans to investigate

Aravind wants to find out how the light switch in his bedroom works. He uses batteries, a flashlight bulb, a bulb holder, thumbtacks, and a paper clip to help him.

How Aravind uses process skills

He decides to **use a model** of the switch and the wires in the wall.

He **predicts** that the bulb , wires, and batteries have to be connected to make the bulb glow.

He **infers** that moving paper clip interrupts the flow of electricity and turns off the light. Aravind's model verifies his prediction and inference.

Process Skills

Use a Model : make a model to help you understand an idea, an object, or an event, such as how something works.

Predict : form an idea of an expected outcome, based on observations or experience.

Infer : use logical reasoning to explain events and draw conclusions based on observations.

What Swetha plans to investigate

Swetha wants to know what type of towel absorbs the most water. She plans a test to find out how much water different

types of towels will absorb. She can then suggest her father which type of towel is the best one to buy.

How Swetha uses process skills

She chooses three types of towels. She **hypothesizes** that one type will absorb more water than the others. She **plans and conducts an experiment** to test her hypothesis, with the following steps:

- Pour 1 litre of water into each of the three beakers.
- Soak a towel from all the three brands into three different beakers for 10 seconds.
- Take the towel out of the water, and let it drain back into the beaker for 5 seconds.
- Measure the amount of water left out each beaker.

Swetha **control variables** by ensuring that each beaker contains exactly the same amount of water and by maintaining the time exactly.

Process Skills

Hypothesize – make a statement about an expected outcome.

Plan and Conduct Experiment – identify and perform the steps necessary to test a hypothesis, using appropriate tools, recording and analyzing the data collected.

Control Variables – identify and control factors that affect the outcome of an experiment so that only one variable is to be tested in an experiment.

Reading to learn

Scientists use reading, writing, and numbers in their work. They read to find out everything about a topic they are investigating. So it is important that scientists know the meaning of science vocabulary and that they understand what they read. Use the following strategies to help you become good science readers.

Before Reading

- Collect relavent information related to your topic.
- **Think:** I need to find out what are the parts of an ecosystem and how they are organized.
- Look at the **Vocabulary** words.
- Be sure that you can pronounce each word.
- Look up each word in the Glossary.
- Define each word. Use the word in a sentence to show its meaning.
- Read the title of the section.
- **Think:** I need to know what an ecosystem is. I need to read to find out what are the parts of an Ecosystem. The heading Different Ecosystem gives me a clue that an ecosystem may have both living and nonliving parts.

Let us observe the following table of endangered species

Flora and Fauna	Name of the species
Plants	Orchids species,sandalwood tree,cycas, medicinal plants, Rauvolfia serpentine etc.
Animals	Leopard, Indian Lion,Indian Wolf, Red Fox, Red Panda,Tiger, Desert Cat, Hyena etc. Gharial, Tortoise, python, Green sea turtle etc. Peacock, Great Indian bustard, Pelican, Great Indian horned bill etc. Golden monkey, Lion tailed macaque, Nilgiri Languor, Loris

Endemic Species

Observe the pictures and identify the animals. Also try to find out where these can be found?



You may find that these animals are specifically found in certain regions of the world.

You are also aware of the fact that many plants and animals are widely distributed throughout the world. But some species of plants and animals are found restricted to some areas only. Plants or animal species found restricted to a particular area of a country are called **Endemic Species.**

- Name an Endemic Species of our State?
- You may notice that kangaroo is endemic to Australia and Kiwi to New Zealand. Can you tell which among the above pictures represent an endemic species of India?

Name some other endemic species of India.

You can take help of books from your school library or internet.

During reading

Find the main idea in the first paragraph.

- Group of living things and their environment make up an ecosystem.

Find **details** in the next paragraph that support the main idea.

- Some ecosystems have only a few living organisms.
- Environment that have more space, food, and shelter have many living organisms.
- Plants and animals in an ecosystem can meet all their basic needs in their ecosystem.

Check your understanding of what you have read.

- Answer the question at the end of the section.
- If you are not sure of the answers, reread the section and look for the answer to the question.

After Reading:

Summarize what you have read.

- Think about what you have already learned about ecosystems their interaction.
- **Ask yourself:** What kind of system is an ecosystem? What interactions occur in an ecosystem?

Study the photographs and illustrations.

- Read the captions and label the parts.
- Think: What kind of ecosystem is shown in the photographs?

What are the nonliving parts of the ecosystem?

What living parts of the ecosystem are shown?

Reading about science helps you understand the conclusions you have made based on your investigation.

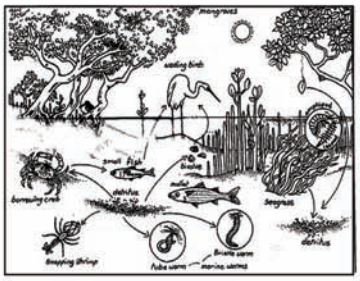
Biotic Components

Producers - magrrove, spirogyra, euglena, oscilatoria, blue green algae, ulothrix, etc.

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

Decomposers - Detritus feeding bacteria, etc.

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



Food web in Coringa Ecosystem

Do you know? There are over 1000 organisms living on our skin. In the chapter on microorganisms you have already seen the pictures of some of them. The biotic community consists of bacteria, fungi and small arthropods etc. The abiotic factors are dead skin cells, water, salts and oil of our sweat, air etc.

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.

(Brochure of CoP-11, Biodiversity Conference, Hyderabad, 1-19, Oct, 2012)

THE DESERT ECOSYSTEM

The desert occupy about 17% of the land and occur in the regions with an average rainfall of less than 23cms. Due to extremes of temperature, the species composition of desert ecosystem much varied and typical. The various components of a desert ecosystem.

Writing to communicate

Writing about what you are learning helps you connect the new ideas to what you already know. Scientists write about what they learn in their research and investigations to help others understand the work they have done. As you work like a scientist, you will use the following methods of writing to describe what you are learning.

In informative writing: you may

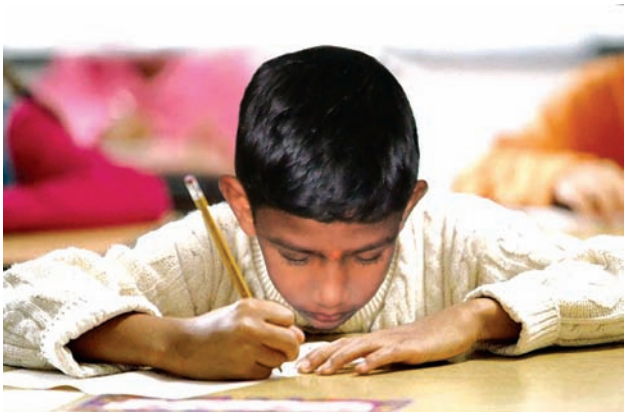
- Describe your observations, inferences, and conclusions.
- Tell how to do an experiment.

In narrative writing: you may

- Describe something, give examples, or tell a story.

In expressive writing: you may

- Write letters, poems, or songs.



In persuasive writing: you may

- Write letters about important issues in science.
- Writing about what you have learned in science helps others understand your thinking.

Measuring

Scientists make accurate measurements as they gather data. They use different measuring instruments, such as thermometer, clocks, timers, rulers, a spring balance, scale and they use beakers and other containers to measure liquids.

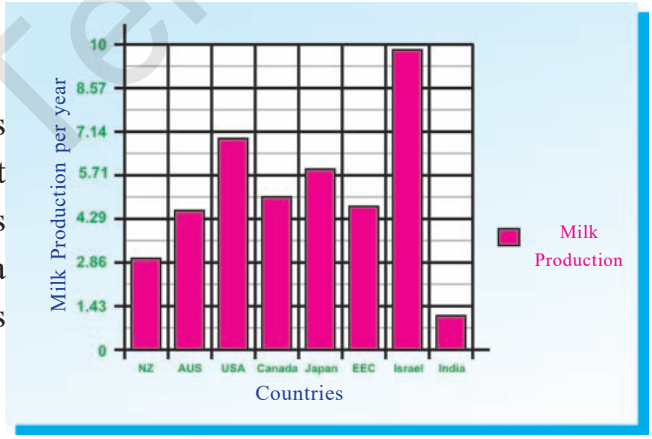
Using numbers

Scientists use numbers when they collect and display their data. Understanding numbers and using them to show the results of investigations are important skills that a scientist must have.

As you work like a scientist, you will use numbers in the following ways.

Interpreting Data

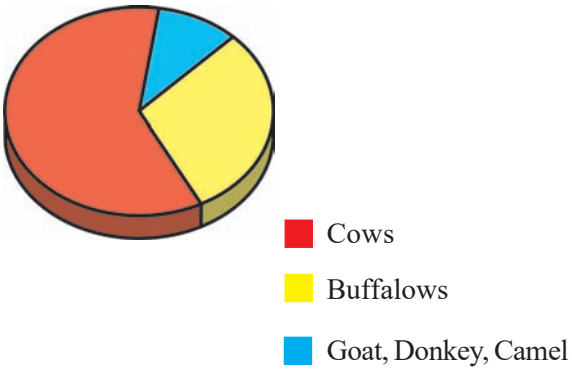
Scientists collect, organize, display, and interpret data as they do investigations. Scientists choose a way to display data that helps others understand what they have learned.



Tables, charts, and graphs are good tools to display data so that it can be interpreted by others easily.

Using Number Sense

Scientists must understand what the numbers they use represent. They compare values compute the numbers shown on graphs and record the measuring scales given on thermometers, measuring cups, beakers, and other tools.



Good scientists apply their math skills to help them display and interpret the data they collect.

In your school laboratary you will have many opportunities to work like a scientist.

An exciting year of discovery lies ahead!

Safety in science

Doing investigations in science can be fun, but you need to be sure of doing them safely. Here are some rules to follow.

1. **Think ahead :** Study the steps of the investigation so you will know what to expect. If you have any questions, ask your teacher. Be sure that you understand the safety symbols that are shown.

2. **Be aware :** Keep your work area clean. If you have long hair, pull it back so that it doesn't disturb you. Roll or push up long sleeves to keep them away from your experiment.
3. **Oops! :** If you want to throw or break or cut something inform your teacher.
4. **Watch your eyes:** Wear safety goggles anytime you are directed to do so. If anything fall in your eyes, tell your teacher immediately.
5. **Yuck! :** Never eat or drink anything during a science activity unless you are permitted by your teacher.
6. **Protect yourself from shocks :** Be careful while using an electrical appliance. Be sure that electric cords are in a safe place where you can't trip over them. Don't ever pull a plug out of an outlet by pulling on the cord.
7. **Keep it clean:** Always clean up the place after finishing the work. Put everything back in their place and wipe your work area. Wash your hands.

The secret of inventions and discoveries only lies in identifying the problem. The earth revolves around the sun even before the discovery of Helio centric theory by Copernicus. In the same way the things fall down on earth even before Newton's investigations. The meaning behind that

was those people thought beyond the common man in identifying the problems. They thought and observed in unique way. We know that necessity is mother of invention, when people needed a mode to travel faster from one place to another. We discovered vehicles. In the same way to travel faster we invented supersonic jet planes and even space craft's (to learn more about the development of science go through the book History of science written by F. Cojori).

There is a sequential order in discovering things. Let us observe how your mother cooks, you also can observe how a cycle mechanic repairs a cycle, try to observe how farmer ploughs his field. You will find a systematized pattern in all these things.

Write what you observe about these patterns and discuss in groups.

How do birds and ants find their way home? Why trees shed leaves in a particular season? Likewise many more questions might sprout up in your brain. Try to answer them in your own way. For this you need to follow a sequential order, please go through the following steps.

1. Identifying problem - Let us identify any problems from your surroundings
   Ex: The bulb is not glowing in the room.
2. Making hypothesis - List out different solutions possible for the identified problem.
   Ex: De filament, fuse failure, switch problem, wire problem.
3. Collecting information- To solve the identified problem, collect required material, apparatus, Information, and persons to be consulted.
   Ex: Collect material like tester, screwdriver, wooden scale, wires, insulation tape, table and blade.
4. Data analysis - Arrange the collected data or information to conduct experiment.
5. Experimentation- Conduct experiment to prove selected hypothesis.
   Ex: Observe filament of the bulb.
6. Result analysis - Analyzing the results to find out the solution for the problem based on the results you need to select another hypothesis to prove.
   Ex: Filament of the bulb is good in condition, so we need to observe the fuse.
7. Generalisation - Based on the experiment and its results explain the solution for the problem.
   Ex: Fuse is damaged so the bulb did not glow, so we need to replace the fuse.

This is the way to find out solutions for the problems in a scientific way. You may also select such problems and, find out your own solutions.

Chapter

2

Cell - The Basic Unit of Life

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Our earth is a beautiful place where in different types of organisms co-exist. From minute mosses to huge conifers, invisible bacteria to huge blue whales all have a basic unit called 'Cell'. Let us study about the 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 unaided eye. Thereafter many scientists have been observing and describing unknown world with the help of microscopes.

Do you know?

A few of the many scientists mentioned are Athanasius Kircher (1601–1680), Jan Swammerdam (1637–1680), Antonie van Leeuwenhoek (1632–1723) and Robert Hooke (1635–1702) observed different things under the microscope

Antonie van Leeuwenhoek (1632–1723) in 1674 was one of the earliest to see living bodies like bacteria, yeast, protozoa, Red Blood Cell and the streaming life in a drop of water. He prepared several types of magnifying glasses, and used these (lenses) to study about both living and non living things.

You may recall that all living organisms carry out certain basic functions. Can you list those 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, preparation of microscopic slides and staining is essential. (You can revise the use of microscope, preparation of microscopic slide and staining technique from Annexure.)

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)

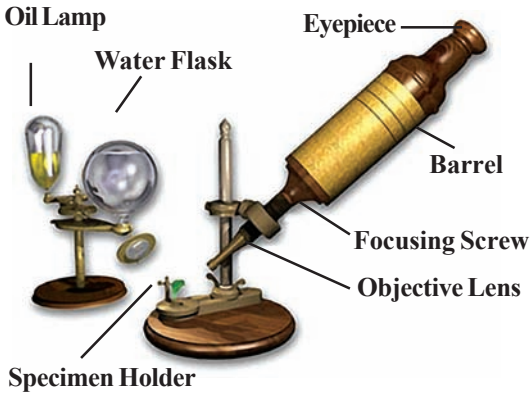

Fig-1 : Robert Hooke's Microscope

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 the cork was made up of very small cavities. Robert Hooke called these cavities as "**cells**". Cell is a Latin word for a **little room** (Fig-2).

Fig-2 : The cells in the thin section of cork appeared like this to Robert Hooke

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

Activity-1

Observing a match stick

In the place of cork, let us try to see a similar type of structure, as seen by Robert Hooke, in a section of match stick.

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

Compare your figure with Fig-2. Do you find both of them are similar or different? Have you noticed the box like structures? What are they 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 knowing more about cells.

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Activity-2

Observing an onion peel

Peel an onion and cut out a small fleshy portion from the bulb [Fig-3(a)]. Break this piece into two small parts and try to separate them slowly [Fig-3(b)]. You will notice a thin translucent membrane holding the pieces together. Take out the 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.

Are there any differences between these two figures? If so. What are they ?

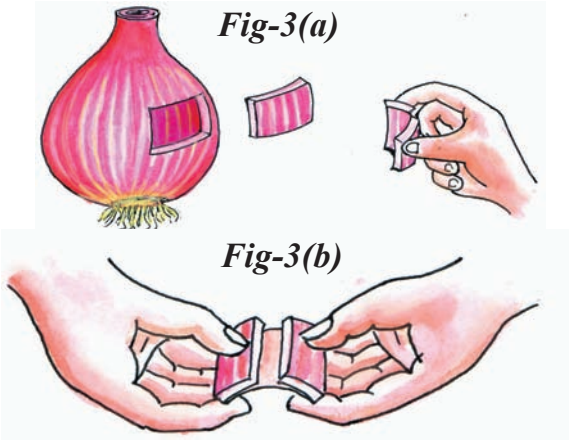

Fig-3 : Extracting the peel from an onion

The onion peel cells that you observed are plant cells. Do animal cells also look similar to these cells?

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

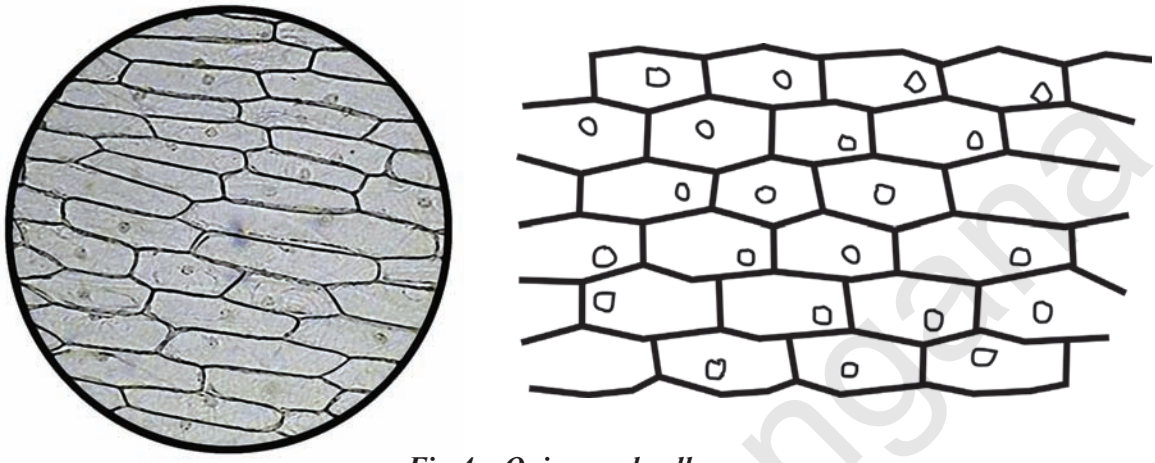

Fig-4 : Onion peel cells

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 may 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 cells that you see would be very similar to those shown in Fig-5. Is the outer covering of both the types of cells similar?

Fig-5 : Human cheek cell (without stain)

Do you know?

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 known part. In 1831, while observing cells in the epidermis of Orchid leaves, Robert

Robert Brown (1773–1858)

Brown noticed a circular spot that was slightly more opaque than the surrounding areas (Fig-6). He noted that similar structures were present in other cells as well. Robert Brown claimed that this structure was an integral part of the cell and called it nucleus.

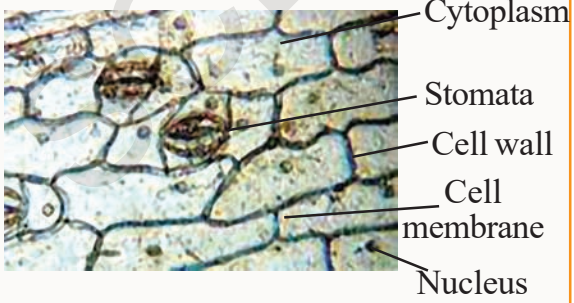

Fig-6 : Plant Cell

In the above figure we can see stomata and nucleus. Stomata 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 removing 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.

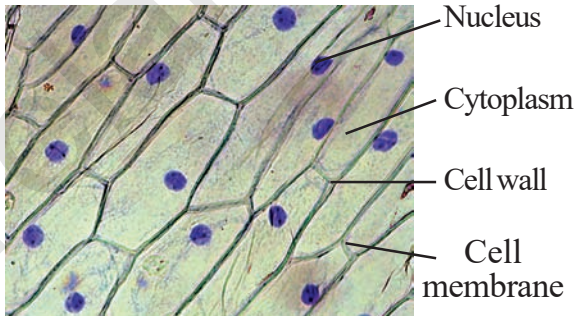

***Fig-7 : Onion cell showing nucleus* (stained)**

The blue or red spot observed within the cell is the nucleus.

Now let us see the nucleus in our own cells (animal cells).

Acitivity-5

Observation of the Nucleus in cheek cells

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

Now let us compare the onion and the cheek cells.

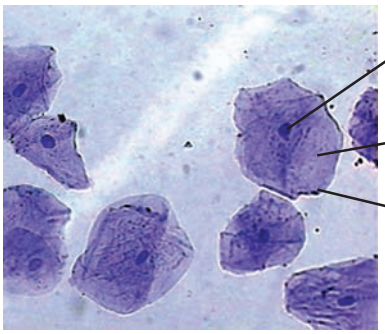

Fig-8 : Cheek cells showing nucleus (stained)

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

The outer layer of a cheek cell is the **cell membrane**. This gives a shape to the cell and selectively allows substances to pass through it, in and out of the cell. About this you will learn more in higher classes. 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 and strength 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, but towards periphery. The jelly like substance between the nucleus and the cell membrane is called **cytoplasm**. It is a heterogeneous material. Ask your teacher why it is called as heterogeneous. 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 basic 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? Does bigger onions have bigger cells?

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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 observe permanent slides of *Amoeba, Paramoecium, Chlamydomonas* etc. in the chapter on microorganisms. 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.

Living organisms having more than one cell are called multicellular organisms. Basic life processes in multicellular organisms are carried out by different types of cells.

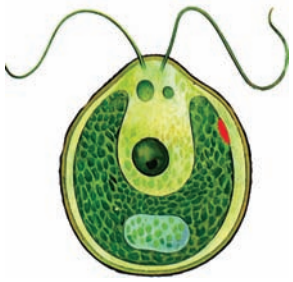

Fig-9(a) : Chlamydomonas

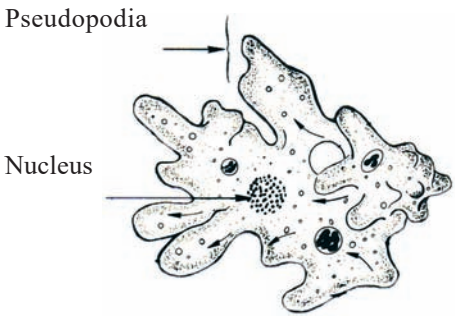

Fig-9(b) : Amoeba

Fig-9(c) : Escherichia coli (Bacteria)

Fig-9 : Unicellular organisms

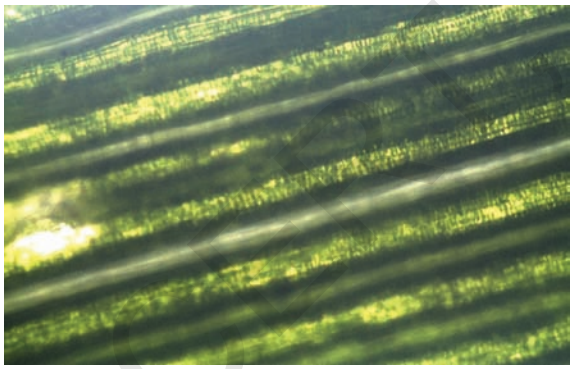

Fig-10 : Cells in a grass blade

Activity-6

Observing cells in a leaf

Take a peel 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? You may have seen different types of cells or groups of cells in the slide?

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

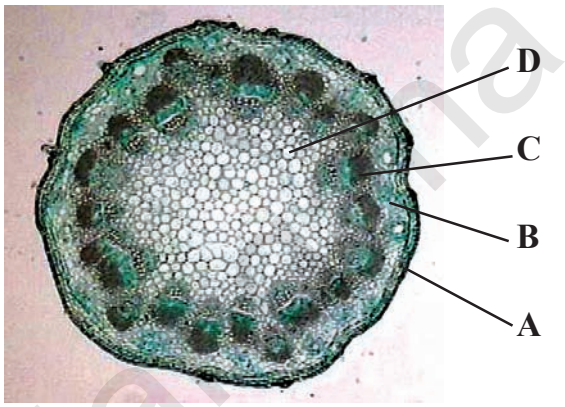

Fig-11 : Transverse Section of Dicot Stem (Tridax)

Observe the given diagram of a section of the stem of Tridax/Spinach. Note the different types of cells that you observe in the section. Fig-11 shows 4 different groups of cells as described below:

Group A cells form the outermost layer of the stem and they give 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 matured stem.

Thus in Transverse section of Tridax (Gaddichamanthi) /spinach stem you can see different shapes of cells in one plant. Think why do the stems contain different types of cells?

Activity-7

Observe the given figures of different kinds of cells in the human body. Observe permanent slides of these cells in your school laboratory.

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

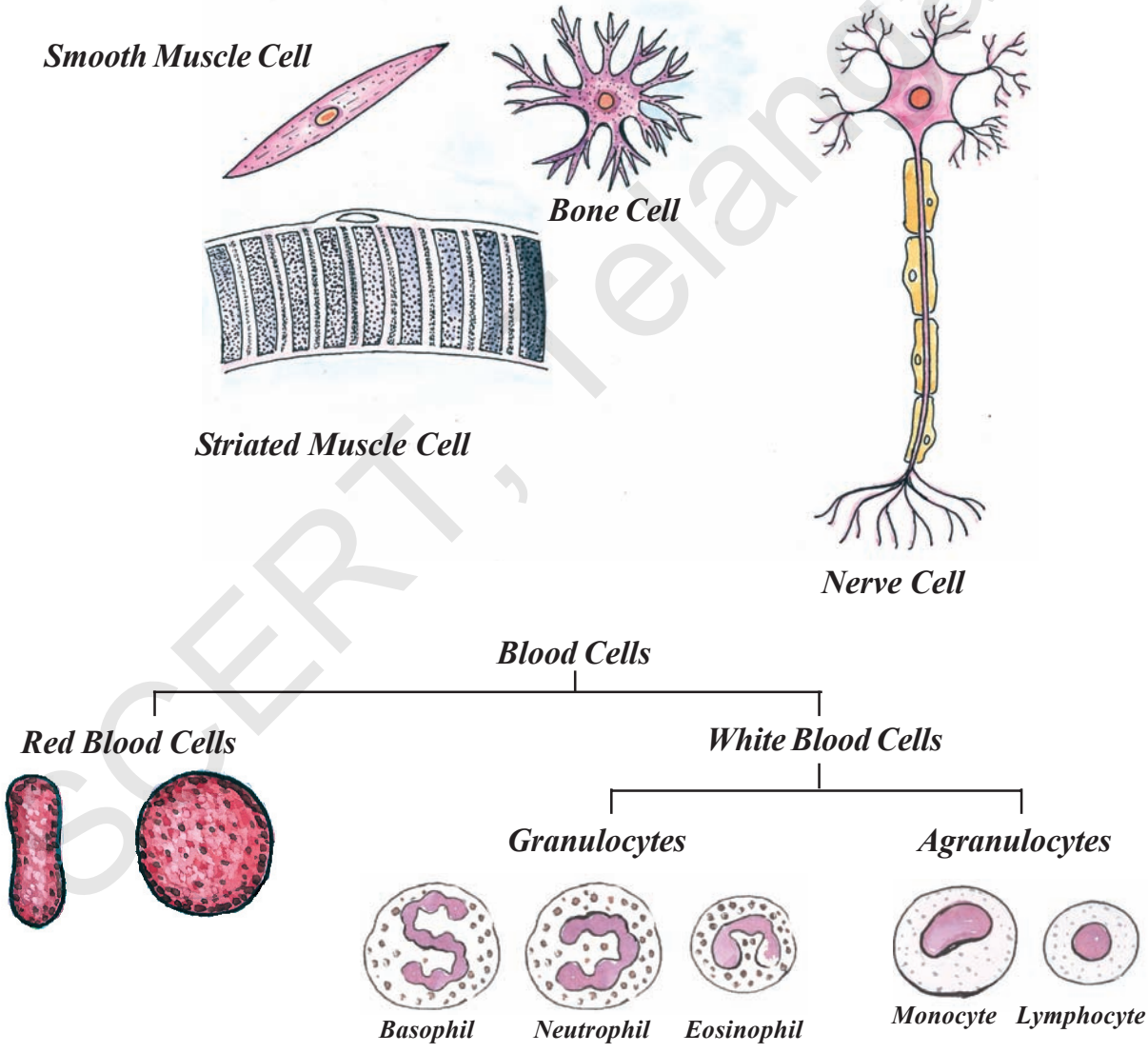

Fig-12 : Shapes of the different cells in the human body

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

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

- Are there any similarities in shape of the cells?
- Do you find nuclei in all the cells?
- Can you name the longest cell in all animals?

So far you have seen many kinds of cells. Are all cells similar in shape and size? The shape and size of cells vary considerably but all of the cells are 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 by protruding out of its body. These are called **Pseudopodia** (Pseudo: false, Podia: feet). The projections appear and disappear. Pseudopodia help Amoeba in feeding & locomotion.

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

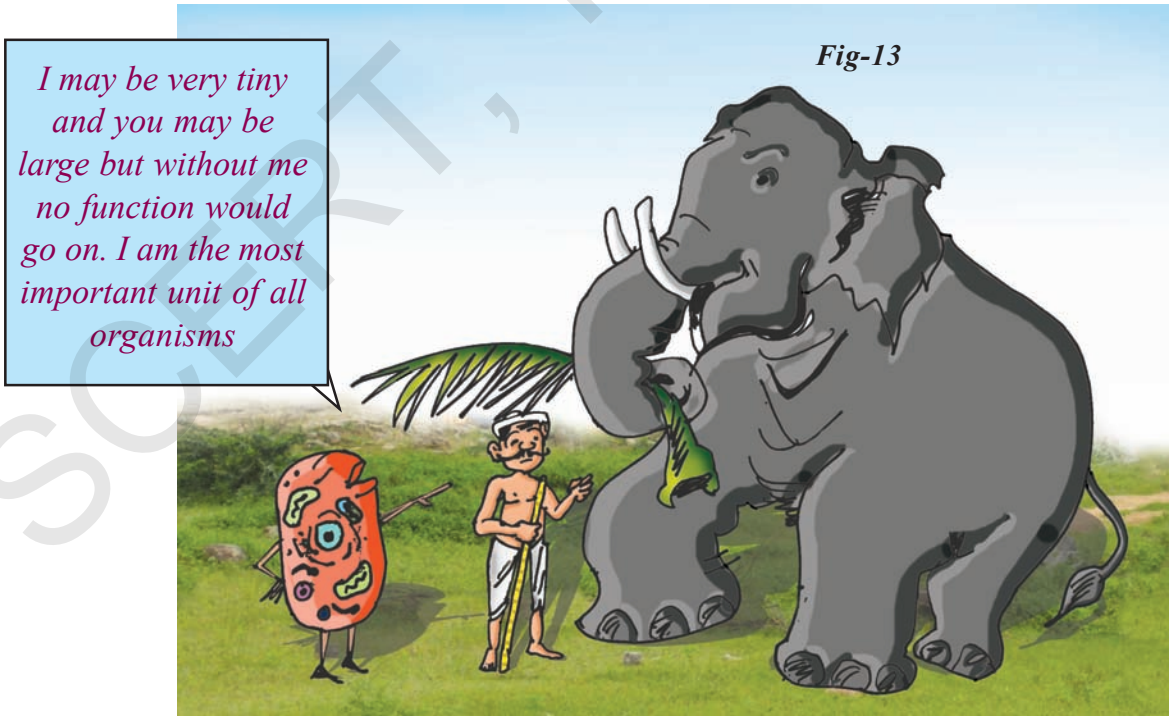

Fig-13

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 unaided eye. They can be seen only through a microscope. The smallest cell 0.1 to 0.5 micrometers (Microns) is found in Bacteria. A human liver and kidney cell is 20 to 30 micrometers in size.

1 Meter = 100 Centimeters (cm)

1 centimeter = 10 millimeters (mm)

1 millimeter = 1000 micrometers/ microns (µm)

1 micrometer = 1000 nano meters (nm)

Some of the cells can be seen with naked eyes. Human nerve cell is nearly about 90 to 100 cms. long. 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 of transferring message in both of them.

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, 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.
- 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 as cell wall.
- Cell wall gives strength and rigidity to plants.
- Cell exhibits a variety of shapes and sizes and number.
- Single celled Organisms are called unicellular organisms and those with more than one cell are called multicellular organisms.
- Basic functions in multicellular organisms are carried out by different types of cells.

Improve your learning

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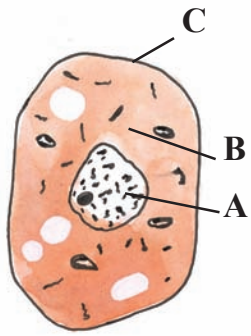
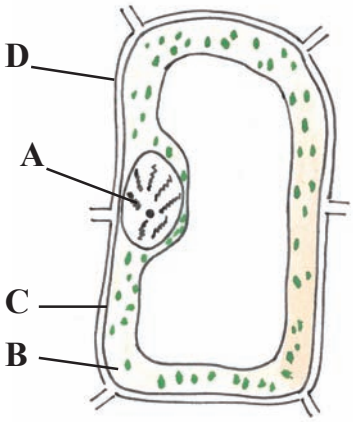
1. Who discovered the cell for the first time? What procedure did he follow? (AS 1)
2. Name the factors on which shape of the cells depend? (AS1)
3. Distinguish between unicellular and multi cellular organisms? (AS1)
4. How will you prepare slide without drying quickly? (AS1)
5. Deekshith said that, "we can't see cells with unaided eye". Is the statement true or false? Explain. (AS1)
6. 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.
7. Describe the functions of nucleus. (AS1)
8. What is difference between cells in onion peel and cells in spinach? (AS1)
9. Label parts of diagrammes given in page 25, And identify which is plant cell and which is animal cell. (AS5)
10. What questions will you pose to know about diversity in cells? (AS2)
11. If you want to know about unicellular and multi cellular organisms, what questions will you pose? (AS 2)
12. 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 digram of what you observed. (AS 3)
13. 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)
14. Make sketches of animal and plant cells which you observe under microscope. (AS5)
15. 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 2)
16. How do you appreciate the fact that animals, human beings and trees are made of cells,which are very small and we can look at them through microscope? (AS 6)
17. Deepak said, "A plant can't stand erect without cell wall "? Do you support this statement? (AS 7)





A .....

B .....

C .....

A .....

B .....

C .....

D .....

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 with a combination of more than one lens was also invented. The first compound microscope was

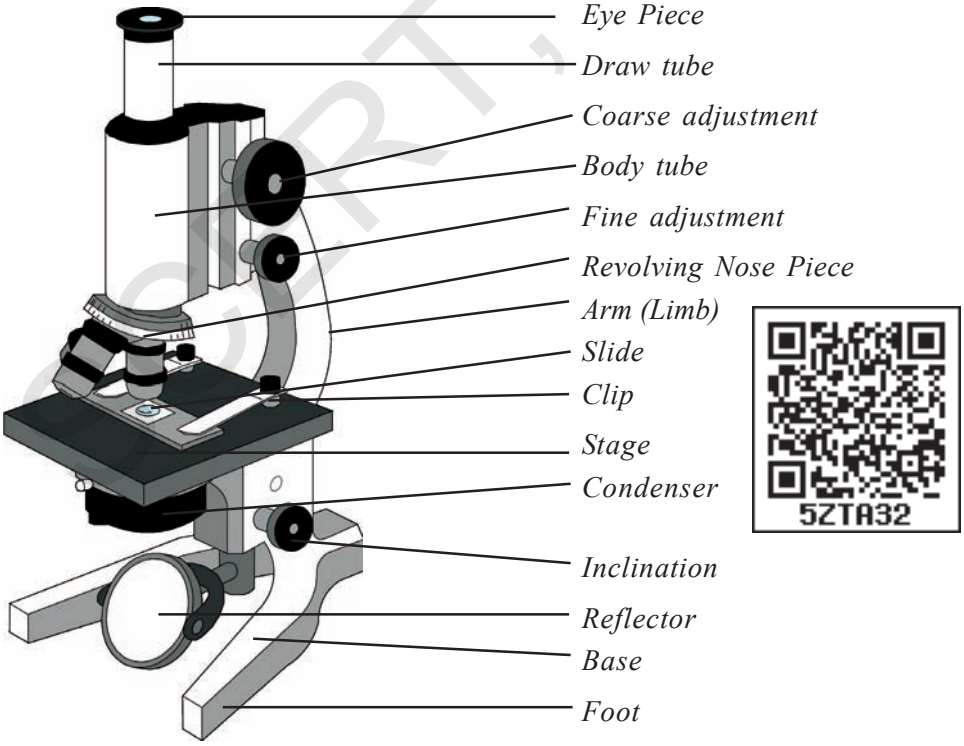


Fig-13: Compound Microscope

made in the year 1595 by the scientist named Jaquarius 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) If 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 light in such an angle that you see a bright back ground, while looking through the lens.
2. Usually you will find three or four objective lenses on a microscope. They are 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 **focussing.** While doing so, make sure that the material doesn't touch or water in which it is kept does not touches the lens, to prevent it cover the material with a cover slip (very thin glass).
5. Put a drop of water with finger or dropper, put specimen in water, you may use needle brush 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 the mirror. Do this until clear appearance of object with clear magnification is observed.

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. Place the stained object on a slide. Add a drop of water should cover with cover slip without forming air bubbles. Remove excess of water on the slide using a blotting or filter paper.

The Cover slip protects the lense of the microscope from coming in contact with water and specimen. 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 ¼ tea-spoon of saffranin in 100 ml. of water.

Chapter

3

The World of Microorganisms : Part-I

Why do we add small amount of curd to lukewarm milk to make curd?

Why does 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.

Microscope invention-discovery of microorganisms

Fig-1(a): Antonie van Leeuwenhoek

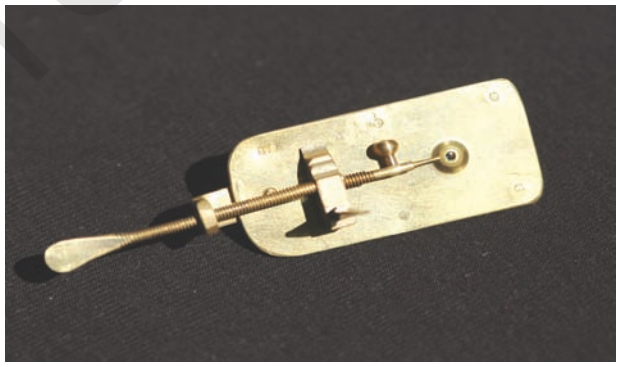


Fig-1(b): Microscope prepared by Leeuwenhoek

Antonie van Leeuwenhoek was a cloth merchant from Netherlands. Leeuwenhoek built a single lens microscope, which could magnify the object 300 times. His curiosity and skill of making powerful lenses was the secret of this invention of powerful microscope. At around 1674, with the help of his microscope, Leeuwenhoek discovered many small moving organisms in a drop of lake water. He called them "animalcules". Later these were named bacteria. Along with the animalcules, he also observed many other microorganisms under his microscope which were named later on. The invention of powerful microscope helped in further discovery of other microorganisms.

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

Microorganisms

There are different organisms present around us, which can be observed through microscope. Photographs of some microorganisms are shown in Fig-2 to Fig-6.

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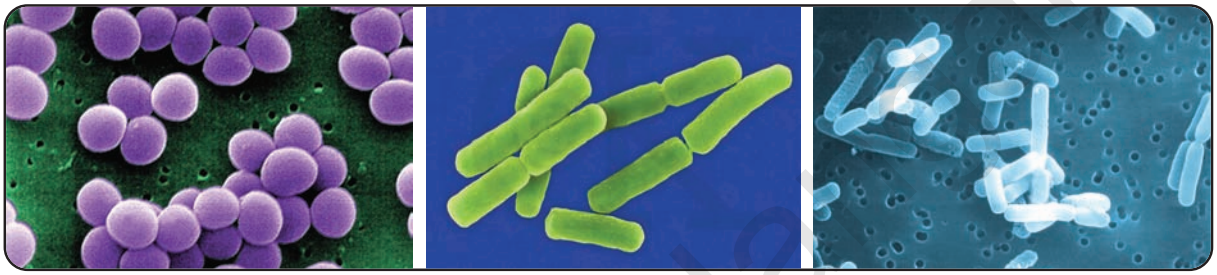


Coccus *Bacillus* *Lactobacillus*

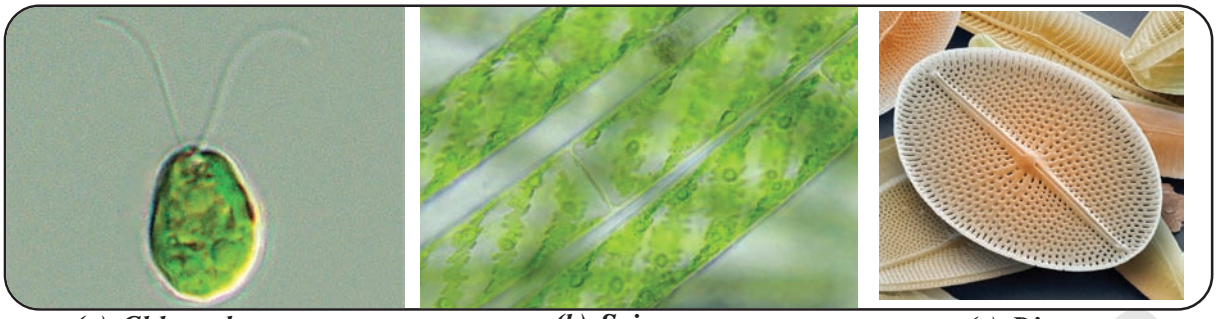
Fig-2 : Different types of bacteria

Penicillium *Rhizopus (Bread mould)* *Asperigillus*

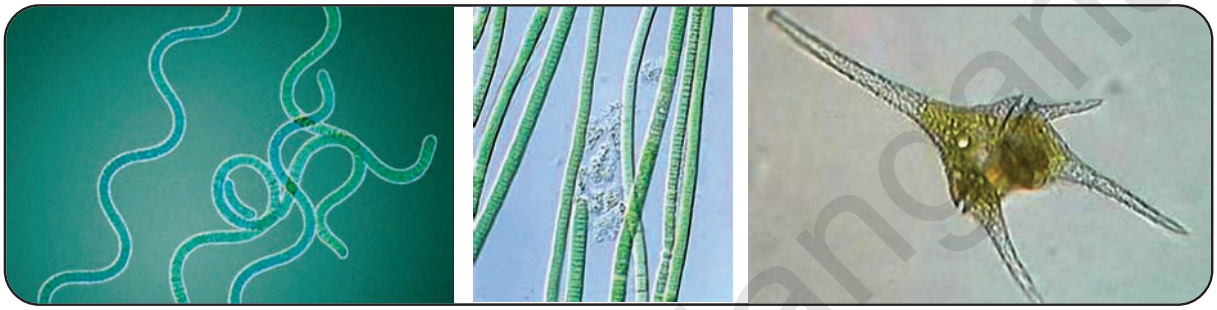
Fig-3 : Fungi

Amoeba *Paramoecium* *Vorticella*

Fig-4 : Protozoa



(a) Chlamydomonas *(b) Spirogyra* *(c) Diatom*



(d) Spirulina *(e) Oedogonium* *(f) Ceratium*

Fig-5 : Algae

(a) Cyclops *(b) Daphnia* *(c) Scabies mite* *(d) Eyelash mite*

Fig-6 : Micro Arthropods

Groups of microorganisms

Let us study some microorganisms that belong to the groups like Bacteria, Fungi, Protozoa, Algae and certain micro arthropods with the help of some activities.

For this we need a Microscope. You already know how to use it. You could also refer to Chapter "Cell-The basic unit of life".

Activity-1

Microorganisms in water

Collect some pond water / water from any tank in your surroundings. 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 it under the Microscope. Draw rough sketches in your note book of what you have observed. Compare it with the

figures given above for observation and identification. You may also hold discussion about their shape, size and other characteristics with your friends. Take the help of your teacher also.

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 might have observed white patches on the bark of trees. These patches are formed due to 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, place it on a slide. Put a drop of water, place a cover slip on it and observe it under the microscope.

Fig-7(a) : Photograph of curd in bowl

Draw rough sketches in your note book of what you observed. Take the help of Fig-3. This is the common bread mold *Rhizopus*.

Observing Bacteria

There is bacteria 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 stain, 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. Compare it with Fig-7.

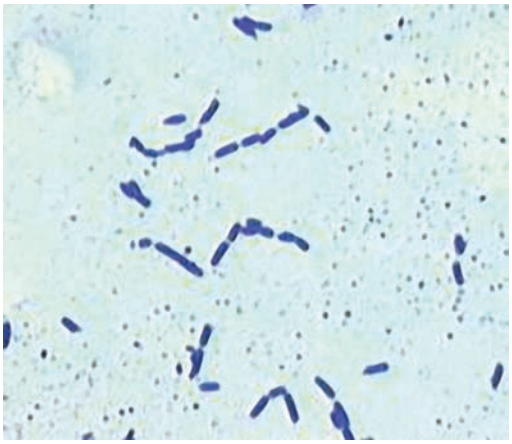


Fig-7 : Stained Lactobacillus bacterium

Do you know?

There are several bacteria that grow on our skin. Some of them cause diseases. Some shows symbiotic relation with other Bacteria. There are different kinds of bacteria in our body. Bacteria present in our digestive tract are useful in digestion. Bacteria are found everywhere and there are over thousand types of them in soil, air, water etc. They can live in low and high temperatures also. One of the biggest bacteria *Thiomargarita namibiensis* was discovered (0.75mm) by Heide N. Schulz in coastal waters of Namibia, which can be seen with unaided eye.

Observing Algae

Very often we 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.

Let us collect pond water or water from the tanks with a bit of greenish scraping. To observe some of the microalgae growing in water, let us do the following activity.

Activity-4

Select a few strands (green string like bodies) from water sample collected and put them on a slide. Cover it with a cover slip and observe it under the microscope. Draw rough sketches of what you have observed in your note book. Compare it with Fig-5.

Do you know?

Photosynthesis in microalgae is very useful to organisms which lives on earth. Nearly half of the oxygen in the atmosphere is produced by the microorganisms.

Observing Protozoa

These are present in water and soil. Let us do the following activity to observe them.

Activity-5

To grow Protozoa, soak hay in pond water to prepare a decoction of hay. After 3- 4 days. 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. Compare your figures with figure 4.

Observing Microarthropods

Some micro arthropods are very important for the soil. They help in increasing soil fertility. They may also be found on our skin, eyelids, beddings, rugs etc.

Some microarthropods cause diseases like scabies e.g. scabies mites. Actually these are not as small as bacteria, but they are of minute size and are 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. But excess use of pesticides kills these microorganisms. We can see them through a microscope.

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. Compare them with Fig-4, 5, 6.

From all the above activities you will be able to understand how diversified the microorganisms are. You can also appreciate the fact that this is another amazing world of living organisms. We will discuss some more in next lesson.

Viruses are an interesting type of microorganisms. They behave like non living things when they are outside a living cell. But they behave like living organisms when they are inside the host living cells such as bacteria, plants and animal cells and multiply.

Fig-8(a) : Electron Microscopic view of a virus

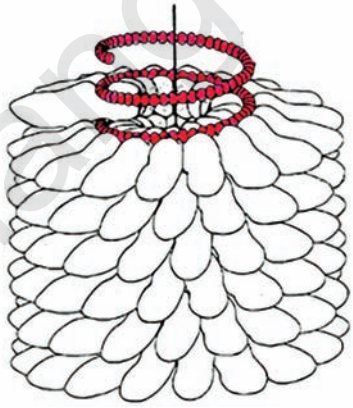


Fig-8(b) : Tobacco Mosaic virus

They can only be seen through very powerful electron microscope.

Diseases like Polio, Swine flu, Conjunctivitis, Smallpox, Chickenpox, Common Cold and AIDS are caused by viruses.

Viruses 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.

Do you know?

Bacterial Staining

Bacteria are very small/ tiny micro-organisms. 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, Algae, Bacteria, Fungi, Protozoa, Micro-arthropods, Virus, Staining.

What we have learnt

- Microorganisms are very minute living things. We cannot see them with our unaided eye.
- We can see microorganisms with the help of Microscope.
- Antonie van Leeuwenhoek invented a powerful single lens microscope.
- Microbes are present everywhere in our surroundings. They live in water, air, soil and even in ice cold climate to hot springs.
- 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

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1. Which organisms act as an interlink between living and non-living organisms? Why do you think so? (AS1)
2. Write the diseases caused by micro organisums? (AS 1)
3. What type of micro organisams we can observe in pond water? (AS1)

4. Whether micro-organisms are useful or harmful. Explain.(AS1)

5. Why the cooked food spoil soon but not uncooked food. Give your reasons.(AS1)

6. What questions would you like to ask your teacher to know about different shapes of Bacteria? (AS2)

7. What would happen if you add buttermilk to a) chilled milk? b) hot milk c) luke warm milk (AS2)

8. How are the human actions causing the death of useful bacteria and fungi? What will happen if this continues? (AS 1)

9. What procedure did you follow to observe lactobacillus bacterium in the Lab? (AS 3)

10. Visit any bakery near your school with the help of your teacher or parents. Know about preparation of bread and cake and prepare a note on them. (AS 4)

11. Observe some permanent slides of microorganisms in your school lab with the help of microscope. Draw this pictures. (AS 5)

12. Prepare a model of any microorganism with clay and write the characteristics of the microbe. (AS 5)

13. Do you clean your hands with soap before eating? Why? (AS 6)

Chapter

3

The World of Microorganisms : Part-II

Microorganisms - Our friends or foes?

Microorganisms are present in air, water, soil and within the bodies of animals and plants. 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 Microorganisms

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 useful in the preparation of medicines required to cure different diseases. Some of them are farmer friendly as they increase soil fertility. Let us do some activities to grow microbes and produce products used by 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* which 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 hot water and knead it to make dough. Keep the dough in a warm place. Observe the dough after 3-4 hours.

- What changes did 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 Idli and Dosa. What could be the reason for prepearing Idli and Dosa dough a day before cooking it?

Fig. 1: Cups containing Maida dough.

- *In which of the two cups yeast was added to maida dough?*

In bakery 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 makes the dough spongy in nature.

Activity-3

Commercial use of microorganisms

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

- *What differences did you observe between the two bowls?*
- *What may 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 etc. Yeast is grown in natural sugars present in grains like barley, wheat, rice and crushed fruit juices like grapes.

Medicinal use of Microorganisms

Sometimes when we fall ill or get injured doctors prescribe some medicines that kill the microorganisms (bacteria) which causes diseases. Such medicines are called as **antibiotics**. These antibiotics are produced by growing specific microorganisms such as fungi. Nowadays, a number of antibiotics like Penicillin, Tetracycline, Streptomycin and Erythromycin are being produced. Antibiotics help in curing many bacterial diseases like Typhoid, Gonorrhoea Diarrhoea, Tuberculosis and prevent infections like Septicaemia.

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

Fig-2(a) : Antibiotic injections

Fig-2(b) : Antibiotic capsules

Do you know?

We must use antibiotics prescribed by a qualified doctor. If we use antibiotics without consulting a qualified doctor it may harm us. Unnecessary use of antibiotics, affects blood cells which fight infections and also cause resistance towards antibiotics. Sometimes they may kill useful bacteria in our body too.

The discovery of Penicillin - The Antibiotic

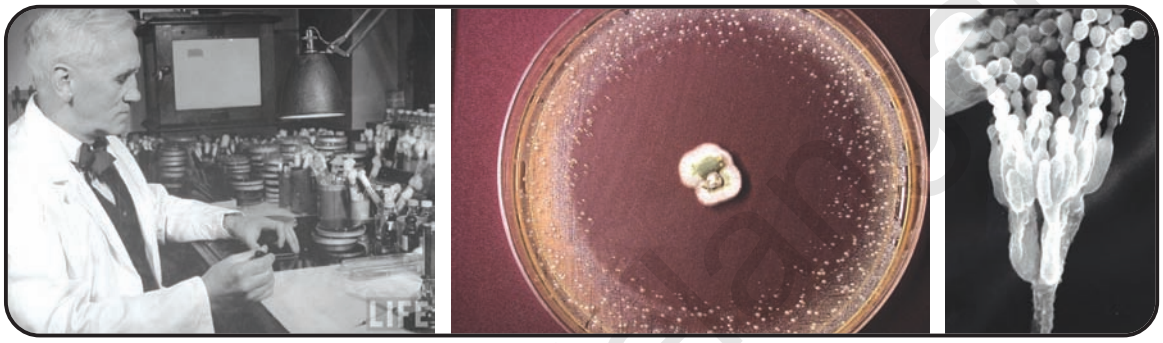

Fig-3(a) : Dr. Alexander Flemming

Fig-3(b) : Pencillium species inhibiting bacterial growth in petridish

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

He was working on antibiotics in his lab. Accidently one day he observed that some fungi (mold) 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 those disease causing bacteria.

The fungus was identified as *Penicillium notatum.* The substance which was produced by the fungus *Penicillium* was named as **Penicillin**.

The discovery of the antibiotic, Penicillin was announced in 1929. In 1945 Dr. Alexander Flemming was awarded the Nobel Prize along with other scientists namely Dr. Howard Florey and Dr. Ernst. Chain.

The discovery of Penicillin paved the way to the discovery of many antibiotics like Streptomycin, Erythromycin etc.

Do you know?

Inventor of Aureomycin

Dr. Yellapreggada Subba Rao was born in West Godavari district of Andhra Pradesh state, India. He discovered some antibiotics like Tetracycline which cure number of bacterial diseases like Typhiod, Plague, Tuberculosis etc.

Vaccine

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

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

The weak/dead disease causing microorganisms which are administered in our bodies are called as **vaccines**. When vaccine is administered in our bodies antibodies are produced and information about the same is stored. The process of administration of weak/dead organisms into our body is called **vaccination**.

Polio is given in the form of oral drops which prevents polio in children. There are many other vaccines available to prevent diseases like Smallpox, Chickenpox, Hepatitis, Tuberculosis, Mumps, Diphtheria, Wooping Cough, Measles.

Vaccination protects us from getting the diseases over a long period of time (often throughout our life). You may have heard

Fig-4 : Child consuming polio drops.

that children below five years must take polio drops.

- *Why are polio drops given to children?*
- *Were you given polio drops, when you were a child?*
- *Do you know about pulse polio programme?*

Our national objective is to achieve a Polio free society. What do they do in this programme? You know that polio is a dangerous disease. What could be done to make the polio free society? Discuss in your classroom about polio contamination and its methods of prevention. Write your findings in year notebook.

- Collect a pamphlet or broucher on Pulse Polio Programme and discuss the points which are mentioned in them.

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

Now, we know about several vaccines which protect us against many disease 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 get them.

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

Activity-4

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

Rabies was discovered by Louis Pasteur. Rabies causing virus enters our body through dog bite, only if the dog has the same infection.

Discovery of Smallpox vaccine

Fig-5 : Baby with small pox

Dr.Edward jenner inoculating vaccine

Dr. Edward Jenner setup his medical practice in a village which saved mankind by eradicating some diseases. 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

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took the fluid from a cowpox pustule on a dairymaid's hand and inoculated a 8 year 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. The fluid collected from Cowpox pustule acted as a vaccine to prevent smallpox. This invention of smallpox vaccine saved millions of people from the deadly disease.

This paved the way for the discovery of number of vaccines which prevent us from harmful diseases. The word vaccine comes from word 'vacca' which means cow.

Soil Microorganisms - Soil fertility

About 78% of air around us is Nitrogen gas. Plants need it mainly for growth. But they can not make it from the atmosphere directly. Microorganisms like *Rhizobium, Nostoc* - Fig 6(a), *Anabaena* - Fig 6(b), *Azotobacter*, etc., help to provide this essential element to the plants by absorbing them from atmosphere to form certain compounds and then fixing them into the soil that can be taken up by plants.

Fig-6(a) : Nostoc

Fig-6(b) : Anabaena

Nitrogen Fixation

Rhizobium bacteria present in root nodules of pea family or *Leguminaceae* plants such as pea gram, groundnuts fix nitrogen.

Activity-5

Collect root nodules from ground nuts, beans and pea gram crush. Put them on a glass slide. Press it with coversslip. Observe it under compound microscope. Draw and discuss about it with your friends.

Rhizobium converts atmospheric nitrogen into nitrates and stores in roots. Plants use this stored nitrates. Plants gives shelter to *Rhizobium*. They co-operate one another. Such a cooperation is called "symbiosis". Soil fertility increase in growing legume crops in the fields. Farmers plough crop field along with legumes on the onset of monsoons.

Fig-7 : Root Nodules

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

Do you know?

What is Bt?

Bt stands for *Bacillus thuringiensis* which is the name of a bacterium. It produces a toxin which kills pests on plants or crops. The bacterium is used as bio pesticide. 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. It shows severe impact on plants and animals. Discuss, about effect of Bt in your class.

Activity-6

Take two pots or dig two pits in the corner of the garden at home or at your school ground. 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 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 did you observe?

In which pit did the materials decompose? Why? Is there any harm with non-decomposing material? Discuss.

Fig-8 : Compost pit

You might have observed the same thing happening in your own surroundings as well. Microorganisms present in our surroundings act upon wastes around us and decompose them. They are converted into simple substances. Thus microorganisms help us in cleaning the environment.

Think and discuss

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

Micro organisms like several bacteria help in the process of sewage treatment. Bacteria are useful in cleaning sewage water. Oil sleeks formed due to leakage of oil from oil tankers (ships) in oceans. This kills marine animals because of shortage of oxygen and light.

Introducing oil eating bacteria can safeguard aquatic marine animals from oil sleek.

Harmful microorganisms

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-7

Meet a doctor of your locality and ask him about the different types of diseases caused by different microorganisms. 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, some of your family members or friends getting cold and cough with the sudden change of weather. When the infected person sneezes or

coughs, the pathogens enter into air from such infected persons. When this air containing pathogens enters into the body of a healthy person, it may cause cold. These type of diseases which spread from

Fig-9 : Anopheles female mosquito

infected people to healthy ones are known as "communicable diseases". They spread through air, water, food or through physical contact with infected person (or his/her used towels, kerchiefs) or through insects like houseflies and mosquitoes. Such insects or other animals are called **vectors**. Common cold, Conjunctivitis, Typhoid, Smallpox, Chickenpox, Swine Flu, Tuberculosis, Chikungunya are some of the communicable diseases.

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 as in ponds, tanks, waste pots, waste flower pots.

- *Why should we keep our sorroundings 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 Secunderabad. For full story of discovery of Ross. refer annexure.

House flies also carry disease causing microorganisms and can spread diseases like Typhoid, Cholera, Diarrhoea etc. When they sit on garbage, excreta of infected persons or animals, pathogens stick to their bodies. When these flies sit

Fig-11 : House fly on food

again on uncovered food, they may transfer the disease causing microbes. Whoever eats this food becomes infected. So we must avoid taking uncovered food. That is why we should always cover the food. Houseflies breed on garbage. We can control houseflies by keeping our surroundings clean.

- *Where do you find more number of houseflies? Why?*
- *What are the measures to be taken for preventing houseflies?*

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

TABLE-1: SOME COMMON DISEASES CAUSED BY MICRO ORGANISMS IN HUMAN

Name of the disease	Causative Microorganism	Mode of transmission	Preventive measures
Tuberculosis	Bacteria	Air	* Vaccination (BCG) * Avoid using infected persons materials.
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	Plasmodium	Female anopheles Mosquitoes (vector)	*Use mosquito nets, repellents. avoid stagnaton of water
Dengue	virus	Mosquitoes aedes	,,
Chikungunya	virus	Mosquitoes aedes	,,
Japanese Encephalitis	Virus	Mosquitoes culux	,,
Diphtheria, Whooping Cough, Tetanus, Hepatitis B, Haemo-philus, Influenza 'B'	Bacteria virus	Contaminated water, food, Direct contact	Pentavalent.
Diphtheria, Whooping cough, Tetanus	Bacteria	Contaminated water, food, Direct contact	DPT, Triple antigen.

Study above table and answer following questions.

1. *Which diseases can be prevented if we control mosquitoes?*
2. *Which diseases can we prevented by vaccination?*
3. *Name the diseases which are spread through by contaminated water?*

4. *Can you name few diseases which are spread through by Air?*
5. *Can we protect ourselves from bacteria and protozoan diseases through vaccination? Discuss in your class?*
6. *Discuss in your class about Indradhanussu.*

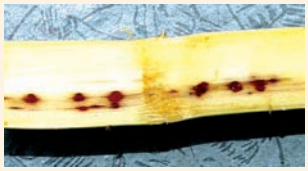
The Diseases caused by microorganisms in animals

Anthrax mainly show effect on cattle, sheep, goat and also effects humans, foot & mouth disease, viral diseases in prawns, and fishes, fowl fox septicimia disease, bird flue in poultry, Rabies in dogs.

Disease causing microorganisms 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	
Smut disease of Rice	Fungus	Air	

Discuss with your friends about plant diseases and in what way they spread in your area. For this read agriculture magzines.

Food poisoning

Sometimes you might have heard 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.

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 smells and tastes bad. Water or moisture present in food items helps the microorganisms to grow. How can we preserve our food? 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? 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.

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 in cold and hot conditions.

Pasteurisation

Another method of preservation is pasteurisation. You might have read this word written on some milk packets. In this process milk is heated up to 72°C for 15 to 30 minutes and then suddenly chilled and stored. This prevents the growth of most micro organisms. This process was discovered by **Louis Pasteur**. So this method is known as **pasteurisation.** High temperature short time pasteurisation-HTST. (see page - 145).

Think what would have happend if pasterurisation had not been invented.

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

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 infection.

Storage and packing

Nowadays dry fruits, milk, cool drinks, food items and 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, in any season.

Key words

Lactobacillus, penicillum, fermentation, sterilisation, vaccination, pathogens, vectors, pasteurisation, symbiosis, Vaccine, Small Pox

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

8JYEAZ

1. How do vaccines works in our body? (AS1)
2. What are the differences between Antibiotic and Vaccine? (AS1)
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. 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)
5. Make an Album of scientists and their discoveries related to Microorganisms.(AS 4)
6. Visit the veterinary hospital and prepare a list of cattle, Goat, Sheep diseases by asking questions to the doctor? (AS4)
7. What is pasteurisation ? How is it useful? (AS 6)
8. Edward Jenner's collects fluid from cow pox pustule and injects to a eight year old boy. Then he exposed the boy to smallpox and the boy did not get smallpox. How do you appreciate the daring action of Edward Jenner? (AS 6)
9. Visit a nearby milk chilling centre/a librarey . 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. Jeevan said that "If there are no micro organisms earth will remain with wastes" will you agree with this statement, why? (AS 6)

13. kavita is suffering from serious illness. Doctor priscribed antibiotics for five days. After three days of usage she stopped taking antibiotics. Is it correct or not, discuss. (AS 6)

14. What are the precautions taken to eradicate malaria? (AS 7)

15. One medical store owner is giving antibiotics to his customer who is suffering from fever without a doctor's prescription? But the customer's daughter Malathi is telling her father not to take antibiotics without doctor's prsecription. Whom do you support and why? (AS7)

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 talk 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 expressed 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 Uttarakand 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 carreer. 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 of 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. Then he 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 became 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 carry 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 transmit 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 is 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 in 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 some 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.

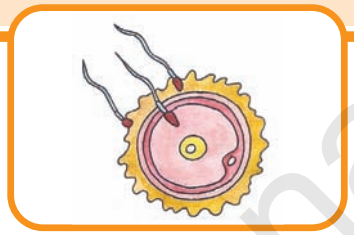
Ross rough drawings and notes about what he observed

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.

Chapter

4

Reproduction in Animals



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 and wondered.....

- *Whether all eggs hatch into nestlings?*
- *Did the pigeons' egg came first or the pigeon?*
- *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 learnt how a new plant is produced from other plant in chapter ***"Reproduction in Plants"*** of class VII. Now you will study about reproduction in more organisms.

Fig-2 : 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 us. 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-1.

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

Table -1

S. 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.

Table -2

S. 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 and 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 germinates and grow into a plant. The process of living beings producing it's off springs is called reproduction. This is one of the basic life processes like respiration, digestion. 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

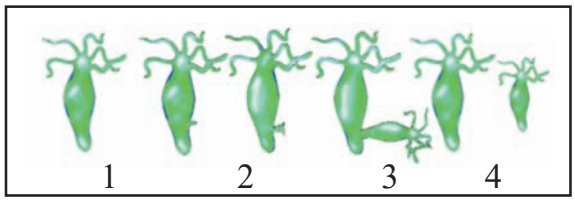
Generally in our surroundings we see most of the organisms as male and female forms. But in lower organisms this differntiation is not seen. In some animals the formation of gametes does not take place. Still they produce offsprings like themselves. As the formation of gametes does not take place there 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, paramoecium, 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.

a) What did you observe in slide/picture 1, 2 and 3?
b) What is the main difference between slides 1 and 2 as well as 3 and 4?
c) What did the swelling (bulge) part develop in 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 new individuals develop from the buds. This type of asexual reproduction is called ***"Budding".***

- *Does **gametes** and **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.

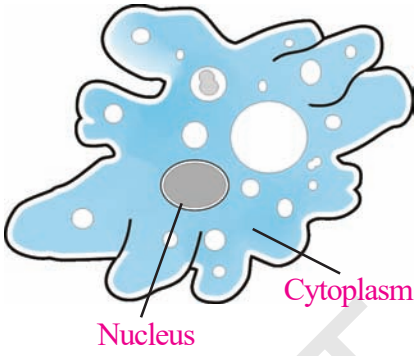


Fig-4 : Amoeba

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.

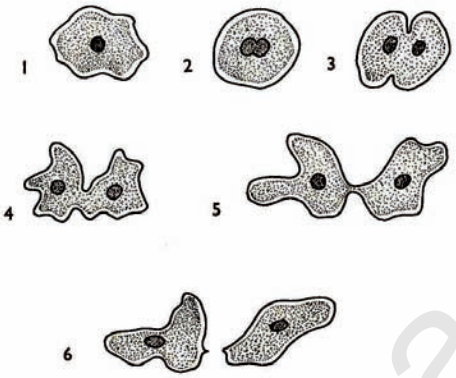


Fig-5 : Binary Fission in Amoeba

Table -3

Changes in the nucleus/body structure
1st diagram:
2nd diagram:
3rd diagram
4th diagram
5th diagram
6th 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 *two daughter* amoebae. 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.

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 pollensac 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 gamete with the female gamete*** .

Do you know from where the male gametes and female gametes are produced in animals? In animals also, sexual reproduction occurs by the fusion of female gamete or ***ovum*** and the male gamete 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.

Observe the male and female pumpkin flowers in Fig-6(a), Fig-6(b). Collect any male and female flower from your surroundings.

Fig-6(a) : Male Flower

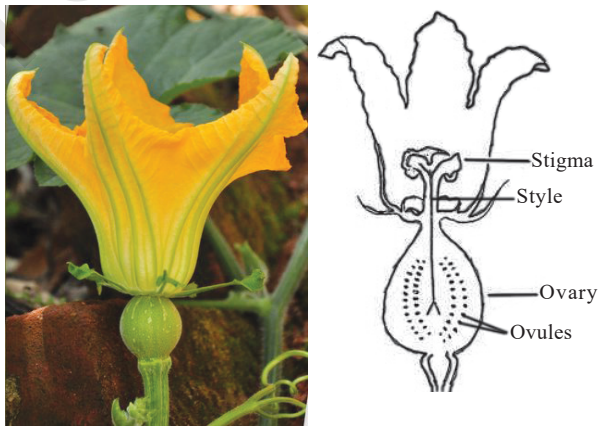


Fig-6(b) : Female Flower

Parts of the male flower

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

Parts of the female flower

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

Like plants, animals also have specialized organs for reproduction.

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

Male reproductive system

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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 pollen grains play any role in formation of seeds? Fusion of pollengrain and OVUM is essential to form a seed. Likewise a male produces sperms which is quite essential for reproduction.

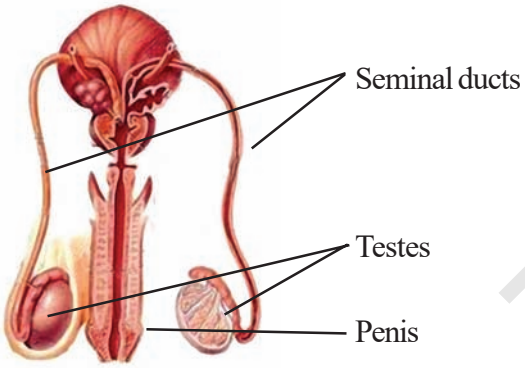


Fig-7 : Male reproductive system

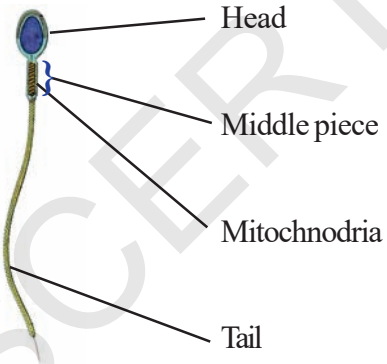


Fig-8: Human Sperm

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 the purpose of the tail of a sperm serves?

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***), ***Uterus*** and ***Vagina*** (see the figure - 9). 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. Vagina is the passage in the body of a woman or female animal that connects the outer sex organs to the part where a baby grows (womb). The ovum is surrounded by an outer covering. A nucleus floating in cytoplasm is found in the centre of it.

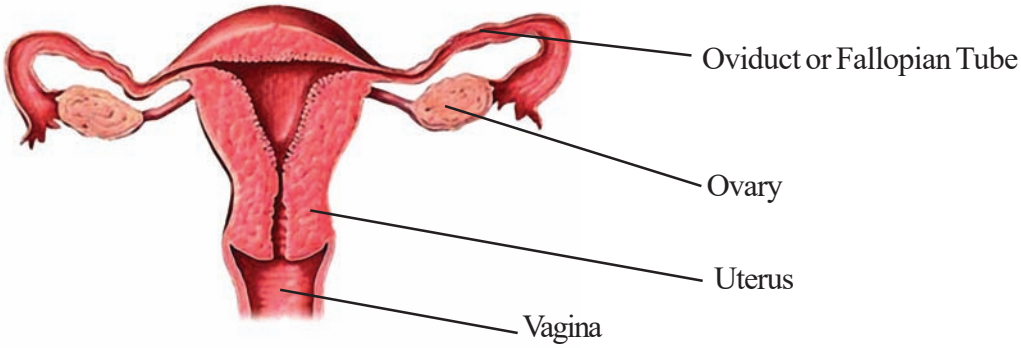


Fig-9 : Female Reproductive system

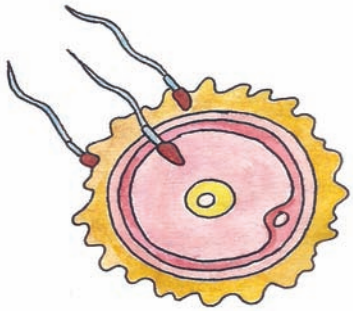


Fig-10 : Sperms trying to enter ovum

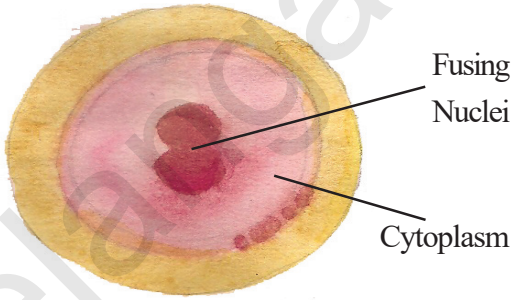
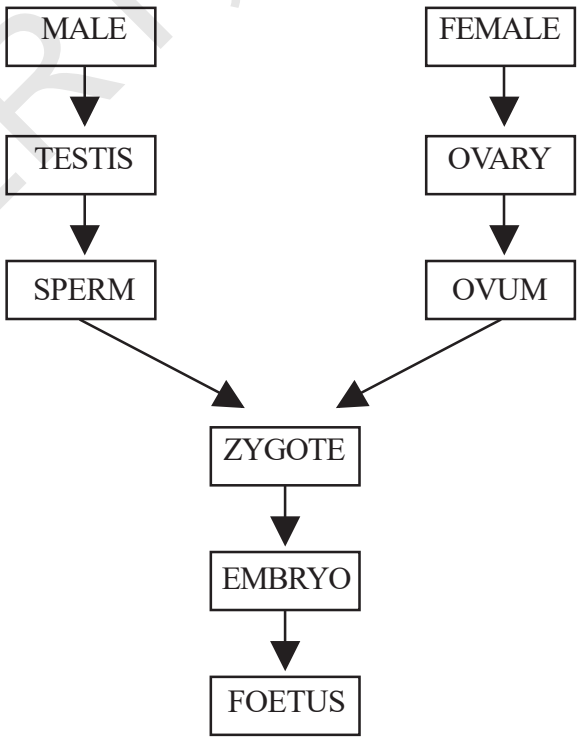


Fig-11 : Fusion of ovum and sperm (fertilization)

Fusion of ovum and sperm (fertilization)

Look at the flow chart given below:



Then the fusion of sperm and ovum takes place, which 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.

Internal fertilization

For internal ferti-lization it is necessary for the sperm to reach inside the body of the female. Some arrangements for ensuring this is present both in the male and female bodies. This type of fertilization occurs in different organisms like insects, snakes, lizards, birds and mammals etc.

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

Development of the embryo

This zygote formed after fertilization 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 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.

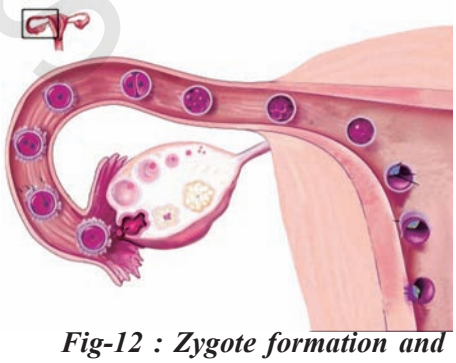

Fig-12 : Zygote formation and development of an Embryo

When the embryo develops fully and all other parts are distinct, it is called a ***foetus.*** The period from which zygote fully develops into foetus is called ***"Pregnancy period".*** Usually, after completion of this period (about 270-280days) a baby is born. This is called gestation period.

Now, you can try to fill the blank boxes of flow chart in the previous page.

- *What would happen if fusion of sperm and ova doesn't takes place?*
- *Why do animals give birth to their babies?*

Think what would happen if all the animals stopped 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.

Table - 4

S. No	Name of your friend	Name of the organ	Character Resembles mother	Character Resembles Father	Characters resembling with other family members / relatives
1.		**A** .Nose **B**. Eye **C**. Eye brow **D.** **E.**			
2.					

Now discuss 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. Some times your characters may resemble with your aunt, uncle or grand parents.

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 some men deffective sperm production and low sperm count is observed. 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.

External Fertilization

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.

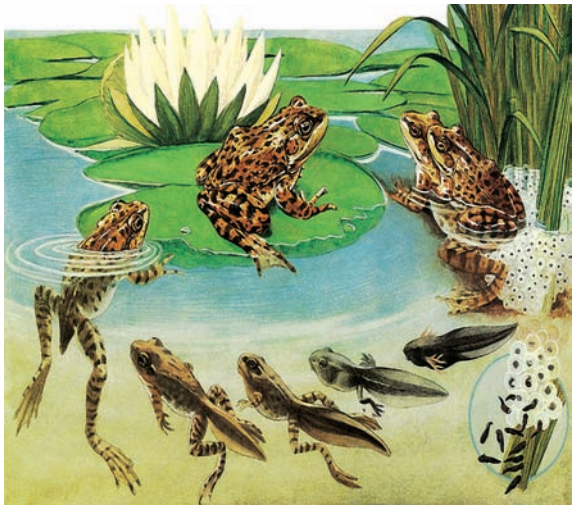

Fig-13 : Life Cycle of Frog

Life cycle of frog

Do all young ones (offsprings) resemble their parents?

In class seventh you have learnt about the life history of silk moth. Does the larva of a silk moth resembles 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 swimming in a pond? Refer to the Fig-14 to identify them. These fish like forms are called ***tadpoles***

Fig-14 : Tadpole

Have you ever observed frogs in such a position as in Fig-15?

This figure shows copulation or physical interaction between male and female frogs leading to external fertilization usually during the rainy season.

External fertilziation in frogs usually occurs in water.

Fig-15 : Copulation

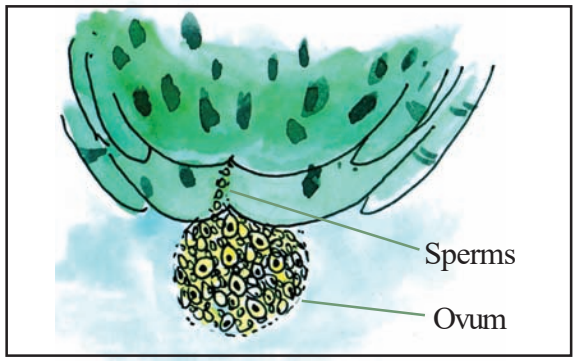

Fig-16 : Release of eggs and sperms

Project work :

NOTE: This project work needs patience and carefulness. Teachers and students 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, you need not worry. You can start your project after collecting Tadpoles.

To conduct this project you require:

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

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-18. 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. These must be the fertilized eggs and the blackish part is embryo.

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. You may take the help of the following table to record your observations.

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	43-45days observations diagram	46-48 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 -19) Pour it in a watch glass.

To observe the tadpole 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-20. It is for accommodating tadpoles to settle out side for some time. It is essential in this stage as respiration through lungs starts.

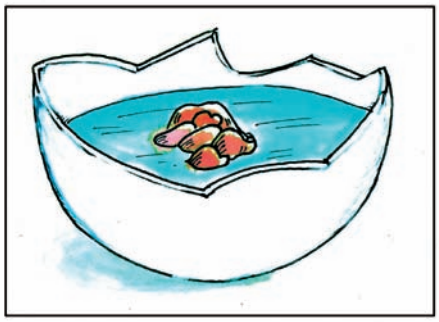

Fig-20 : Setup for late tadpole

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.

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

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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, Binary fission, Ovary, Internal fertilization, Embryo, Testes, Foetus, Oviparous, Sperms, Bisexual animals, Viviparous, Ovum, 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 mainly 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 microorganisms.
- Budding, Binary Fission etc. are some common methods of asexual reproduction. Budding is observed in Hydra and binary fission is observed in Amoeba.

- Reproduction resulting zygote formation 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, uterus and vagina.
- 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

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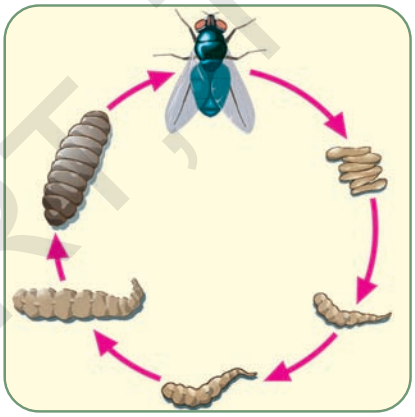
1. Differentiate between: (AS1)
   a) Sexual reproduction and asexual reproduction
   b) Gametes and zygote
   c) External fertilization and internal fertilization
   d) Viviparous and oviparous animals
2. Compare the reproduction in Hydra and Amoeba. Note down the differences in your notebook. (AS1)
3. 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)

4. Can animals produce offsprings even without formation of zygotes, how? Explain with suitable example. (AS1)
5. How can you identify the animal is viviparous or oviparous. (AS1)
6. 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...
7. State the reason why most of the terrestrial animals' fertilsation takes place internally. (AS1)
8. Observe the following figures and write their functions of them. (AS1)

9. a. Label the following life cycle? (AS1)



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

10. Match the following (AS-1)

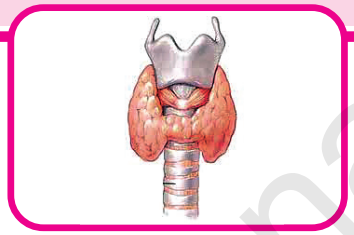
A) Oviparous	( )	1. Tadpole to adult
B) Metamorphosis	( )	2. Birds
C) Embryo	( )	3. Fertilisation outside the body
D) External fertilization	( )	4. Developed Zygote.

11. What would happen if all the organisms stop the process of reproduction? (AS 2)
12. 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? (AS 3)
13. Collect information from your library or from other sources like internet and discuss the life cycle of Honeybees in the symposium at your school. (AS 4)
14. Sketch the diagrams of male and female reproductory systems? (AS5)
15. Draw labelled diagram of life history of frog and identify which stages are herbivores (AS 5)
16. 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)
17. Fill in the blanks.
    (a) Animals which give birth to babies are called .....
    (b) I n human's foetus develops in .....
    (c) Ovum is released from .....
    (d) Tadpole is the primary stage of .....
    (e) Budding, binary fission are ..... reproductive methods

Chapter

5

The Age of Adolescence



Usually, we see changes in the age of 10-19 years. This period is called "Adolescence". During this period changes take place inside (internal) and outside (external) the body. For example, Change in voice, growing tall etc.

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- *Observe these changes in yourself too. Write down the changes that you observed during your adolescence.*

Have you reached the age of "Adolescence"?

Read the following questions. Think whether the following changes have occured in you too.

- *Did your voice change?*
- *Is hair growing under arm pit/genital region?*
- *Are there pimples or acne on your face?*
- *Are you looking your face in the mirror frequently?*
- *Are you showing restlessness while your parents suggest you to do something?*

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

This is a complex stage of our life, because we grow from childhood to adolescence. We have a lot of stress due to these changes and are unable to decide whether we belong to adulthood or childhood. This is the period of confusion and transition.

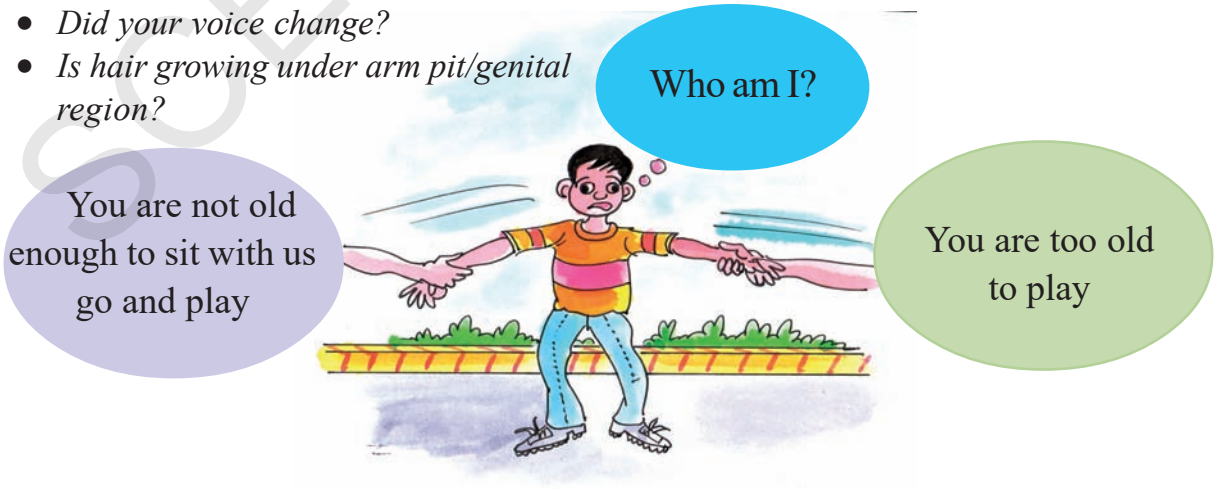


Fig-1

Changes at adoloscence

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 gaining new features.

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

- Do you know upto what age you will grow?
- Will your growth in height stop after a certain age?

Activity-1

Observing growth rate

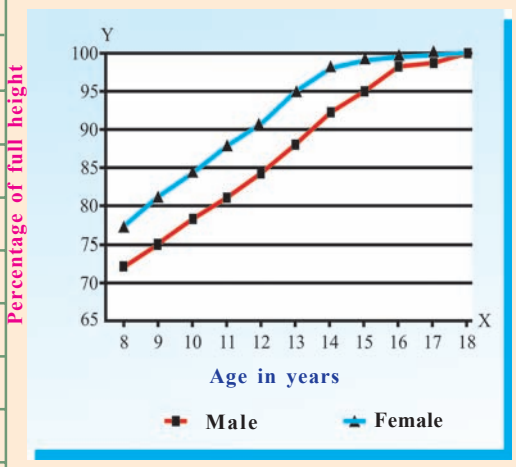
The following chart gives the average rate of growth in height for both male and female with age (Table-1).

The figures given in Column-2 (Male) and Column-3 (Female) of Table-1 show the percentage of height against the age attained by a person as shown in Column-1 of the same table.

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

TABLE-1

Age in years	% of maximum height (Male)	% of maximum height (Female)
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



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 among the males and females grow faster? How can you say?

Initially the female 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.

Activity-2

You may try to caluclate your approximate height on the basis of a standard growth chart as given in table-1.

Maximum height that you may attain =

$$\frac{\text{Present height (cm)}}{\text{\% of full height at this age (as given in the chart)}} \times 100$$

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 X 100 = 131.5 cm.

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

Table -1 shows that girls grow faster than boys in their adolescent period. For example by the age of 11, a boy has reached 81 % of his probable maximum height, while a girl has reached 88% of her maximum height. Form a group of six students including you in your class. Measure heights and calculate future heights of the group members in the following table.

TABLE-2

Name of the Student	Age	Present height	Maximum growth in height in future

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

Activity-3

Changes in your body

Form five groups in your class. Take at least 15 students in each class (6-10). Your selection should be random which means students with odd role number or whose name starts with letter 'S' etc.

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

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	Hoarse

For each class (VI to X) you have to prepare one table. And then you 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 the change sudden or gradual?*
- *In which classes do you find a maximum growth in height?*

(Information collected by you will give a clue about some changes you notice 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 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?
- How do you know whether the speaker is a boy or a girl?
- 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.

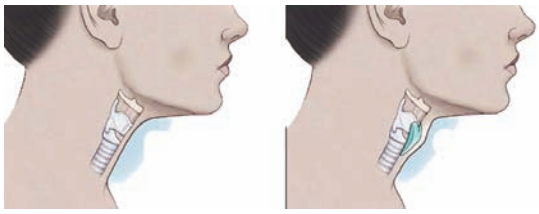


Fig-2

Adam's apple in an adolescent boy

Look at figure-2 and observe some projections at the boy's throat. Try to see the same thing 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 Adam's 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 hormones (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 acne. Sometimes these pimples lead to infection.

The secretions of sweat glands 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, often the pimples become infected too. Owing to extra secretions, sometimes a distinctive odour is also produced from their bodies. Do not squeeze the pimples or it might hurt and result into dark spots on your skin.

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. Consult doctor if necessary.
- Never get worried of pimples because stress and strain may help them to increase.

Development of body

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 sperms. In girls, the ovaries enlarge and ovum begin to mature. Ovaries also start releasing mature ovum.

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 grow in the armpits and at the genital region. These characters 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

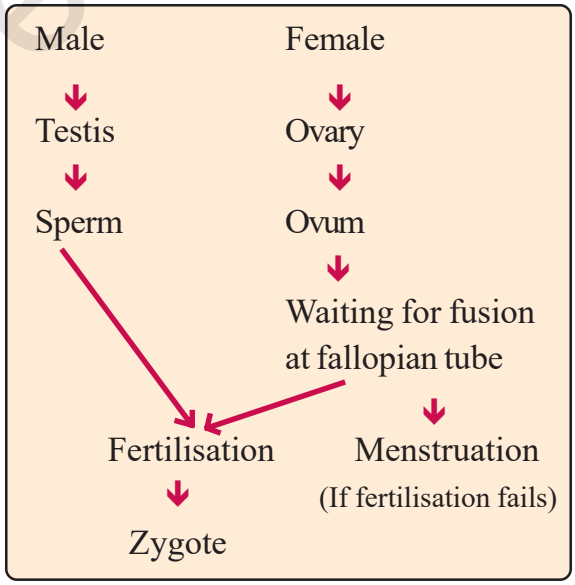
Reproduction is required for continuation of human race. You know that reproduction takes place by the fusion of male and female gametes.

Do you know? When do our reproductive capacity begin?

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-days girls are reaching adolescent period earlier than expected. Some studies explain that it is because of polluted food material such as estrogen present in milk. This fact may also effect the boys and delay the reach of the reproductive phase.) The reproductive capacity lasts for a much longer period in males than in females. Though their bodies are prepared for reproduction physically, mental growth and maturity are still far away.

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.

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



Schematic diagram of menstrual cycle and reproduction

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

- How does ovum change after fertilization?
- 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 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 if this occurs it 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 resulting in bleeding. This process is called "Menstruation". It is nature's wonderful phenomena.

At 45 to 50 years of age, the menstrual cycle stops. This stage is known as 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 beyond an year, then one must consult a doctor (gynecologist).

Menstruation and myths

Some sections of people in our society believe that during the period of menstruation women are untouchable. So, they are asked to keep a distance from others. During this time, females 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.

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. If the ovum is not fertilized, the materials of the uterus are expelled out along with blood and ovum.

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. It also helps in continuing the next generation. However marrying before attaining proper age is an unhealthy practice.

Child marriage is social evil and should be stopped by any means. It affects the lives of children adversely and cause unwanted damage to their lives.

Let us read the story of Latha which is about a protest against child marriage.

Latha was studying VIII class in Bijjaram village of Kosgi Mandal in Mahaboobnagar district. Her parents decided to get her married. She protested as 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 wrong.
- 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 18 years for girls and 21 years for boys. This is because adolescent mothers are not prepared mentally or physically for motherhood.

Activity-4

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

Check list:	
Prefer to spend more time before the mirror.	
Like to use perfumes.	
Do not want to listen to parent's suggestions.	
Feel only friends are correct, not parents.	
Want to be identified by teachers and peer group.	
Want more independence in taking decisions.	
Feel responsibility in work allotted at school, house.	
Like to take risks.	
Take decisions by critical thinking.	
Sometimes feels shy, sometimes feels confident.	
Have more self consciousness.	
Show more sensitivity towards others emotions.	

To make your future in a right way, you need to know more about adolescence. For this here are some points to help. Do you know why you behave like this? You know the difference between good and bad. You are often inclined towards anything that attracts you.

These are all common in the phase of adolescence. Interest towards body and self is natural. Attraction towards opposite sex

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

Adolescence : Changes in behaviour

Adolescence is the growing age where physical change takes place. Apart from this we may observe some changes in behaviour also. Adolescents often are very fast in taking decisions. Often do not want to be forced to do any work.

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. They behave in a different manner as compared to what they did during childhood with peers and elders. They are more independent in nature and very self conscious.

An adolescent feels 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

Effects of Hormones in 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.

Endocrine System

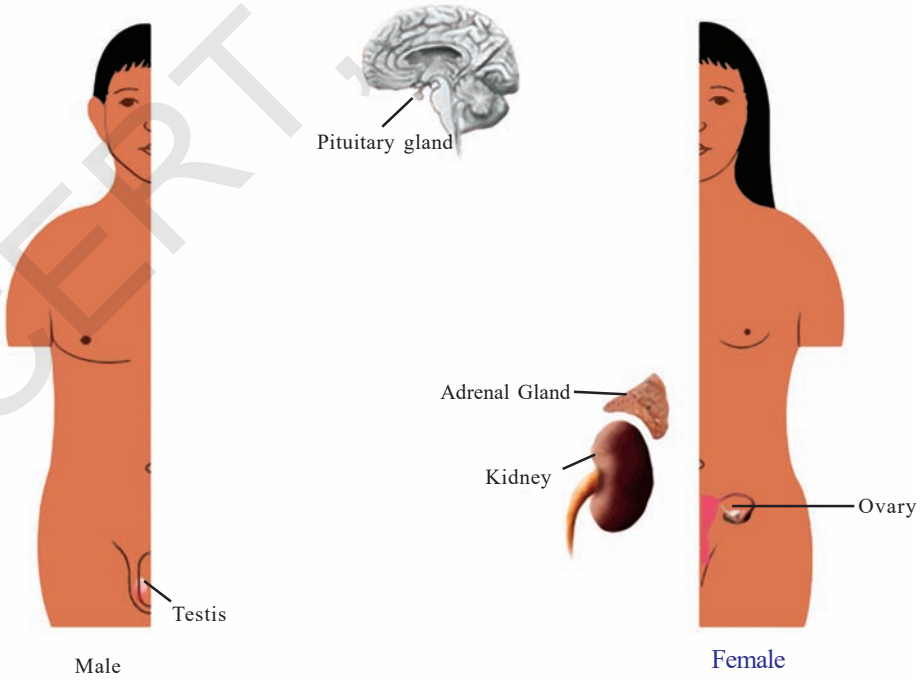


Fig-3 : Position of some endocrine glands in the human body

The endocrine glands do not have specialized ducts so, they are called as ductless glands. The secretions of these glands are known as hormones whcih are directly released into blood. The endocrine hormones perform several functions in the body like, controlling the sugar levels, salt and calcium levels in the blood, development of the reproductive system etc. Physical changes during adolescence, starting of menses, pregnancy and menopause etc are largely under the control of these hormones.

The male hormone 'testosterone' is 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.

Do you know?

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

TABLE-4

S. No.	Gland	Hormone	Effect
1	Testes	Testosterone	Formation of sperm, secondary sexual characters in male
2	Ovaries	1. Estrogen 2. Progesteron	Formation of ovum, menstruation, embryo-implantation, secondary sexual characters in female
3	Pituitary gland	1. Pituitary hormones like growth hormone, 2. follicle stimulating hormone (FSH) 3. Leutinizing hormone (LH)	Brings about general growth, stimulates other endocrine glands. FSH directs follicles for formation of ova or eggs, while in males directs testosterone to stimulate testes to produce sperms. LH causes the egg to burst out from follicle and flow into the fallopian tubes
4	Adrenal gland	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

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. A meal of *roti*/rice, *dal* (pulses), vegetables, milk and fruits etc. is good for overall health.

We need to ensure that our meal contains the food components (carbohydrates, proteins, fats, minerals and vitamins).

Cleanliness

We have studied that sweat glands become more active in adolescents and give body a distinctive odour. So it is better to to take bath regularly. Your clothes 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 menstruation. Making use of disposable napkins may reduce chances of infections.

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 and sound sleep.

Adolescence is a period when many changes take place in the body. Because of these changes one may get tensed, confused or feel insecure. In this situation if anybody suggests that you will get relief if you try 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, take help and guidance 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.

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, Larynx, Adam's apple, Maturity, Sweat glands, Sebaceous glands, Secondary sexual characters, Menstruation cycle, Menarche, Menopause, Pregnancy, Endocrine glands, Hormones, Testosterone, Estrogen.

What we have learnt

- Adolescence is the period of reproductive maturity which lies usually between the ages of 10 to 19 years.
- During adolescence a child's body undergoes many changes physically as well as mentally.
- Voice of boys becomes hoarse as chords of voice box get loosened and thickened during adolescence.
- Height gain in children take place during adolescence and stops after wards.
- 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 hormone 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 break 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

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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. Why acne and pimples are common in adolescents? (AS1)
6. What can you suggest to your classmates to keep himself / herself clean and healthy? (AS7)

7. If you have a chance to talk to a doctor, what questions would you ask about adolescent emotions and changes in the body? (AS 2)

8. 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)

9. Write five suggestions to improve the performance of Red Ribbon club of your school? (AS 6)

10. Prepare a three minute speech on behavioural changes in adolescents. (AS6)

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 taboo. Prepare some slogans to prevent this. (AS 6)

13. 13 years old Swaroop always think of his height. Can he improve his height? What do you suggest him? (AS 7)

14. Are you angry with your parents. How do you wish your parents to be? (AS 7)

15. What are your expectations about your parents and teachers? (AS7)

Chapter

6

Biodiversity and its Conservation

After attending the Nature Prayer (see back cover page) that is conducted every friday in the school assembly. Rani and her friends went to have a look at the Bulletin Board. Let us read about some important issues that were displayed on the bulletin board.

Endangered Vulture seen in Adilabad District

On the 5th of June 2013, it was reported that, critically endangered vultures were seen in Adilabad district. The numbers of vultures were going down at a fast rate due to pollutants in the area. A forest range cited them in Murliguda Forest of Bejjur Mandal (now in Kumurambheem Asifabad district) and initiated conservation efforts.

Fig-1 : Vulture

Our state Bird is "Palapitta"

Our Government has declared "Blue Jay-Indian Roller", also known as Palapitta as our state bird. The scientific name of this bird is *"Coracias bengalensis"*.

This bird which was frequently observed at different places, now is in endangered list of birds. Due to changes in environment, frequent use of insecticides and non availability of food, the number of these birds have gradually decreased. So our government has taken an initiation to conserve this bird.

Fig-2 : Blue Jay

We can conserve these birds by implementing national and international laws and by having an understanding of their habitats properly.

Deforestation mainly due to conversion of forest land to agricultural land became problematic issue for their existence.

That day after dinner, Rani discussed what she had observed on the bulletin board. She told her family members that Vultures and Blue Jays were called endangered birds. She had also seen 'endangered' written on some pictures of animals and plants displayed during the International Biodiversity meet in 2012, held at Hyderabad. She had noticed there, that animals or plants whose population was diminishing at a fast rate were called endangered. Her mother then pointed out about sparrows, which were commonly seen everywhere earlier seemed to have disappeared now. Even the crow, myna and koel have become a rare sight. Her grandfather told them, how the big banyan tree of their village was a host to many birds, animals and insects earlier, was cut down, in spite of protests. Her father joined to tell about tribals who visited the houses often in the locality selling honey earlier, occasionally did so now.

They also discussed about some areas where monkeys were entering into villages. There is a marked decrease in snake and lizard population in the areas.

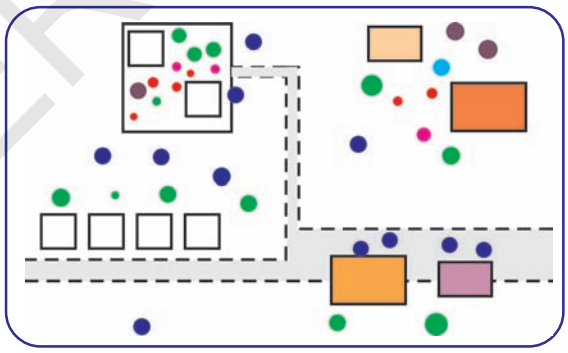
About 30-40 years ago variety of birds like crane, sparrow and parrot were seen frequently. Now, it is not so Rani's mother said that the diversity of organisms or biodiversity was being affected in most areas in this manner.

What is Biodiversity?

How do you feel whenever you go to a garden? You expect to be delighted with beautiful flowers. If only red flowers are found there, how would you feel? Would you like such kind of environment?

Activity-1

Rani listed out the organisms in her surroundings in the following manner. First she drew a sketch of her house and its surroundings on a paper She drew squares and circles numbering them serially. Now she marked plants, humans, animals, birds, insects, others with a particular colour code as shown in the figure below.



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Colour code

Plants	-	P	-	Dark green (Big Plants) Light green (Small Plants)
Animals	-	A		Red
Humans	-	H	-	Dark blue
Insects	-	I	-	Brown
Birds	-	B	-	Pink
Fish	-	F	-	Blue

Now conduct a survey as done by Rani, around your school or your house. Then make a diagram of your observation as made by Rani. Display it in your classroom.

Think and discuss

- *How many different colours could you mark on your sheet?*
- *What does your total colour code count indicate?*

Activity-2

Try to carry out the same activity (if possible) when you go for a survey to a nearby forest, orchard or crop field. Take care not to miss anything like the bird's nests, cobwebs, worms, leaves, insects, mosses etc. At the same time please don't disturb any nest. Use above colour code for this activity also. Now you need some colours to prepare your block diagram. The wide variety of wild life will wonder you. Let us do the following…

- What were the things that attracted you very much during the survey?
- Write your observations of the survey.

We see a variety of plants and animals in our surroundings. Every living being is unique and plays a prominent role in nature.

Do You Know?

Diverse world of life under a microscope

The whole world before you has wide variety of living organisms. Is invisible living world also the same? In the chapter The story of micro organisms you have learnt about different microorganisms like algae, fungi, bacteria, viruses etc, and also about the micro arthropods. Is the world of microbes diverse as well?

We can see that both the microbial world and the visible world around us are diverse. But have you ever wondered how they became so diverse?

Let us take some examples and see how an area becomes rich in diverse forms.

A variety of living organisms are present in an area and they vary in different aspects.

Activity-3

Finding variations

Is it possible to find any variations even within the similar types of organisms? Do the following activity in groups of 5 each. To do this, you need a tabular column.You have to prepare your own suitable tables for observations.

Variations in plants

Collect 2 similar grass plants (nearly of the same height) and observe them carefully.

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List at least 5 differences. (You can add more differences to your list) list at least 5 similarities. (You can add even more)

Variations in animals.

Observe animals of similar kind like any two hens, dogs, goats etc.,

Do you find any difference in the colour of fur, nails, claws, hoofs etc. If they are

birds list at least 5 differences in their feathers, feet, crown ,tail etc.

- Observe two students of your class. Are they same in height?
- Observe their hands, fingers, toes, nails, hair, eyes, ears etc. What are the variations?
- Observe the texture of skin? Is it dry, oily, smooth or rough?
- If there are twins in your class/school/ family, observe them and find variations among them.

Activity-4

Collect and paste some pictures of your favourite cricket players belonging to countries like West Indies, Australia, India etc., in your note book.

Write the variations that you have noticed in them.

Display the findings of the above activities in the class and discuss the following questions.

- *Could you find any two person with exactly same characters?*
- *Could you find any two grass plants having exactly same characters?*
- *What can we conclude from this?*

Fig-3 : Biodiversity on earth

Based on the surveys and above clippings we can summarise that many varieties of plant and animal exist in this world. Though they look similar, upon careful observation we find differences or variations between them that leads to Biodiversity (Biological-diversity). Diversity is the nature's way. Even at the microlevel this is true.

Biodiversity: a case study

To understand the importance of biodiversity we need to observe present scenario. For this here is a case study of Ramagundam forest of Peddapalli district.

Case study of forest at Ramagundam : *60-70 years back Ramagundam had dense forest with a rich heritage of wild life. This forest extended to border areas of Mancheryal. It was an abode for wild animals like tigers, leopard, deers, hyenas (kondrigallu), foxes, wild pigs (adavi pandhi), bears, pythons, cobras, porqupines (mulla pandhi), owls, hares, monitor lizards (udumu) scorpions, geremandals (like the desert spider) etc.*

After the establishment of thermal power station at Ramagundam (using coal to produce power) and other industries, human activities increased. Then many buildings, roads and stone quarries have come into existence. Forest area was cleared and so several organisms started disappearing.

Though an area near Mancherial (very close to Ramagundam) was once known as Tiger valley, shows no signs

of tigers now. Animals like foxes, deers and geremandals (resembles desert spider) are also not seen these days. We rarely see animals like pythons, cobras, deers, some kinds of scorpions and Bears in the forest.

Now there are several human settlements in the area. Some areas of less dense forests are inhabited by animals like pythons, cobras, deers, scorpions etc. Bears are rarely found. Peacocks have been sighted recently.

The above case study explains you the need for conservation of biodiversity.

- What is the difference between the situation regarding types of animals present 70 years ago and now?
- What might have happened to tigers of Ramagundam?
- Do we find tigers anywhere else in our country?
- Peacocks love eating snakes. Can you guess why they dwell in this place?

Based on the case study we find that many animals that were found earlier are not found now.

For example the disappearance of tigers from that area (Ramagundam) means it is extinct for that particular area only. But, can be found in other parts of our country and in the world as well.

When animals vanish forever from the earth, it is said that the species has become extinct.

There are several stories like the case study of Ramagundam in every part of the world. Why this kind of situations take place? Who is responsible for this?

- *Is there any extinct species in your area? Name them and write a note on them.*
- *Give your reasons for why organisms become extinct.*
- *How biodiversity is depleting in your area? How to improve it?*

Endangered species

Observe a sign board displayed at a zoo. "Do you want to see the cruel creature which damages the nature severely and its biodiversity. Please turn this sign board" (There is a mirror backside of the sign board). What does it say?

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Endangered means, it is a warning signal about the organisms whose number has declined rapidly and the species might be wiped off from the earth in near future.

Data of Endangered Species

Keeping track of endangered Species.W.W.F.(World Wildlife Federation) and the I.U.W.C (International Union for Wildlife Conservation) published a book containing the details of endangered and threatened species of Flora and Fauna called as **RED DATA BOOK or RED LIST BOOK.**

The Red data book symbolizes a warning signal for those species which are endangered and are to be protected. Otherwise they are likely to become extinct

(disappear from earth for ever) in the near future.

The following figures show some endangered species of plants and animals of India.

Lion

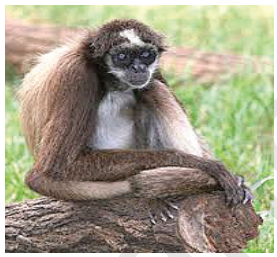
Red fox

Single horned Rhino

Vulture

Spotted Chital Deer

Loris



Black spider Monkey

Wild cat

Cycas

Rauvolfia serpentina

Nepenthes

Sandalwood tree

Do You Know?

Table shows some of the endangered species

Flora and Fauna	Name of the species
Plants (Flora)	Orchids, sandalwood tree, cycas, *Rauwolfia serpentina*
Animals (Fauna)	Leopard, Indian Lion, Indian Wolf, Red Fox, Red Panda, Tiger, Wild Cat, Hyena. Crocodile (Gharial), Tortoise, python, Green sea turtle Peacock, Great Indian bustard, Pelican, Great Indian horned bill Golden monkey, Lion tailed macaque, Nilgiri Languor, Loris

Endemic Species

Observe the pictures and identify the animals. Also try to find out where these can be found?

Peacock *White Tiger* *Ant Eater*

Fig-4

You may find that, these animals are specifically found in certain regions of the world.

You are also aware of the fact that many plants and animals are widely distributed throughout the world. But some species of plants and animals are found restricted to some areas only. Plants or animal species found restricted to a particular area of a country are called **Endemic Species.**

- *Name an Endemic Species of our State?*
- *You may notice that kangaroo is endemic to Australia and Kiwi to New Zealand. Can you tell which among the above pictures represent an endemic species of India?*
- *Name some other endemic species of India.*

You can take help of books from your school library or internet.

Do you know?

Western Ghats support diverse plants and animals. These are about 4,000 different types of plants in the Western Ghats of which 1500 grow only in this area and are called endemic of this area. So far we have been using the term species as endangered, extinct etc. but, 'The Species Concept' doesn't include all organisms. Species concept applies to majority of the organisms that interbreed among themselves or capable of sexual reproduction. Many animals, flowering plants and microorganisms reproduce sexually.

But, all the organisms do not reproduce sexually. There are several organisms that produce by asexual mode of reproduction. eg. bacteria, yeast cells, hydra etc. The species concept does not apply to all these.

Origin of biodiversity and balance in nature

We know that many habitats exist in nature which are quite different from each other. Natural calamities like floods,

earthquakes, forest fires or human intervention wipe out diverse forms in an area, yet after some time we find organisms growing in those areas.

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The process often occurs as sudden invasion of organisms like plants, insects, microbes, humans etc. They interact with each other and form new habitats and increase in numbers till the habitat gets balanced in its own manner.

Do you know?

***Invasive Alien Species* (*IAS*)**? When alien species (non native species) is introduced or invades, it spreads throughout the natural habitats and threatens biodiversity. Even transport of few species to new environment becomes invasive. Their negative impacts on food, security, plant, animal and human health can be extensive and substantial. eg. The Spanish flag plant of the forests and the water hyacinth of lakes are most notorious for invasions.In cities like Hyderabad invasion of pigeons (a non native species) lead to decrease in crows. Now a days a city like Hyderabad lacks these natural scavengers.

Fig-5(a)
Hyderabad pigeon

Fig-5(b)
Water Hyacinth

Diversity is not only seen in wild plants and animals. There is also a great diversity in food crops. In our country we cultivate around 1200 varieties of different species of rice. If we take the example of rice alone there are tens of thousands of varieties of a single species of rice.

Ask your parents about various names of paddy. You will learn more about variety of food crops in the chapter 'Production of food from plants'.

Importance of biodiversity and its conservation

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Why should we conserve a small insect like a bee or a butterfly?

Observe the above two insects. They are sucking nectar from the flowers. In what way do the flowers get benefit? Most of the flowers get pollinated through bees and butterflies. The number of these insects are decreasing due to spraying of pesticides, insecticides.

- What will happen if these insects become extinct?
- What can be done to save these insects?

Measures of saving plants (flora) and animals (fauna) so that they are not lost from the earth surface are carried out through conscious steps of conservation. Government of India has taken initiative to conserve wildlife by making National parks and Sanctuaries which are certain forest areas to conserve forest, flora and fauna from being destroyed.

Efforts towards conservation

Let us read a case study: Project Tiger

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Fig-8

(Source : The national Tiger conservation Authority on internet)

Tiger the largest member of the cat family is the most threatened of the world's carnivores. India has 60% of the world's tigers. For the past 5 years the tigers population decreased to an average of 35% due to poaching and other reasons. In 1972 Government of India launched this project to save the tiger from the brink of extinction. The health of the ecosystem depends on the well being of tiger .At present there are 50 tiger reserves in our country tiger area occupancy found to be stable at 88,985 km^2. According to National Tiger Conservation Authority (Project Tiger) report 2019- the number of tigers present in our country is between 2603-3346. The success of the project was achieved by enforcement of strict anti poaching measures and scientific conservation practices.

Think and discuss

- How can project tiger help to save wildlife?
- What will happen to deer population in a forest where tiger population has gone down?
- What will happen to the plants in such an area where tiger inhabit?
- Why protection of forest is a must?

The above case study of project tiger clearly shows that it's not just saving the tiger but conservation of other flora and fauna related to the tiger is also very important. For example if a tiger has to be saved, its food web should be protected. The tiger depends on deer and many other herbivores for food. If the tiger disappears, the deer and other herbivore population will increase and that would affect the flora of the area. All organisms in nature influence each other, in some way or the other so we need to protect all of them.

Hence, many areas of forests have been protected against human interference.

Activity-5

Let us recall 'Forest our life' that you studied in the previous class. Have a discussion in your class about forest and forest people who help to conserve biodiversity. Write a note on what you understood by human intervention and its impact?

Are not humans a part of the nature as well? There are many people who are completely dependent on forests and live there. What will happen to them if they are removed and not allowed to live in the forest?

National park and a sanctuary

A national park is a large area hitched to conserve wild life, particularly the wild animal species in their natural habitat. For example lions, tigers, rhinocerores etc. No human activity is allowed there in any form. Even grazing of domestic animals is prohibited e.g. Jim Corbett National Park, Uttarakhand.

A sanctuary is a place where conservation of species takes place with an objective of allowing human activity in a limited way without effecting the habitat. Eg. Pakhal Sanctuary Warangal.

- Collect information about various National Parks and Bird Sanctuaries in our country and show in India map.

Lakes and streams are drying up and plenty of organisms living there are being lost. Suggest some ways in which these areas could be conserved. You could refer to your class VII textbook for the same.

Do you know?

Some endangered animals are brought from the wild area and raised in the zoo and released into the wild area again. Here some conservationists disguised as pandas feed the animal before leaving it into the wild. It gives a natural feeling of being fed by mother and living between the pandas. They can survive without human care.

Conservation of biodiversity is an important issue to protect our nature for the future generations. Follwoing is a project idea

7AMQ8N

Project work:

Studying migration and its effect on biodiversity of an area

Look at the sky in the morning and evening.

Do you observe birds flying in groups

(if possible use a binocular for a better vision)

Note the types of birds observed everyday for atleast a period of 6 months.

Fig-9

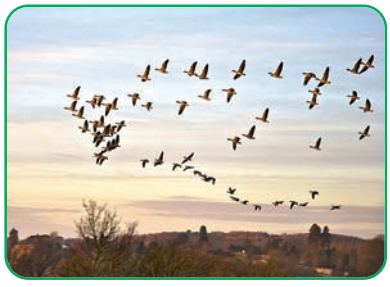

Fig-10

Did you get the same number and types of birds every day?

Was there any sudden variation in a particular season?

Did you notice any new type of bird population in any season?

Discuss with your friends about the effect of the presence of such population.

Why do these birds move from one place to another?

Sometimes at night we see birds flying in groups. Where do they fly? Think.

Sometimes some birds live in the same habitat throughout the year. Other birds which don't have permanent nest and join into small flocks and move from one region to the other for food and shelter(nesting habits) are called as 'migratory birds', and such phenomenon is called as 'migration'.

During rainy season most of the birds from far away places migrate to Kolleru and Pulikot lakes of Andhra Pradesh. They build their nests on the trees in the nearby villages also. In the olden days people believed that these migrated birds are divine ones. But now-a-days most of the trees are being cut down. There is hardly any place for birds to build their nests.

Think and discuss in what way human activities disturb biodiversity.

Do you know the Siberian cranes to escape the winter and food shortage migrate from Siberia (Russia) to India covering a long distance? Collect information about bird migration from your school library or internet and make a booklet on bird migration.

A small step towards saving forests-Recycling of paper:

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A student of an Engineering college sent a message to his teacher on mobile 'Please stop examination – Save trees'.

Even though it is a funny comment, it raises the need of thought towards reducing usage of paper and importance of recycling of paper.

Why should we recycle paper?

We write many things on paper. Often we waste more paper than we write. Incompletely written papers or scribbled ones are usually wasted.

- Try to list where paper in generally misused.

As papers are valuable products made from a green source, which is decreasing day by day we should use it carefully.

To make a ton of paper around 15-25 trees have to be cut down. Wasting paper or using more paper means felling more number of trees causing deforestation.

Using more paper involves using more chemicals that's harmful to us and nature too. Another interesting fact is that the paper can be reused by recycling it 5-7 times.

Project Work :

How to make recycled paper *from waste news papers*?

Materials:

2 plastic tubs, wooden spoon, water, clean cotton cloth, old news papers, wire screen, measuring cup, plastic wrap, blender, heavy books / roller.

Procedure :

1. Cut the newspaper strips and soak in a tub with full of water for a day.
2. Put two cups of soaked paper and six cups of water in a blender. Blend till the mixture turns into a pulp (like runny oat meal).Pour it in a clean tub.
3. Fill the tub with one fourth of blended paper pulp.
4. Lay a cloth on a flat, waterproof surface. Slide the wire screen under the wet paper pulp. Remove the screen gently. Press the news paper pulp to squeeze out any extra water.
5. Carefully flip the screen on to the cloth. Press it down firmly. Remove the screen.
6. Lay another cloth on top of the mixture. Cover the cloth with a plastic wrap and stack the books on the wrap.
7. After several hours remove the books on the cloth and let the paper dry.
8. You can even use a hair dryer to blow the paper dry.
9. By adding few drops of edible colours to the pulp you can make your paper colourful. Iron the new made paper with a iron box and cut it to your required size and shape.
10. Beautiful greeting cards, file covers, bags etc can be made using recycled paper.

Compressed Cardboard

How is it prepared? Is it sustainable? For our comfort and convenience we use wood for making doors, furnitures etc. Earlier furnitures were made using long wooden planks or blocks of wood.

This involves cutting many trees that leads to deforestation. But now a day's compressed cardboards are widely used. Let's know how it's made. It is made from the pulp using bits of wood, saw dust etc. Sulphate chemicals are added to the pulp to extract cellulose.

The pulp is spread evenly as layers and the saw dust sandwiched between the two layers. This is compressed and dried it becomes hard and strong as wooden board. For making compressed cardboards bits of wood and saw dust is required. Hence there is no need to cut down the whole tree. This helps in reducing deforestation.

The existence of biodiversity in nature teaches us that every plant and animal whether useful or not has right to exist on earth. Every organism is a part of our ecosystem. Loss of any organism endemic or otherwise effects the food chain and food web of that ecosystem, which has impact on the survival of other organisms. Hence if we want to protect the biodiversity on our planet first we must become a part of conservation and then make others aware of it. Otherwise, today we see extinction of some other species tomorrow it could be our own species.

Conserving the biodiversity in a wider perspective is utilizing the forest resources judiciously without affecting the ecosystems so that we can have a sustainable development and the biodiversity can be conserved and life on earth survive forever.

Nature is for human's need, not for his greed. We usually think of how to utilize nature for our own benefits . We never think of what to do to conserve nature. Human being is only a part of the nature, not the whole. If we protect nature it protects us. This earth belongs to all animals and plants and every organism has equal right to live. Human beings must be sensitised in this aspect to protect biodiveristy.

•Without biological diversity, we would perish.

- Food webs would be disrupted and organisms will become endangered and then extinct.
- Perhaps the most important value of biodiversity, particularly in a country like India, is that it meets the basic survival needs of a vast number of people.

Key words

Biodiversity, Endemic species, Flora, Fauna, Deforestation, Endangered species, Extinct species, Red Data Book, National Park, Sanctuary, Migration, invasive, Conservation.

What we have learnt

- The variety and variability seen in plants and animals is called Biodiversity.
- The plant or animal species of a particular area (zone), region or country is called Endemic Species.
- Species of plants and animals that have vanished from earth for ever are called Extinct.
- Plants and animal species that are on the verge of becoming extinct are called Endangered.
- The book published by IUWC that contains the details of Endangered and Extinct Species is called RED DATA BOOK.
- Conservation of wildlife along with environment is seen in National Parks.
- Conservation of wildlife, mostly birds is seen in Sanctuaries.
- Movement of birds for nestling from one region to another is called Migration.
- Paper should be used carefully. Using more paper causes more deforestation.

Improve your learning

8YPL7D

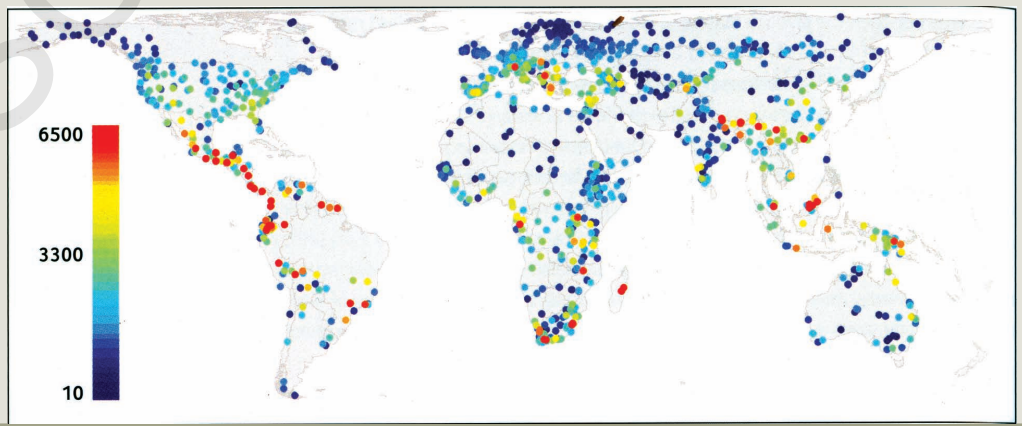
1. Read this and answer the following questions. (AS 4)

Biodiversity-2050.

A news item on Biodiversity discussed by Conference of parties (CoP) -2012-Hyd says in the next four decades the earth's natural resources will be limited to grass lands, mountains, ice and arid and semi arid plains.

By 2050 the loss of Biodiversity will lead to unprecedented climate change would be the key factor. Nearly 1.3 million natural ecosystems will be without any original species.

(The coloured areas are indicators of biodiversity loss. The red areas show maximum biodiversity loss.)



What does the areas with colour codes indicate?

Which areas show maximum biodiversity loss?

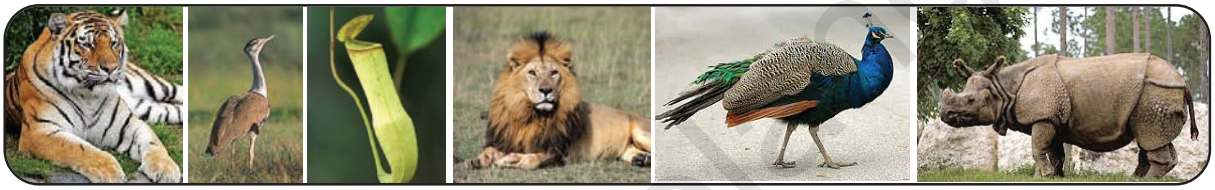
Which areas show minimum biodiversity loss?

From 2010-2050 what difference do you find in the state of biodiversity?

So what steps would you suggest to conserve our biodiversity?

(Courtery CoP-2012 on biodiversity-Hyderabad)

2. How can you say that forests are biosphere reserves? Give reasons. (AS 1)
3. What do you understand about the terms (a) extinct (b) endangered (c) endemic. Give examples. (AS 1)
4. What is the scientific reason behind bird's migration? (AS 1)
5. Identify the endemic and endangered species and write them against the pictures.(AS 1)



6. What is the need of conducting biodiversity meet? Collect information about these meetings when and where it was conducted and its agenda also. (AS 1)
7. Now-a-days we find animals like leopards and bears intruding into our living places. What may be the reasons for this? (AS 2)
8. Make a list of animals /birds seen now and 30 years ago. Take the help of your elders. Write few reasons for their disappearance. (AS 4)
9. Select an area in your locality .Observe the animals (living and visiting) for a day. Prepare a list and plot a graph. (AS 4)
10. When tree is considered as an ecosystem, record the flora and fauna connected with it. (AS 4)
11. Browse through the internet or books on wild life and gather information on bird sanctuaries in India. Prepare a list of birds migrating to India. (AS 4)
12. Visit local forest office and collect the data of local flora and fauna. (AS 4)
13. Where do you find most of the biodiversity on the earth? Draw Telangana map showing maximum biodiversity areas. (AS 5)
14. What do you understand by biodiversity? How can you say variations are present in them? (AS 6)

15. Most of our biodiversity is being lost due to human activities. Suggest few ways to protect them. (AS 6)
16. When you see a park, sanctuary or a zoo with many kinds of plants and animals, how would you express your happiness? Write a few lines on them. (AS 6)
17. Prepare an essay to give a talk on biodiversity and conservation. (AS 6)
18. Rani said conservation of biodiversity starts from our home. Is she correct? How do you support her? What will be your action plan for this? (AS 6)
19. When we take steps towards conserving the tiger, what are the other things that have to be conserved? (AS 7)
20. Prepare some slogans or a pamphlet to make aware of people about conservation of biodiversity. (AS 7)

ANNEXURE

NATIONAL PARKS AND SANCTUARIES IN TELANGANA, ANDHRA PRADESH

S.No	National parks/ Sanctuaries	District	Plants & Animals
	Telangana State		
1.	Kawal sanctuary	Adilabad	Cheetah, tiger, panther, barkingdeer, peacocks,
2	Pranahitha sanctuary	Adilabad	tiger, panther, black buck, storks and herons
3	Eturunagaram sanctuary-	Jayashankar Bhupalapalli	tiger, barking deer, wild boar, fox, jungle cat
4	Pakala sanctuary	Warangal Rural	teak, bamboo, tiger, panther, ningai, hyena, birds
5	Kinnerasani sanctuary	Bhadradri Kothagudem	teak, bamboo, tiger, wild dog, snog bear Chinkara, marsh crocodile.
6	Tiger project	Karimnagar Mannanuru, Nagar Kurnool	teak, tiger, langur, sambar, python, Cheetah
7	Akshara Ujwala Park	Karimnagar	Deers
	Andhra Pradesh State		
8	Papikonda sanctuary	East &West Godavari	wild dog, hyena, tiger, panther, gaur Mouse deer, barking deer, wild dog.
9	Kolleru sanctuary	West Godavari	water birds, herons, flammingos
10	Koringa sanctuary	East Godavari	sea gulls, storks, herons, flammingos, ducks
11	Krishna sanctuary	Krishna & Guntur	fishing cat, otter, jackal, birds
12	Nelapattu bird sanctuary	SPS Nellore	Siberian cranes, pelicons
13	Koundinya elephant snactuary	Chittoor	Elephants
14	Telineelapuram bird sanctuary	Srikakulam	Siberian cranes

The Animals Lawsuit against Humanity

What happened when the animals decided to revolt and take the humans to court for cruelty? A 1,000-year-old story that should still be told today, let us read the story...

Beraf the wise, king of spirits arose from his throne, the sear of judgement and proclimed: "If you humans would practise loving-kindness, the animals would work willingly alongside you. Heaven and Earth would come together and gentle rain would fall. No one would need direction or instruction and all things would take their course. If you humans understood this, like would be transformed and all would be at peace.

"If you humans wish to rule, you must serve with humility. If you choose to lead, you must learn what it means to follow. In this way, when you rule, the animals will not feel oppressed and they will not be harmed. The whole world will support you and not tire of you.

"Do you think you can rule the world and actually improve it?

"I, Beraf, do not believe it can be done. The world is sacred. You cannot improve it. Ultimately, you can change only yourselves.

"The Creator's providence gives all things life. All Nature's creatures are nourished by it and so all of us seek to follow Nature's way. They want to do this because it is natural for them. How does the Creator's providence give them life and rear them? It nurse them on loving kindness, bring them to maturity, feeds and shelters them.

"Therefore, oh humans, heed my words: cultivate loving-kindness in yourselves. Cultivate if in your families. Cultivate if in your settlements. Cultivate if in your nations. Cultivate if in the world and it will everywhere. Then Bersaf the king declared: "Now I will deliver my verdict".

And all the king's advisers and the sage spirits, all the representatives of the humans, and all the emissaries of the animals rose up and stood silently awaiting his words.

"By the grace of Nature, I find in favour of the animals, for they have been sorely tested and abused. However, it is clear to me that these humans now realise the harm they have caused to Nature's other creations and now begin to understand more of what it means to be their rulers. Therefore, although I find in favour of the animals in their lawsuit, the humans are guilty for what they have done up until now.

"You humans are hereby served notice that your behaviour towards your fellow creatures must change! And to ensure your compliance with this court's decision, I am sending a record of these proceedings to the Supreme Court on high.

"Furthermore, acting as agent of that Court on High, I am setting 10 signs as warnings to you lest you backslide. If these things begin to occur, know that you had better change course and return to the Creator's way lest catastrophe overtake you.

"Should you err, the animals will begin to disappear, one by one, forever, from the face of the Earth; and the air in your settlements and fortresses will become dangerous to breathe.

"Should you still not change, the sky will weaken and the earth willh reveal its nakedness to the sun, the water in your streams and the rain in the sky slowily will turn undrinkable.

"Persevere in your wicked ways, and still worse will happen: the seasons will be reversed and your climates turned on end; the earth will cease yielding up its goodness and the sky will cease its rain. In the middle of summer, plants will drop their leaves, and unripe fruits will fall as if it were autumn.

"Nor shall this be end. Continue, and the animals you eat-fish and fowl, beast and bug-will bring sickness and death upon you, and you will be forced to fight each other - and even eat each other - for lack of food.

"In the end, should you ignore all these previous signs - you humans will be displaced from your place of glory and no longer rule the Earth.

"So mark my words, you humans, and heed my warning. Change your ways while there is yet time.

"Oh humans, Creation is good; you can be good. So cease this ferocity towards your fellow creatures. Things need not turn out as I have said.

"For now, let me simply remind you of your duty: you have domesticated some of the beasts, and now that they are used to shelter and a regular supply of water and grains, they could not survive again in the wild.

"You humans have responsibility for them and you will be held accountable for the health and vitality of the domesticated creatures. You ought not to rule them, but to serve them, so that they might serve you better. The beasts are simple-hearted. In time they may come to trust you again if you carry your task out well.

"This is my verdict, as nature is my witness."

The humans stood in stunned silence, contemplating the weight of the fearsome curses and picturing what life would be like if the King's prophency were to come about, but no one could muster a response, with heads bowed.

All stood as mutes, with heads bowed.

Finally, Hochmach, the wise and sagacious woman, came forward. Then she prayed and confessed; "Praise the Ruler of All World, the Source of being and Giver of life to us all. What you say is true, our Lord and King, and your judgement is just.

"We have done wrong and we will try to do better. We must choose our leaders wisely and not surrender to crude anger, violence and power.

"Universe is One, Creation is one, all life is one. And when one part of that whole suffers, all of it eventually will suffer. Practising loving-kindness restores wholeness and build unity. Thus we should always have this essential unity and wholeness in mind. My Lord and King, you bands of spirit sages, and you families of animals, we shall try to live our lives defferently."

Chapter

7

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.
- Non living and living things are part of a habitat.

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Try to add more such points to your list.

- ……..
- ……..

Fig-1

Gayathri and Venkatesh are debating whether habitat and ecosystem are same? You may also ponder on that. Let us try to understand how the term ecosystem came into existence and in what way ecosystem is different from habitat.

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 influenced by many non living environmental factors and vice versa.

Till the use of the term ecosystem, people were studying inter-relationships in nature in separate units mainly of an individual and those live in the environment. Habitat is a place that fulfils the needs of such organisms.

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

Lab Activity

Structure of the ecosystem

Aim : Let us study an Ecosystem. It may be your school/home garden. It will help you to understand the structure of an ecosystem.

Materials Required : Measuring tape string, small sticks, hand lens, hand towel, shovel.

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

Form groups, each group with four students.

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/small sticks as shown in figure 2. This is the area now we have to observe.
3. Observe the study area (that has been marked). Look for plants and animals that live there. Use the hand lens for keen observation.
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.

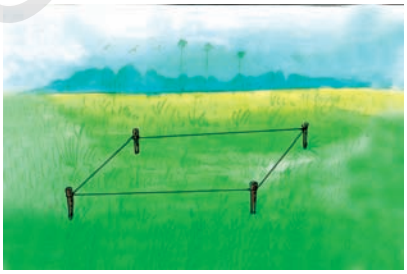


Fig-2 : Marked area of 1 meter square.

Write your observations in your notebook.

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 could you record from your study area?*

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

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

Interdependence among the biotic components

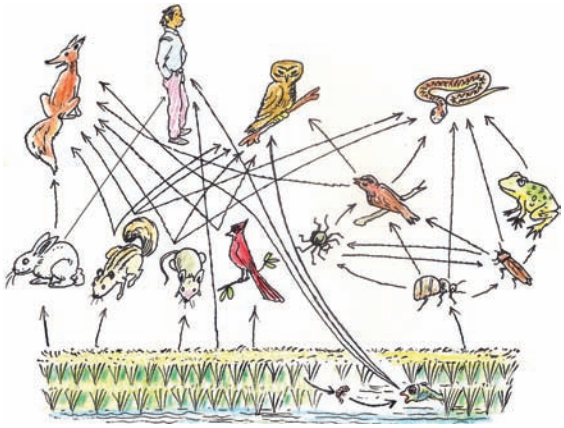


Fig-3 : Relationship between biotic components

- *What do the arrows in the figure indicate?*
- *Trace the path from grass to snake. (You may trace out other paths as well).*
- *On how many organisms fox is dependent for its food? 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.

- *Where do plants get their food from?*
- *Except food what other things do animals need for their survival?*

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 during photosynthesis. Animals do not get energy directly from the sun. Many animals eat plants, which use sunlight to make food. Animals that do not eat plants still indirectly depend on the energy of sunlight as they eat other plant eaters. So energy from sunlight is transmitted to all living things.

When scientists describe the way energy moves through ecosystems, they use the term food chains.

There are different feeding levels in a food chain. At first level several plants, algae etc use sunlight to make their food and are called **producers.** At second level some animals eat plants and are called **Herbivores**. At third level some other animals eat herbivores are called **Carnivores**. Herbivores and Carnivores are called as "Consumers".

At every level there are organisms called **Decomposers**. They feed on wastes, debris of plants and animals or on their remains after they die. They decompose remnants and return nutrients to the soil. Plants use these nutrients and the cycle goes on.

Now answer the following questions:

- *Make a list of producers in the food web?*
- *Which organisms are consumers?*
- *Where does the food web start from?*
- *Where does the food web end.*
- *What happens when plants die in a food web?*

Changes in the ecosystem

Organisms affect their environments to meet their needs.

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 due course of time, there will not be enough food for the birds. In this situation some birds would leave the area. This would effect ecosystem, where they go away. It may restore balance to the ecosystem that they left (or) affect it adversely.

Powerful storms, earth quakes, fire accidents, tsunami, etc can destroy ecosystems very quickly.

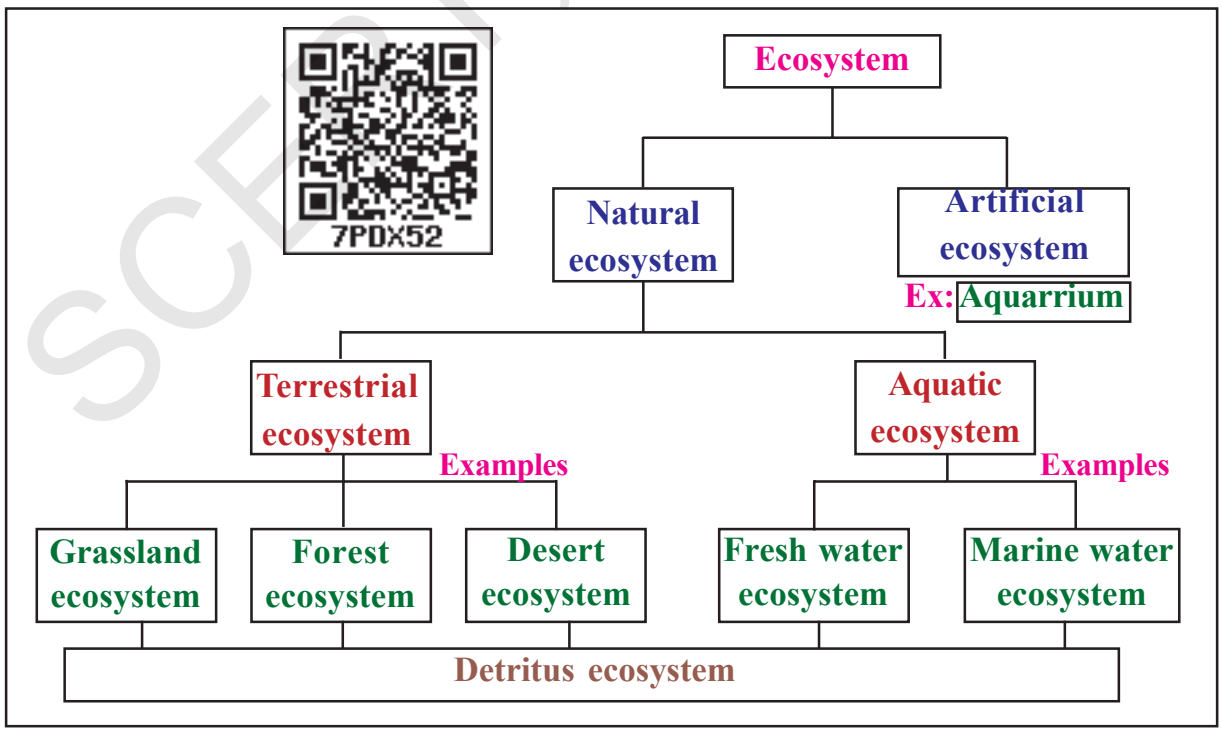
Humans are also instrumental in bringing about changes in ecosystem.

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 this biosphere into different ecosystems based on various aspects.

Types of Ecosystem

Due to the Abiotic and biotic factors, different ecosystems develop in different ways. These factors and their interaction between each other have resulted in the formation of different types of ecosystems.

On the basis of habitable areas, ecosystem may be classified as follows:



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 ecosystems. 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.

Now let us study some ecosystems.

Mangrove ecosystem

Mangroves are one of the most productive ecosystems on earth, deriving mineral nutrients from terrestrial fresh water and tidal salt waters. Mangroves are the forests that grow in back waters of low depth areas of sea shore. Mangrove serves as an important feeding, nourishing and breeding ground for a variety of commercial by important organisms and also serves as protected area for 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 Corangi and Gaderu rivers, tributaries of Gautami and 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.

Fig-4 : View of mangroves in Coringa

Biotic components

Producers - Mangrove, *Spirogyra, Oscilatoria, Ulothrix* (blue-green algae) etc.

Consumers - shrimp, crab, Hydra, protozoans, mussel, snail, turtle, daphnia, brittle worm, tube worm, etc.

Decomposers - Detritus feeding bacteria, etc.

Abiotic components - Marine and fresh water, air, temperature, sunlight, soil, etc.

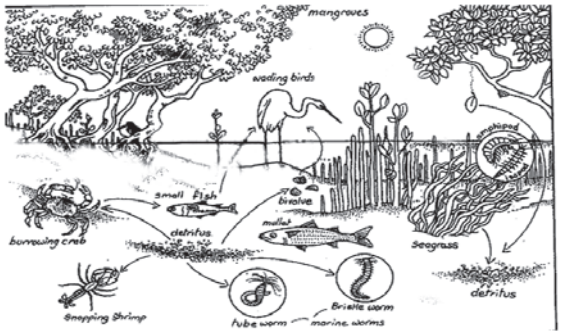


Fig-5 : Food web in Coringa Ecosystem

Do you know?

There are between 5,00,000 to 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.

The Desert Ecosystem

The deserts occupy about 17% of the land and occur 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. They have so many adaptions according to surroundings. Desert areas look like those shown in Fig-6.

Fig-6 : Animals and plants in Desert Ecosystem

1. Producers – The shrubs, 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 into thorns and spines. Some succulent plants like cactus (a type of cactus is *Brahma Jemudu*) are also found in desert. These store the water in their stems to be used during the time of water scarcity. Some lower plants such as lichens, xerophyte mosses and blue green algae etc. may also be present.

2. Consumers – Only a few animals are found in deserts, Comparaed to grass land and forest. Animals which are able to survive in Xeric conditions can only live in deserts. This includes some species of insects, reptiles, birds and mammals. Mammals are represented by a few species of nocturnal rodents. Some birds are also present in desert.

The camel, called the "ship of desert", feeds on tender shoots of the plants. It has the ability to conserve water in its body. The larger animals are scarce. The desert animals have various morphological and physiological adaptations which enable them to live in such extreme environment. How do long legs and large eyelids help the camel?

3. Decomposers – Due to poor dead organic matter and less amount of vegetation, decomposers are few. They are thermophilic fungi and bacteria.

Forest Ecosystem

Activity-2

Divide all of your classmates into four groups and collect the information on forests of Telangana. 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	
Moss and fungi		Birds	
Add other plants		Insects	

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

Investigations:

1. *Do all forests have same type of vegetation?*
2. *Are producers of forest ecosystem higher than its consumers? Why?*
3. *Do all the forests have same type of animals? What are the different types of animals in each forest?*

Forest ecosystems 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.

Producers (Flora): These are mainly plants 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 ground vegetation.

Consumers (Fauna): It includes insects like ants, flies, beetles, grass hoppers, bugs etc., and other animals like. Eg: Elephant, Nilgai deer, moles, squirrels, etc. Also carnivores like mongoose, snakes, birds, lizards, fox, mongoose, Lion, tiger also live in forest feeding on animals.

Decomposers: These include a wide variety of micro organisms which live on the dead bodies of flora and fauna (including) fungi and bacteria are decomposers.

Energy flow in an ecosystem

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

The main source of energy is sun. 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, land and in evaporating water. Nearly 8% of light energy reaches plants, of which 2% is utilized in photosynthesis.

The energy stored by plants is passed into the community or ecosystem through a food chain. A food chain consists of producers, herbivores and carnivores and omnivores or organims that feed both on animals and plants. Herbivores , carnivores and omnivores are 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.

Key words

Habitat, Ecosystem, Food web, Producers, Consumers, Decomposers, Rodents, Flora and Fauna, Thermothilic fungi, Mangroves, Energy flow, Nocturnals, 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 web explain interdependence between biotic and abiotic components in the form of nutrient and energy.
- Food chains have three level- producers, herbivores and carnivores.
- Decomposers and integral part of every level in a food chain.
- The producers trap the sunlight to produce food.
- 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

8YYH91

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. What happens when two animals having similar habits share one ecosystem? How could you conserve this type of bio-diversity? (AS 2)
4. What is the difference between habitat and ecosystem? (AS 1)
5. 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. .....
6. Which of the following is a producer? and why? (AS 1)

   (a) fox (b) fungus (c) hen (d) grass

7. What do you understand by food web?
   Describe your own food web with the help of a diagrammatic representation.(AS 1)
8. An ecosystem has mice. What happens if more cats are added to it? (AS 2)
9. List out producers (Plants, Bushes, Trees). Consumers (herbivores and carnivores) and Decomposers that you observed in your agriculture field or school garden. (AS 4)
10. 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)
11. Plant, Tiger, Rabbit, Fox, Eagle

    Did you find any connection among the above list of things. If we remove Rabbit from the list what will happen? (AS 6)
12. What do you understand by inter-dependency of animals and plants? How do you appreciate? (AS 6)
13. Collect the data of plants and animals from a park near by you and fill in the table in the page No. 109 and write a report on it.
14. Prepare a table on adaptations of the desert animals, collect the data from your school library?
15. Construct the food web with the following?
    Grass, Plants Grasshoper, Frog, Snake, Eagle, Goat, Fox, Tiger, Wolf, Rabit.

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

-Mahatma Gandhi

ANNEXURE

Energy flow in ecosystem

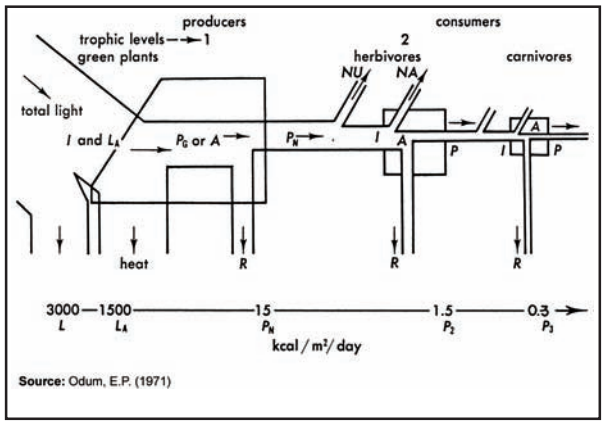


Fig of Energy flow in an ecosystem

Fig. Observe 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 production actually represent food potentially available to primary consumers 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 to ecosystem.

Chapter

8

Production of Food from Plants

Naveen went to his uncle's village for a vacation. On his way to home, his uncle showed him their fields. Curiously, Naveen asked his uncle, what crops are grown in the village? Uncle said that Maize, Paddy, Wheat, Ragi etc., are grown there.

Activity-1

Crops in India

Observe the following map (India). Observe and list out the crops and the places where they are grown.

- What are the crops that are grown in most of the parts of our country?

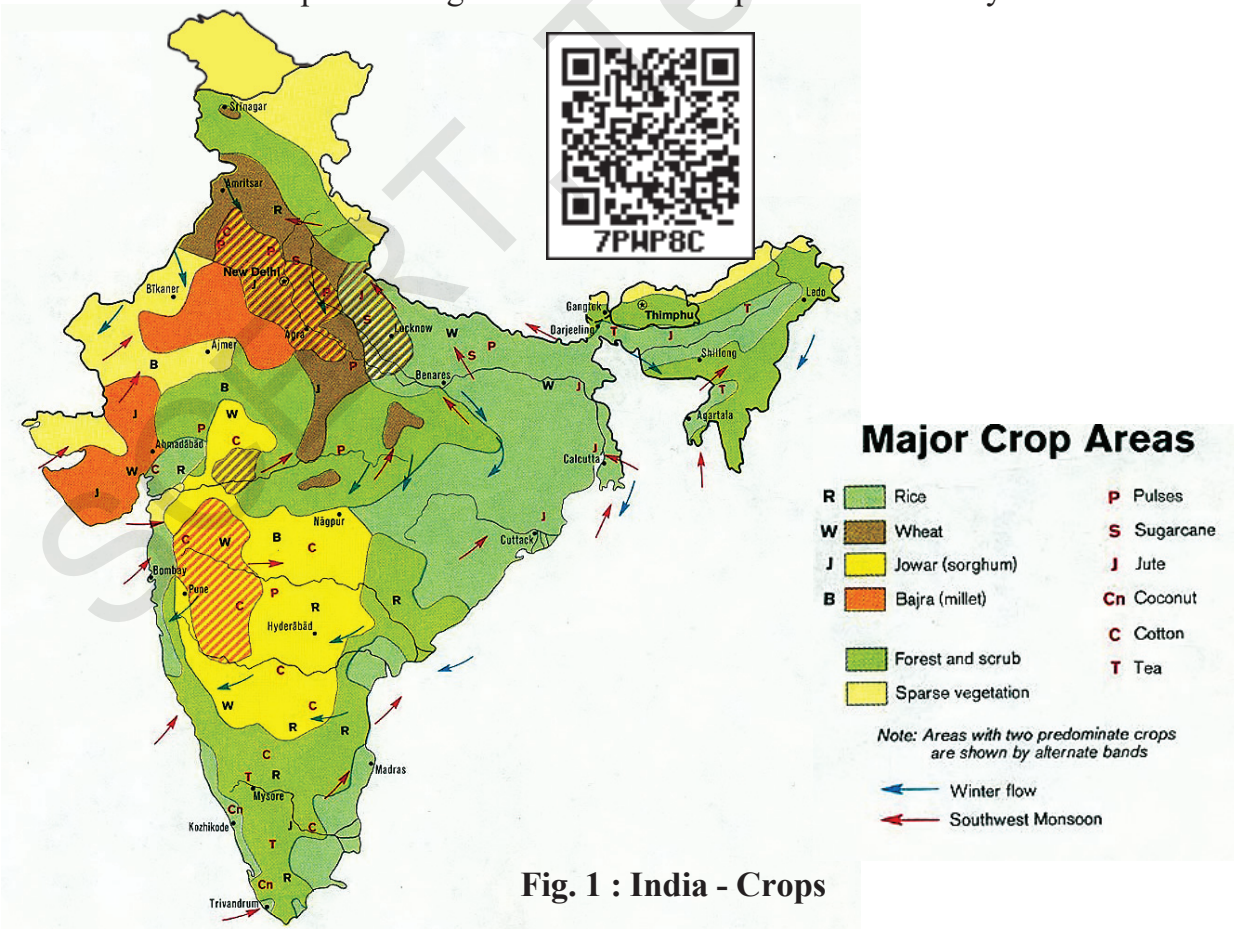


Fig. 1 : India - Crops

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

Go through your social studies text book/library books and make comparative statements showing crops largerly grown in different areas.

a. In our Country _____

b. In our State _____

c. In Your District _____

d. In Your village _____

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

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'.

- How many days are required for getting the crops?
- Is growth period for all the crops same?
- Which crop needs more duration?

Activity-2

Duration of crop

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

Table - 1

Name of the Crop	Duration of the crop

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

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

.....

.....

Some crops like green gram, black gram take 100 days for harvesting and such crops are called "**short term crops".**

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

.....

.....

Activity-3

When are crops 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.

Table - 2

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 crops. Generally in rainy season, ponds, wells, rivers, ditches are pooled with water. Hence, farmers grow varieties of crops in this season. Can you name some crops that grow in rainy season? (June to October). The crops grown in the rainy season are termed as "**Kharif (rainy season) crops**". In Arabic Language Kharif means 'Rain'. Paddy, Chilli, Sugar cane, Jower, Cotton, Black gram, Turmeric etc are Kharif crops.

Now see the table 2. What are the vegetables, fruits, cereals and pulses you have written in the table. Which crops are widely grown in winter season. Do these crops require water like Kharif crops? The crops that are grown only in winter season (October to January/ April) are generally called **"Rabi (winter season) crops"**. In Arabic language Rabi means 'Winter'. Wheat, maize, Coriandar, Barley etc are rabi 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 some main reasons for flowering of plant.

1) The flowers will come out from the plant after certain growth. In some crop plants flowering initiates after growing certain branches, nodes and after producing a few leaves.

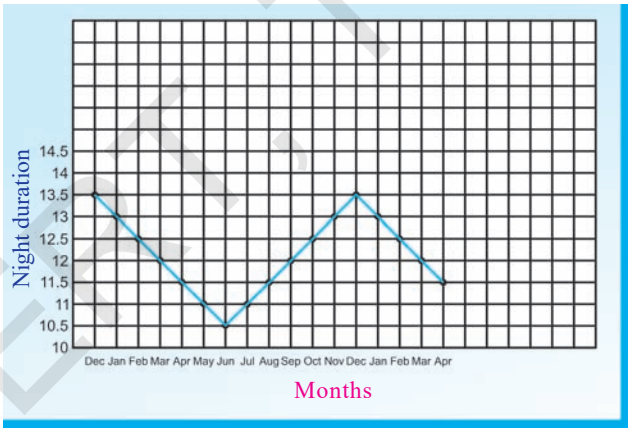
2) Flowering of plants also depends upon the duration of night time. The effect of night duration in flowering plants differs from plant to plant. In some plants when the night duration is shorter than 12 ½ hours the flowering will be more. For example in wheat plants flowering takes place only in short night durations. As long as the nights are longer than 12 ½ hours the wheat plant does not flower. In addition to that, temparature is also not sufficient to seed formation. So these are called short night duration plants (these are also called as Long Day Plants).

In plants like maize and cotton flowering will be more when the night duration is more than 12 ½ hours. These are called long night duration plants (these are also called as Short Day Plants).

3) In some plants night duration is not at all the reason for flowering. They can give flowers any time during the year Eg: Soyabean. These are called Day Neutral Plants.

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. So the flowering does not take properly at that time. Seed formation is effected due to low temperature. So the production of crop will be low.

Now observe the graph and answer the following questions.



- *Why farmers cultivate Wheat crop only in Rabi season?*
- *What happens if it is cultivated in the month of September?*
- *Why do farmers not cultivate Wheat in Kharif season?*
- *If we cultivate wheat in the month of 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. Short night duration and suitable temperature are needed for proper flowering in wheat plants.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 seasons. 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 and collect the information from nearest farmer and fill the following table.

Paddy growing season	Paddy Production Per hectare (1 Hectare = 2.4 acres)	Quality of seeds	
		Size	Weight
Rabi			
Kharif			

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

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

Growing paddy and Agricultural practices

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

Table - 4

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

Think and discuss

- What are the reasons for high production in Japan?
- What are the reasons for low production in India?

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

- How paddy grown in fields?

The paddy growing field is divided into so many plots (Kayyalu or Madulu). Do you know 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 they plan they take into account the nature of the soil, humidity, rainfall and temperature, because they vary from time to time and place to place. They cultivate the crops accordingly. In general farmers start agricultural works before monsoon reaches (May, June months). At that time farmers celebrate festivals like "Eruvaka". Ask your parents, elders about this festival.

Do you know?

Rice growing is a seasonal task and associated with many festivals. The sowing and transplanting is associated with Eruvalea and harvesting is associated with Sankranthi. Agricultural tasks are carried out to the tune and rhythm of certain songs related to cultural practice. Do you sing such songs? Collect those songs from your village and sing them in your School Theatre day (Bala sabha).

Agricultural tasks sowing to storing

The cultivation of paddy involves a series of activities. Do you know them? Write the list of practices in your note book. Now you will learn about the agricultural practices to be followed from time to time and their methods in general. Many crops are cultivated in the same way but some need special methods. They are as follows

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

Agriculture practices are carried out either using manpower and 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. Now let us know about these practices in detail.

1. Preparing the soil

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

a) Ploughing and applying manure

Farmers divide the field into plots (madulu). Then each plot is ploughed and harrowed. 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.

Think and discuss

- Do they prepare the dry lands also in the same way for cultivation?
- what are the advantages of ploughing?

Fig-2 : Wooden plough

Before growing crops proper ploughing of the soil is necessary. Ploughing loosen the soil and it helps in easy 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.
- Soil friendly micro organisms and earth worms can grow well when the soil is soft.
- Some harmful microorganisms insect eggs come out and 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. At the end of the plough a sharp chisel like

Fig-3 : Iron plough

iron nail is attached, which helps in penetrating the soil.

- *How many nails does a wooden plough have?*

Go to a nearby farmer and 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. This helps for better watering of the crops.

b) Leveling the soil

The fields have a lot of ups and downs even after ploughing. So, a leveller is used for leveling the soil. By leveling the soil water and nutrients can be reached to every part of the land. It also helps in sowing seeds and planting.

The leveller is made of a log and iron blade. This is tied to bullocks with a rope. This helps in the leveling of the soil.

Fig-4 : Iron leveller

Fig-5 : Preparing field for sowing

2. Sowing the seeds

Sowing of seeds in the field is an important task. Farmers should take so many precautions before sowing seeds. Production of crop is mostly dependent on quality of seeds.

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

Before sowing, farmers select good quality seeds. The healthy seeds give 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 the crop either they 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 farmers.

Activity-5

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. Next day lay them to dry then keep them to sprout in warm, moist and dark place.

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

Do you know?

The name *Oryza* for paddy- was given 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. Hamsa is the traditional good variety which is grown in our sate. Amrita Sari, Bangaru Teega, Potti Basangi, Sona masuri are some of our traditional varieties. Now a days, the most used 'Sona' variety is also a famous one.

Activity-6

Selection of Seeds

Take some water in a glass. Drop a fist of seeds in it. You can observe some seeds floating on water. Collect those seeds and observe with a hand lens and compare with those seeds that sank in the water. Write your observations in the table. Put a '✓' mark.

Table 5

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

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

Activity-7

Germination and selection

Sow both (sunken and floated) 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?
- Can we test all seeds like this manner?
- How the paddy seeds germinate?

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

Observe a sprout of paddy.

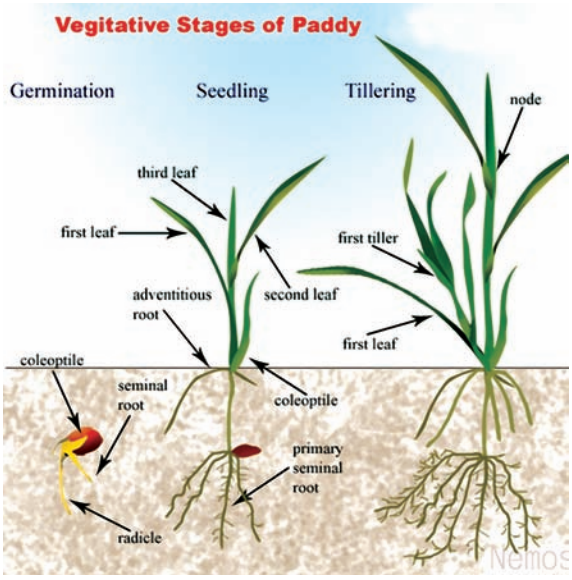


Fig-6 : Different stages in sprouting paddy seeds

Seed crisis

In olden days farmers used to select the seeds from their own crops which are cultivated by themselves. Farmers in our state generally purchase seeds in the nearby market. The grains that are available in the packets play a 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. They grow into plants, but 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 farmer without dependency of farmers on seeds from market?

Selection of seeds free from pests and insects 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-7 : Fungicide

Types of Seeding

The medicated, germinating seeds of paddy are sprinkled on the paddy fields. Generally farmers follow this method to grow paddy crop. Are all the seeds dispersed like this? Most of the time farmers develop seed beds to grow paddy seedlings (naaru). These grown plantlets are uprooted and planted throughout the field (naatlu).

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

Different types of sowing the seeds

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

Activity-8

Sowings Methods

Collect information from the nearby farmers and fill the table.

Table - 6

Seeding by dispersal	Sowing with hands	Sowing with seed drill

Fig-8 : Broadcasting

The method of dispersing seeds by scattering 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 put 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 distance to be maintained between plants, farmers select 3 to 6 piped seed drills. After that farmers cover the seeds with soil.

If we don't do like this, do we 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 and write the reasons for that.

Modern 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.

Fig-9 : Modern seed drill

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

This stage might have taken from 14 to 40 days depending on the variety of paddy, 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. (Natlu veyadam)

The paddy variety 'SRI Vari (SRI - system of rice intensification)' requires much gap between the plants. Ask your elders/ farmers, 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 farmers follow this transplantation method for all types of crops?

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

Fig-10 : Transplantation

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

Fig-11 : Paddy planter

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

3. Applying manure and pesticides:

The growing Paddy 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-12 : Disease affected paddy plants

Activity-9

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.

Table - 7

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 common to 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?

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 affected by pests. Sometimes caterpillars suddenly appear on the leaves of the plants and eat them.

Activity-10

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. If the character is present put a '✓' mark and if there is no character put 'X' mark.

Name of the plant/crop : .....

Place : .....

Table - 8

Characteristics	Leaves	Stem
Twilted		
Rolled		
Spots appear		
Colour		
Fleshy spots		
Powdery spots		
Caterpillars		
Scars		
Worms		
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 formed?
- Are the scars on the stems same as spots on leaves?
- Collect powdery substance of the spots on leaves and observe under microscope. Write down your observations.

……

……

Do you think there is some relation between these spots and caterpillars and insects? 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 rotten 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 formed? Is there any powdery like substance? This is because of virus. We may see white brown colour spots on fruits and leaves. This is because of bacteria. Along with these diseases leaf minor, citrus butterfly, aphids, mites can be seen on lemon plants. They are the carriers of disease causing virus, bacteria and fungi. They spread the disease in crop.

Controlling pests:

- What will we do to crop plants which are affected by the diseases?

Observe the following pest controlling practices.

- A farmer 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 burns them.

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

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

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

Activity-11

Pest controling 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 cuts in leaves are evidence of damage caused by insects, often

by 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 infectiones. 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 help 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 number 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 is less. 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 by round worms mites, crabs, millipedes, snails and slugs.

Fig-13(a) : Aphids (b) : Viral Disease (c) : 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 many pesticides are harmful to other harmless and useful insects. Using pesticides, is very harmful to our environment.

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 in use 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 in the soil decrease and soil becomes infertile. Nature of soil is also changed. 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 (N P K) etc.

- How do farmers manure the crop? What type of tools do they use?
- Do you have a compost pit in your school / house? What material you put in it?

Manure is of two types

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

Natural Manure (Bio fertilizers)

These fertilizers are formed by decomposing plant and animal wastes. In rural areas farmers dump plant and animal wastes outside the village in an open space. Some bacteria like Azatobacter and Nitrobacter decompose it into manure which contain nutrients. This manure when added to the soil, 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, Potassium which are enriched with Nitrogen, Phosphorus and Potassium.

Fig-14 : Chemical Fertilizers

Nitrogen (%)

Phosphorus (%)

Potassium (%)

Think and discuss

Have you ever heard or read in the newspapers that farmers doing strikes for fertilizers. Why does this happen? Why do 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 and write the constituents in it?

Which manure is better?

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

Table - 9

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. Humus is not deposited in soil.	3. Deposits of humus layer is found in the soil.
4. More amount of Nitrogen, Phosphorus and Potassium deposits in the soil.	4. Less amount of Nitrogen, phosphorus and Potassium deposit in the soil.
5. Decrease the health of soil.	5. Increase the soil health.

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-15

Which crops are 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' (W.U.A) 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-16

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 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 are in dissolved state, only then they are absorbed by roots and transported to all the plant body. That's why farmers water their field after adding manure to it.

Activity-12

When should farmers irrigate the field?

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

Table - 10

Name of the crop	Stages of providing water

- Are all the crops provided with equal amount of water and in same number of times?

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 is 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 do farmers provide more water to the summer crops?

Observe the following pictures


Fig-17 : Ancient irrigation techniques

In the Ancient practices of agriculture, farmers used to cultivate lands by using mota bavi, 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?

Modern methods of Irrigation

During irrigation large amount of water is 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-18 : 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 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. It consists of 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. Discuss the uses of drip irrigation.

Fig-19 : Drip irrigation system

Activity-13

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

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 should they 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.

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. Hence, they should be removed.

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 was imported along with wheat from America long before.

Fig-20 : 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 Thunga grow along with paddy.

We can see plants like Tridax, Amaranthus, Golagandi, Typha, Jeeluga grow as vegetable crop weeds.

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

Activity-14

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 up rooted 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-21 : 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 dicot weeds. But these weedicides do not work on monocots.

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

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.

Fig-22

Harvesting of paddy

For a paddy crop harvesting can be done by hand, using a sickle. After cutting , the grain is spread 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 machinary 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 agricultural 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 backbone of our country. So young generations should develop more passion towards agriculture which would be the only benificial profession in near future.

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-23 : Thrashing

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-24 : 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-25 : Modern Harvester

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

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

Fig-26 : 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 use traditional methods to harvest.

Activity-15

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-27

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.

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.

Fig-28 : **Cold storage unit**

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 crops. It starts from June to September.
- The crops grown in winter season are called Rabi crops. It starts from October to January/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 through out 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

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1. State reasons why wheat is cultivated in Rabi season only? (AS 1)
2. Ramaiah levelled his field. Somaiah's field has many up and downs. Who will get more crop yeild? Why? (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. Why do farmers dry the paddy crop after cutting them from fields? (AS 1)
6. Give some examples of plants that grow after replanting? (AS 1)
7. Rahim removed weeds in his crop field, but David did not.Guess who get more yield. Why? (AS 2)
8. What is natural manure? How to prepare it? Give two examples? (AS 1)
9. Why do farmers plough their field during summer? (AS 1)
10. Rajendar cultivated cotton crop in his field. He did not get sufficient yield. Can you guess the reasons? (AS 2)
11. Place a fist full of Bengal gram (or any other seeds) seeds in a bowl of water. Do you find some seeds float while others sink? (AS 3)
    - Why do some seeds float and others sink?
    - Which seeds do you think will germinate and why?
    - Which seeds do you think will not germinate and why?
    - Which seeds do you think farmers should use for sowing in the field.
12. I am a plant. I grow in crop fields. Farmers pluck me as soon as they see me. Can you tell who am I? (AS 2)
13. 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	

14. Prepare a flow chart from ploughing to yielding in paddy (AS 5)
15. How do you appreciate the irrigation systems used in the drought prone areas? (AS 6)
16. 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)
17. 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)
18. Take some paddy grains and soak them in water for one day. Take them into watch glass and sow them in soil. After that observe the radicle and plumule with the help of hand lens and draw the picture of it. (AS 3)
19. What is the relation between night duration and crop field? (AS 1)
20. In a village all farmers have grown same type of crop. What are the disadvantages of this practice? (AS 6)

Chapter

9

Production 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? Are 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 food that is obtained from animals? Discuss in groups and tabulate your discussion in your note book.

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Animal Husbandry:

Farmers adopt different methods of management for getting better yields in agriculture. In the same way, care is also required in the management of rearing animals. Providing food, shelter, protection and breeding of animals is called 'Animal husbandry'.

Fig-1 : Dairy farm

Since long time, we have been using animals not only for obtaining food but also for agriculture, transportation etc. We realized their importance and domesticated them.

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 we domesticated only some of the animals?

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. Food production is the main aim in rearing the animals.

Can we get all nutrients required for our body by eating only plant?

We get our food from plants. But food production from plants alone does not fulfil all our needs, 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 agricultural fields also rear cattle and other animals?
- Is there any relation between agriculture and 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.

Cattle Rearing

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 villagers send their animal to graze at the places where grass is easily available.

- Where do people rear their animal in your village?

Fig-2 : Cattle rearing

Have a talk with them and collect information about cattle rearing. For this you need a questionnaire. Following questions may be helpful to you. You can add some more questions as you wish.

- What are the cattle here?
- At what places fodder is available?
- What are the places where water is available?
- What are the necessities of rearing of cows, buffaloes, goats and sheep?
- What are the major problems that animal rearers generally face?

Earlier, villagers used to appoint a person for cattle rearing and was paid by them. This kind of practice is gradually disappearing from 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 buffaloes in large scale is also the same in sheds. Generally 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 for ploughing and other agricultural practices.

- Make a list of agricultural practices by using bullocks and the buffaloes.

Rearing of goats and sheep is also related to agriculture. Besides agriculture, cattle rearing and sheep rearing are beneficial to farmers. During off season for cropping 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 equally important task in animal husbandry. Most of the times 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 (foot and mouth disease) is a common and dangerous disease partially in cows and buffaloes. Sheep and goats suffer from worm infections (Nattala Vyadhi).

Some parasitic diseases cause damage to liver and intestine. Viral and bacterial diseases also affect 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 the veterinary hospital located in your area?*
- *Who 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.

Fig-3 : Milk production

Cows Buffaloes

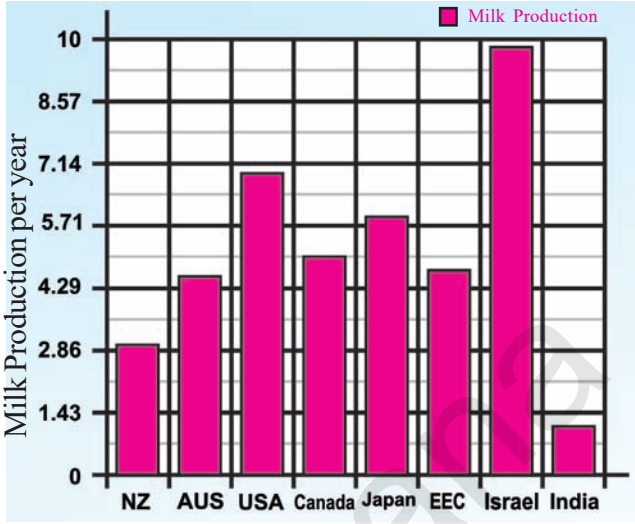
Donkey, Camel, Goat, Sheep

- *From which animal do we get maximum milk?*
- *Apart from cows and buffaloes, which other animals provide milk?*

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 use at your village?*
- *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.



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 varieties of cows in our country which give good quantity of milk. Jersy (England) and Holstein (Denmark) are the Foreign varieties. They give 25 liters of milk per day. These foreign varieties are cross bred with our native or local varieties. They give 8 to 20 liters milk per day. Cows play vital role in total milk production of our country.

Fig-4 : Jersy

Fig-5 : Holstein

Out of milk produced in our country 60% is used to prepare cheese, khova, ghee, curd, milk powder and other milk products. There are number of dairy farms in our state. The milk in dairy farm is collected from households and pasteurized. Milk is preserved in packets and transported. You might have studied about HTST method in story of micro organisms II lesson.

Pasteurization : This is the process of destructing disease causing microorganisms by boiling milk at 63^0C (145^0F) for a period of 30 minutes. After that it is immediately cooled to below 10^0C and stored. This process is used in milk chilling centres.

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)

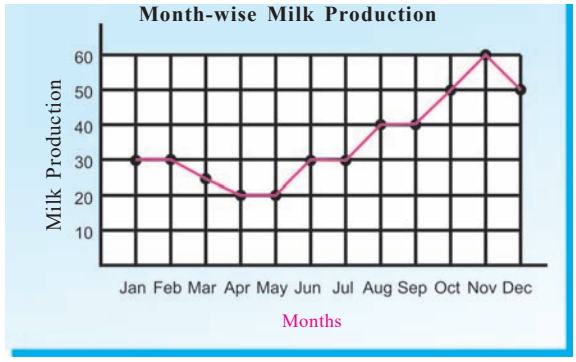
There are private and government milk collecting and chilling centers in our state.

Fig-7 : Milk chilling center

Uttar pradesh is the highest milk producing state in India. Our state is taking many steps to produce milk in higher quantities.

- 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 months. Let us observe the graph showing milk production in our state.



Graph-2

- Why the milk production is higher during some months? Discuss in your class and find out the reasons.

Prof. J.K. Kurian, father of white revolution in India, worked a lot in increasing milk production through co-operative societies to fulfil the needs of our country. He proposed innovative activities in producing hybrid varieties of cows and buffaloes, 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 buffaloes. These nutritious food helps to produce more milk.

Do you know?

Milk production in cows start with the birth of a calf. It is often suggested that after 2-3 days of delivery, milk may be collected for human use. Thereafter a cow may produce milk for a period of upto 10 months. Milk contains fat, proteins, carbohydrates,minerals and vitamins (mainly A, B and E). Nowadays cattle rearers and dairy farmers are using hormone injections to get high quantity of milk.

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 yields (younger ones)
4. Body size, capacity of eating fodder and health.
5. 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.

Do you know?

Now a days adulterated milk is available in the market. Urea, flour and different types of substances are used to produce milk. These are packed and sent in to the market. How do you recognise the original milk? What are the tests administered to know the pureness of milk know from your teacher.

Practices in livestock keeping:

Being high milk yielding varieties, livestock (The animals that are used for milk and agriculture are called livestock) rearing 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 Komuraiah. My family has 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, wider shoulder bone and larger hump. 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 mating. We charge Rs.300 per mating. We have three cows too. Each of them produces upto 20 litres of milk. Our income has reduced because only a few people bring their cows for mating.

Do you know?

In Odisa 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 refrigeration.

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 on. What occasions 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?

The bones of animals are grinded and used as manure. Leather is another animal produce. Leather is used for manufacturing many products like bags, belts, shoes etc.

Fig-8 : Bio gas

Biogas : The excreta of animals reared is used to produce. Is there any biogas center in your village? Collect information about biogas production from your school library or internet and write a note on it. Then 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). We get beef from bulls and buffaloes, pork from pigs, mutton from sheep and goats. These are the prominent meat varieties.

Rearing of sheeps and goats are more in the districts of Mahabubnagar, Nalgonda and Warangal. Discuss the causes in your class room.

Poultry

Production and rearing of hens on a large scale is generally called poultry. Billions of 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 around 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 3rd position in the world by producing 90 million eggs per annum. And also placed in 7th position in the production of meat about 3000-5000 million kgs per annum.


Fig-9 : Local varieties

- Are the hens reared in the poultry is 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. Layer are reared for the production of eggs.

Natural, wild varieties grow fully in 5 to 6 months. But broilers grow fully in just 6 to 8 weeks. This happens due to genetic modification in the hens.

New Hampshire, white Plymouth, Rhode Island Red, white leg horn, Anoka are the foreign varieties of meat giving species.

- Think and discuss – Is genetically modified food useful or not?


Fig-10 : Broiler, Layer

Some hens reared only 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 varieties mentioned earlier.

Aseel (Berisa kodi) the Indian traditional variety is meant for fighting because of its high stamina and other characters.

Fig-11 : 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-12 : Hatching

- *Do you know how many days a hen spends to hatch its eggs?*
- *Prepare a detailed note on how eggs are laid and hatched?*

Fig-13 : 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 is generally 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 a group of 5 or 6 students. Collect different types of hens and find their characters. If you want to know more details, 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 (National Egg Co-ordination Committee)

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.

NECC
NATIONAL EGG CO-ORDINATION COMMITTEE

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 weights 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 Telangana, started the Emu farming. Meat, chicks, skin, leather, oil, feathers eggs are the main products in the Emu culture. Its meat and eggs are costly. The Emu market is not so good at present in our state.

Emu egg

Apiculture

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Culture of Honey bees (Apis) is called Apiculture. It is the 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.

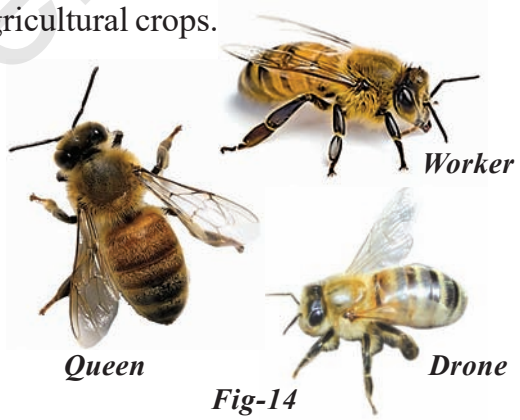

Fig-14

- In what way honey bees are helpful in pollination?

Presently there are six well known species of honey bees in India. *Apis dorsata*, *Apis indica*, *Apis florea*, *Apis melipona*, *Apis trigona*, *Apis cerana* are the species which are available in our country. *Apis cerana* honey bee hive produces 3-10 kgs of honey per annum. A bee hive of *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 is evident 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 as 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. 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 place in the open when the queen is in flight. The Drone dies during the act or immediately as their abdomen burst open during this process.

Sources of nectar

Plants which contain nectar and pollen liked by bees are called bee 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 mustard, gingelly, wheat, cotton, sunflower; Vegetable plants like beans, lady's finger, 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-15 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-16 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 bee 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

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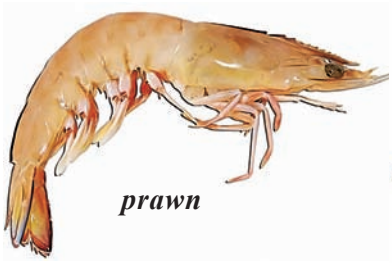
Fish constitute an important and rich sources of high quality animal protein. India has a coast line of about 7500km and the total available area for fishing both inshore and offshore is nearly 0.48 million square meter. In addition there are extensive inland water areas comprising of numerous rivers, 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 country. 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.

Fish



prawn

Crab

Fig-17

Cultivating fish and prawn is a large scale industry in our state. In our state cultivating fish is done in lakes, rivers and reserviors. Fish breed are collected suitable to these water and reared. Fish larvae or fish eggs are called as fish seeds (breed). Selection of fish breed, collecting fish seed 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 7500 km of coastal line and deep seas beyond it. 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-18 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 Mullets, Bhetki and Peral spots, Sea 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. Display the information on wall magazine.

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-19 Fish pond

Generally farmers rear only one type of fishes or Prawns. 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. This species can use all the food in the pond without competing with each other. This increases the fish yield from the pond. Even if one species of fishes are infected with disease it is not spread to others.

- 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, Palkbay, Gujarat coast and around Lakshadweep, Andamon and Nikobar Island are the 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 pests 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, biogas, poultry, hatching, incubator, apiculture, honey bee hive, bee wax, queen bee, drone, aqua culture, marine fisheries, inland fisheries, breeding, food processing.

What we have learnt

- Providing food, shelter and protection to 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.

- One should take milk and egg daily as it is the only source of cheap and easily available food with all nutrious values.
- 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 converted into fish ponds in the coastal districts of Andhra Pradesh.
- Marine and inland fisheries meet the global food needs.

Improve your learning

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1. One honey bee hive consists of different types of bees. What are they? How they differ from each other? (AS 1)
2. Make a list of characters of local variety of buffaloes which give good quantity of milk in your village? (AS 1)
3. Explain the process of hatching eggs under broody hen in rural areas? (AS 1)
4. Write about the accessory products produced in animal husbandry. (AS 1)
5. What is estuaries, how they are suitable for both marine and river fish to live. (AS 1)
6. If you have a chance to visit milk chilling center, what doubts would you like to clarify? Please list out them. (AS 2)
7. Poultry ? Emu culture / Fish forms /Apiculture. Visit any one of the above industries. Get the information from formers and prepare a note on this. (AS 3)
8. Collect news from news papers about milk production and impurities in milk. Prepare a note and display it on wall magazine. (AS 4)
9. Collect information about sea weeds, sea kelp from your school library and write a note with examples. (AS 4)
10. Observe nearby poultry farm and find out how do they export eggs to market? What material is used for transportation? (AS 4)
11. Observe a dry honey bee hive and how the bees built it. Draw a picture. How does it look like? (AS 5)
12. Agriculture and animal husbandry are both sides of the same coin. How can you justify this? (AS 6)
13. How do you appreciate the uses of cattle? (AS 6)
14. What makes you amazing in division of work in Honey bee colony. Support your answer. (AS 6)
15. Conversion of agricultural lands into fish ponds leads to food crisis and environmental pollution. Write your opinion to conduct a in debate on this issue. (AS 7)
16. Raju stated that there is a relationship between Animal husbandry and Agriculture. How do you support this statement? (AS 7)

Chapter

10

Not for Breathing Not for Drinking

One day Akshay and 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 have one. 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 were checked and a pollution under control certificate was issued with details of amount of pollutants in the emissions.

Fig-1 : Pollution checkup

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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.


COMPUTERISED POLLUTION UNDER CONTROL CERTIFICATE

Rule 115(2) Of C.M.V.Rules 1989

Serial No: 214258

AUTHORISED BY

Transport Department, Govt. of A.P.

Type of Vehicle : 2 WHEELER

Type of Engine : 4 Stroke

Make : HERO HONDA

Model : SPLENDOR +

Fuel : LPG / CNG / PETROL

Catalyst : Yes

Date : 01 Jun 2012

Time : 13:55:23

PTS Licence No. : AP-003-003877

Vehicle Registration No. : AP 36 S 5381

Year of Registration : July 2009

Odometer Reading

Photograph of the Vehicle

AP36 S5381

2 and 3 Wheelers (4 Stroke) Mrf after 31/3/2000

Test Result :

	Regulation (%)	Actual Reading
CO	3.5	0.355 % Vol:
HC	4500	0825 PPM

Certified that this Vehicle Co Emission level confirms to the Standards prescribed under Rule 115(2) of CMV Rules 1989

Validity : 6 Months

ALL INDIA VALID

Valid Upto : 30 Nov 2012

Seal of Test Station :

Authorised Signature :

STOP POLLUTION SAVE LIFE

Fig-2 : Pollution certificate

Observe this certificate and 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?

Discuss these issues in the class room.

- In your opinion, what is the 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.

Scientists regularly report on the falling quality of the environment. We ourselves feel the impact of the air and water pollution in our lives. Number of people are 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 living and non-living components which are inter dependent. When everything is working the way it should be, all the components of the environment will be functional, healthy and balanced in the nature.

- What will happen if harmful organisms or substances enter your body? How do you feel?

In the same way if something harmful is introduced into the environment and it gets disrupted it can cause a chain of problems affecting all the resources, plant and animals life. These changes really hurt the health and well being of living organisms. Pollution therefore can be described as the disturbance of environmental balance caused by human activities. It can also be caused by chemical substances, biological species or by dangerous radiations including sound and heat.

Pollution is the addition to the environment (air, water, land) of harmful substances or energy in quantities that are harmful to life.

What is Air pollution?

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 shown in the in the graph and table below:

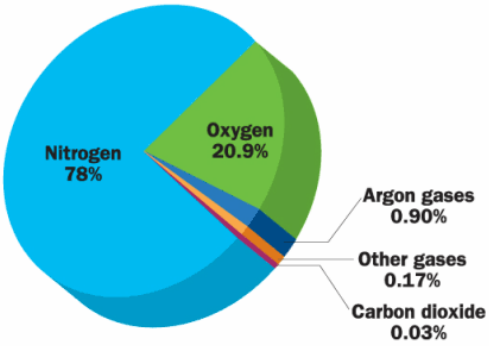

Table - 1

Componet	Symbol	Volume	
Nitroten	N_2	78%	Total Volume of gases = 100%
Oxygen	O_2	20.947%	
Argon	Ar	0.923%	
Carbon Dioxide	CO_2	0.03%	
Other Traces	-	0.1%	
Water Vapour	H_2O	1%	

The atmosphere contains about 21% of Oxygen which is an essential element for survival of all living organisms.

It is also important for the combustion, we read about this in the chapter 'Combustion, flame and fuels'. Carbon dioxide which is 0.03% 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 composition or the state of balance in air is disturbed either by any natural phenomenon or by human activities, it is then called "Air-Pollution" and the substances responsible for disturbing this naturally occurring balance in air are said to be "Air Pollutants".

There are some air pollutants that enter the air by natural disasters, such as volcanic eruptions, forest fires, dust and sand storms.

Activity-1

- Collect information from your school Library for the following natural disasters in the world.
  - ❖ Volcanic eruptions
  - ❖ Forest fires
  - ❖ Sand storms
  - ❖ Tsunamis

These natural disasters lead to air pollution. But the majority of pollutants are added to the air because of human activities.

Think and discuss

- If a person burns tyres or dried leaves at a particular place, where does the smoke and ash go?

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 papers at three different

locations, say, your backyard, your school, near a park, or a parking lot, etc. Let the papers be there for 30 minutes. Later observe and compare all three papers.

- What did you find on those papers dipped in oil?
- Is there any difference in appearance among the papers?
- Try to find out the reason for this difference?
- What do you conclude from observations?

Air Pollutants

As we discussed above, air pollutants arise from both man made and natural processes. These pollutants are of two types : Primary and Secondary pollutants.

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:

- Forest fires release carbon particles (ash) into the air and pollute the air.

Fig-3 : Volcanic eruption

- Volcanic eruption releases various gases and ash into the atmosphere.
- Decay of organic matter releases Ammonia gas into the air.
- Decay of organic matter lying under water releases Methane gas.
- The pollen grains released by plants remain suspended in the air and pollute it.

Human activities

❖ **Burning fuels**

Burning fuels pollute the air producing pollutants like carbon monoxide, sulphur dioxide, smoke, soot and ash.

Fig-4 : Burning fuel

- Name the fuels burnt in day to day activities in both rural and urban areas.

❖ **Vehicles:** Exhaust gases emitted by motor vehicles pollute air by producing the harmful pollutants like sulphur 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 sulphur dioxide, nitrous oxide, chlorine, fly ash , dust, asbestos dust etc.

- Name the factories located nearby. How do they affect the air and water there?

❖ **Nuclear power plants:** The two problems of nuclear power are radioactive waste and the possibility of disasters like **Chernobyl.** Nuclear waste is dangerous because it can cause cancer and other health problems. The radioactive wastes 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.

Chernobyl Disaster

The biggest meltdown of Nuclear power reactor in the world was in Chernobyl, Soviet Union in 1986. After the melt down of chernobyl, there was an explosion and formation of radioactive cloud. The radiation released during this disaster directly killed hundreds of people and affected around 5 million more. About 125,000km^2 of fields were unusable because of the radioactive clouds. The forest area was damaged by the radioactive clouds.

Do you know?

Cement industries are in Mella cheruvu, Matampally of Nalgonda district and Tandoor, Karankot of Vikarabad district. Granite industries are in the most polluted areas because granite powder, cement dust, limestone dust is released into the air causing pollution. Thermal power plants in Ramagundam of Peddapalli, Palvancha of Khammam districts are releasing the pollutants like fly ash, Sulphur dioxide and radioactive substances causing the air, water and land pollution. People are suffering from lung cancer and skin allergies due to the pollutionThe 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.

❖ **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). Electricity is also produced from the air and tides of the oceans. Ash dust and SO_2 from the thermal power plants are polluting the environment.

Activity-3

Go to your school library and collect information to make a list of these power generation plants and where they are located in our country.

Collect information on power generation plants in our country and write the information in a tabular form as shown below.

Table - 2

S. No.	Name of the power plant	Location in India
1.	Mundra thermal power station	

Discuss about the pollutants released and the pollution caused by the power plant listed above.

❖ **Fertilizers and Pesticides:** Use of fertilizers and pesticides in agriculture pollute not only air but also land and water. You already learnt these issues in the chapter 'Production of food from plants'. Discuss its effects in the class room.

Fig-5 : Spraying Pesticides

❖ **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 consentration of carbon dioxide is increasing day by day resulting in global warming. Discuss about the adverse effects of Global warming?

Fig-6 : Deforestation

❖ **Chloro Flouro 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. What ill effects do we suffer from exposure to UV rays?

❖ **Mining:** Mining of coal and stone releases coal dust and stone dust that cause air pollution.

Let us read about pollutants and their sources with the help of Table-3.

Common pollutants and their sources

Table - 3

Pollutants	Sources
Suspended Particulate Matter (SPM)	Automobile, power plants, boilers, Industries requiring crushing and grinding such as quarry, cement.
Chlorine (Cl_2)	Sea-salt production, de-chlorination, biomass burning, pulp & paper mills.
Fluorides	Fertilizer, Aluminium refining
Sulphur dioxide (SO_2)	Power plants, boilers, sulphuric acid manufacture, ore refining, petroleum refining.
Lead (Pb)	Ore refining, battery manufacturing, automobiles.
Oxides of nitrogen (NO, NO_2)	Automobiles, power plants, nitric acid manufacture, also a secondary pollutant
Peroxy Acetyl Nitrate, (PAN)	Secondary pollutant
Formaldehyde (HCHO)	Secondary pollutant
Ozone (O_3)	Secondary pollutant
Carbon monoxide (CO)	Automobiles, incomplete fuel combustion.
Hydrogen sulphide(H_2S)	Pulp and paper, petroleum refining.
Hydrocarbons	Automobiles, petroleum refining
Ammonia (NH_3)	Fertilizer plants, decomposition of dead plants and animals.

From the table, identify the gaseous pollutants and particulate pollutants and then make a list of both, in your textbook.

Let us understand the effects of air pollution not only in human beings but also to the historical monuments. For this we need to study about Taj Mahal. Do you know currently the cars and buses are not allowed to drive to the Taj Mahal but the battery-run buses or horse-drawn carriages are allowed to reach the monument. The Archeological department of India declared that $2^1/_2$km 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 Gas Tragedy 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 Methyle Isocyanate (MIC) into the air from an insecticide factory managed by Union Carbide. Thousands of lives helplessly, crushed under the cruel foot of inhuman activity. This is the unforgettable industrial tragedy towards air pollution.

What are the effects of 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, 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, soil deterioration, soil erosion etc.

Some of the negative effects caused by these pollutants are discussed below.

Various harmful effects of pollutants

- **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 Anaemia, 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 :** It is a poisonous gas. If it combines with haemoglobin in our blood, it forms a stable compound called carboxy haemoglobin. Due to the formation of this compound haemoglobin 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 effect, 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 where a dense smoke is spread in the surroundings. We get cough and feel uneasy even when we close the nose with napkins.

- Why do we feel such discomfort? Think about it.
- If these symptoms 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 kiln, oil mill, food processing mill, etc.) present in your area and observe,

- Are they polluting air and water? If yes, How?
- Is there any green belt around the factory? Name the trees they are growing.
- What precautions dothey take to prevent pollution?

What can we do to reduce air pollution?

Air pollution cannot be totally eliminated, it can however be controlled. Some of the methods for controlling air pollutions are:

- Tall chimneys should be installed in

all factories to reduce air pollution at the ground level.

- The 'Fuel burning equipment' which burns the fuel completely should be used in homes and industries.
- Install electrostatic precipitators in the chimneys of industries.
- Reduce vehicular emissions by using non polluting fuels like CNG.
- Use LPG for domestic use.
- Improve the quality of fuel in automobiles and use catalytic converters in them.
- Make use of Renewable alternative source of energy like Solar Energy, Wind Energy and Hydro Energy.

❖ All motor vehicles should be maintained properly so that they comply with pollution norms.

❖ Use unleaded petrol

❖ Plant and grow more and more trees in your surroundings.

❖ We should protect plants and trees .Do you know about **Vanmahotsav, Haritha Haram** and **Swatch Patashala** where lakhs of Saplings are planted in July every year? But how many saplings are surviving? Discuss, think about the reasons and solutions.

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Water Pollution

Air is the important resource for human survival. In the same way water plays a vital role in our lives. The history of human civilization explains that they develop on the banks of rivers, because water is a main resource for human development. After industrial revolution water resources are being polluted. Water pollution is another hazard caused by greedy human being activities.

Let us read the following news paper clipping understand it and answer the following questions :

❖ What do you understand after reading the news paper clipping?

❖ What are the issues discussed in this news paper clipping?

❖ What are its causes and effects?

❖ How does the problem arise?

❖ Are you also facing this type of

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భూగర్భం విషతుల్యం..

రసాయన పరిశ్రమల కాలుష్యంతో భూగర్భం విషతుల్యమైంది. భూగర్భజలాలు పూర్తిగా కలుషితమయ్యాయి. నీటిలో టీడీఎస్ (టోటల్ డిసాల్వ్‌డ్ సాలిడ్స్) ఉండాల్సిన అధిక మోతాదు 500. అయితే చౌటుప్పల్, భూదాన్ పోచంపల్లి, చిట్యాల మండలాల్లో 10వేల వరకు ఉన్నట్టు పరీక్షల్లో తేలింది. భూదాన్ పోచంపల్లి మండలం దోతిగూడెం గ్రామ శివారులో ఓ బోరుబావిలో నుంచి వచ్చే నీళ్లలో 19,520 దాకా టీడీఎస్ ఉంది. చౌటుప్పల్ మండలం కొయ్యలగూడెంలో 9,143, మందోళ్లగూడెంలో 3,400, చౌటుప్పల్‌లో 3,531, ఆరెగూడెంలో 7,085, గుండ్రాంపల్లిలో 2,009టీడీఎస్ ఉన్నట్టు పరీక్షల్లో తేలింది. ఈ నీళ్లు తాగడానికి కాదు, వ్యవసాయానికి కూడా పనికిరావని నిపుణులు తేల్చి చెప్పారు. అయినా రైతులు సాగు చేసిన పంటలు ఎక్కడికక్కడ చనిపోతున్నాయి.

problems in your area? Can you explain reasons behind?

In the previous class we have already discussed water, its usage and sewage water treatment. Let us see class VII Science Textbook. Just go through the chapter 'Water too little to waste'. Now we will discuss water pollution, it causes and effects.

A Case Study of Patancheru

Patancheru is a suburban mandal headquarters in Sangareddy district, located about 25km from Hyderabad. It is a major industrial hub of Telangana State. It is one of the most polluted areas in India where the villages in the sorrounding areas of 14 km radius were badly affected by the diseases like cancer, respiratory diseases and heart diseases, because of poisining (pollution) of air, water and land."

The presence of pharmaceutical and chemical industries, pesticide units, steel rolling industries, distilleries are releasing the dangerous gaseous pollutants like Chlorine, Hydrogen sulphide which enter 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 (Common Effluent Treatment Plant).
4. Medical care to pollution victims.
5. Sustained continuous vigilance in discharge of effluents.
6. Discharge of treated effluents in to sewage line.

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Lab Activity

Aim: Observation of pollutants in local available water samples.

Material: Glass tumblers, water samples from tap, pond, river, well, lake, Red and 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, pH and hardness.

- pH 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 a soap. If water produces lesser foam, it is referred to as hard water. If water produces more foam, it is called soft water.

Observations : Record your observations in the following table.

Table - 4

Water Sample	Smell	color	pH		Hardness of water	
			Acidic	Basic	More	less
Tap water						
Pond water						
River water						
Well water						
Lake water						

Think and Discuss

- Do you find any relation between pH and hardness of water?
- Which water sample is colorless?
- Which water sample is suitable for drinking and why?
- Do you find any 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 colour of litmus paper. Wash your hands each time. Don't taste any water sample. (If you have followed any more precautions add to the list.)

- Discuss the findings drawn from the contents of the table and record.

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. Thus, the contamination of water with unwanted and harmful substances such as sewage, toxic chemicals, industrial wastes etc. is casuing 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 Musi.

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. Industrial wastes are casuing water pollution in many rivers, ponds of our state.

Acitivity-5

Visit your nearby pond/ lake or river and find out the material being discharged into it. Prepare a Biography on it.

Where is all of this pollution coming from?

There are two main sources of water pollution; definite and non-definite sources.

Fig-7 : Polluted water stream

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 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 the water supply and thus pollute the 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 few examples.

***Plants nutrients*:** Phosphates and nitrates, chemical fertilizers 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 to 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 slick 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 case of hot springs and shallow ponds during summer. The discharge of water that has been used to cool power plants or other industrial equipment is another reason.

Fig-8 : Chemical pollutants

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, smoother 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 launched 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 4R's to control pollution (Reduce, Reuse, Recycle and Recover).
- 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 will become an unsolvable puzzle. We should keep these resources clean and healthy not only for us but also for future generations.

Key words

Polllution, air pollution, polluants, volcanic eruption, thermal power plants, Chloro Fluro Carbons (CFCs), water pollution, potable water, toxic industrial wastes, fertilizers & pesticides, eutrophication, biodegradation, reduce, reuse, recycle suspended particulate matter (spm), biomagnification, carboxy Haemoglobin.

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 Environment 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 using 4R's.

Improve your learning

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1. How does air pollution lead to water pollution? (AS 1)
2. What steps can be taken up to control air pollution and water pollution? (AS 1)
3. Why does the increased level of nutrients in the water affect the survival of aquatic organisms? (AS 1)
4. Road side plants cannot grow properly - Find your own reasons and explain with your argument. (AS 1)
5. Sudheer is a traffic constable. What do you think about his health. Give some suggestions to protect his health during duty period. (AS 2)
6. Write a short note on the effects of water pollution in your village suggest precautions (AS 4)
7. 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)
8. Organize a field visit to a pond / lake / river present in or near to your village with the help of your teachers.
   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. (AS 4)
9. What is air pollution? Make a flowchart to describe its causes and effects. (AS 5)
10. Clear and transparent water is always suitable for drinking. Comment. (AS 6)
11. If our monument like Taj Mahal is effected by air pollution, what is your advice to protect it? (AS 6)
12. Reshma going to talk about controlling measures of soil pollution. Prepare a write up for her. (AS 6)
13. To conduct a quiz program on air and water pollution, prepare five thought provoking questions. (AS 6)
14. 'Use Bicycle – Avoid motor bikes and cars.This slogan is prepared by Sravani. Prepare some more slogans on pollution. (AS 7)
15. If you are a general manager of a chemical industry what precautions would you take to control air and water pollution? (AS 7)
16. How to minimize the usage of paper in daily life? (AS 7)

ANNEXURE

What is fluorosis?

A boy suffering from Fluorosis

Look at this picture. Do you know how and why is he looking so? Yes, he is suffering from a dangerous disease called fluorosis, which is caused by intake of fluorinated food and water. Most of the places in Nalgonda, Medak, Khammam and Mahaboobnagar districts of our state are affected by fluorosis.

Fluorosis is a disease caused by excessive ingestion of fluoride through water and food. The upper limit of optimum fluoride level in drinking water for a tropical country like India is 0.5 PPM (parts per million) 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 Yellareddyguda, Batlapally, Yedavalli villages of Nalgonda. 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, magnesium and vitamin supplementation to children and adolescents to prevent Genu valgum deformities occurring.

All children living in affected areas of fluorosis and 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.

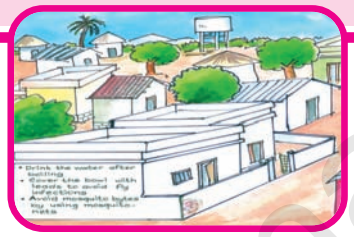
Bony changes occur due to excessive ingestion of fluoride over a long period of time. This leads to crippling in people in endemic regions beyond the age of 30 years. In these places river water is good for drinking than well or borewell water.

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 source of calcium, magnesium and vitamin C Eg: Finger millets, Agathi, Amaranth, Colacasia leaves (Chamakura), Thotakura, Ragi, Curry leaves, Poppy seed, Jaggery, Gingelly seeds, Jowar, Cummin, Amla, Green chilly, etc. School children are provided milk and leafy vegetables in their midday meal. The people living in flourine rich areas need not use flouride toothpaste.

Chapter

11

Why do we fall ill?



Gram panchayat wrote some slogans about healthy habits on walls. Let us read them.

- ***Drink boiled water only.***
- ***Use mosquito nets.***
- ***Keep your surroundings neat and clean.***
- ***Do not leave water to stagnate.***
- ***Eat food when it is hot***
- ***Wash hands before eating food.***
- ***Wash hands after toilet.***
- ***Do not deficate in open, use toilets only.***
- ***Keep food vessels covered with lids.***
- ***Wash vegetables before cooking.***

- Why local Panchayats display such instructions on the wall?
- What do we come to know from such instructions?
- What would happen if we do not follow the instructions?
- In which season do we generally find more mosquitoes? How do they affect us?

Drinking boiling water, protecting food from reach of the flyes and avoiding mosquito bites will help us to remain healthy. But what is health and when do we fall sick?

The significance of 'Health'

We have heard the word 'health' being used quite frequently. We use it ourselves as well as for people around us 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'. Now, the question what exactly does the word 'health' mean? If we think about it, we realise that it always implies the idea of 'being well'. We can think of this well-being as ability for effective functioning. Incase of our grandmothers, their 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'.

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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, cleanliness of surroundings is very 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?
- If they do not have a discussion on it?

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 made available. Proper economic conditions and jobs helps one to be happy. This leads to healthy conditions. By illtreating each other and being 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 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/her 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 good 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 ?

Activity-3

Form a group with five students. List out some diseases and their 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. 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-4

- 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 these 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?

Acute 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 terminated 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 ill 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 diarrhoea, T.B.? How do they spread? 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.

How do the individual and Environmental cleanliness acts as disease causing factors think your self?

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.

Warren and Marshall

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 and insects of different kinds.

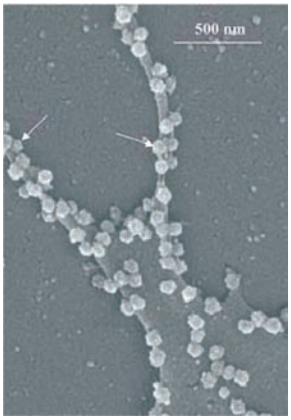

Fig-1(a) Picture of SARS viruses coming out (see arrows for examples) of the surface of an infected cell. The white scale line represents 500 nanometres, which is half a micrometre, which is onethousandth of a millimetre. The scale line gives us an idea of how small the things we are looking at are.
Courtesy: Emerging Infectious Deseases, 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.

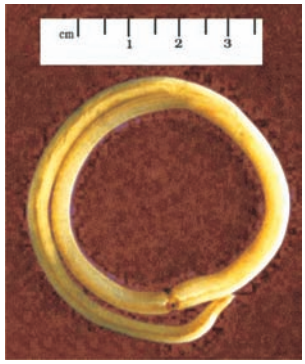

Fig-2(c) Picture of an adult roundworm (Ascaris lumbricoides is the technical name) from the small intestine. The ruler next to it shows four centimetres to give us an idea of the scale.

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. Microorganisms like protozoan cause diseases like Malaria (Plasmodium) and Kala-Azar (Leishmania). 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-5

- 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 antibiotic pills?
- How long did they suffer who did not take antibiotic pills?
- 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.

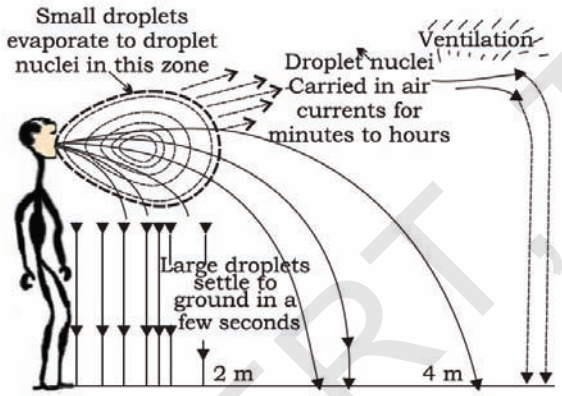

Fig-3

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 and 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. Now a days medicines are available to prevent transmission of HIV from affected mother to baby.

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.

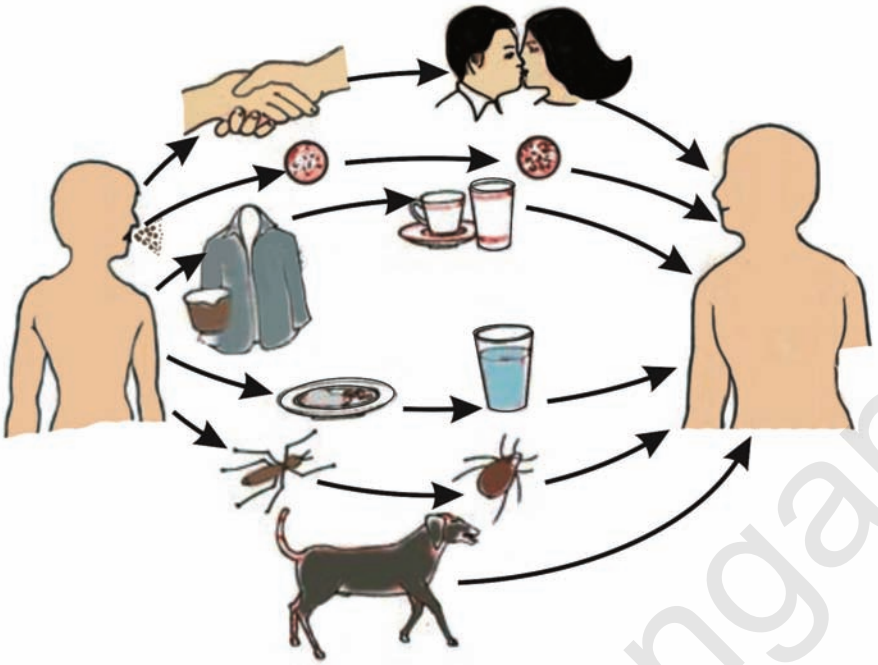

Fig-4 Common methods of transmission of diseases.

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 with many infections that we face every day. Instead, even common 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. which may be directed to healing.

But this kind of symptom-directed treatment by itself may not kill the infecting microbe go away and the disease may not be cured. For that, we need to kill the disease causing 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 and 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. Over a period of time 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 for example, free of breeding ground of infectious disease causing organisms and their vectors. 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 cough and cold 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?

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-6

- 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 any 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 50 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 getting infected.

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 smallpox earlier and survived it. 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 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.

Two centuries ago, an English physician named Edward Jenner, realized that milk maids who 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 'pool' 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-7

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 are we normally advised to take nutritious 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 immunisation programmes available at the nearest health centre in your locality? What frequently seen are the 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

9DPP5E

1. 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)
2. Differentiate the infective and non infective diseases? (AS 1)
3. Why acute disease become chronic disease? (AS 1)
4. Draw the figure of leishmania and trypanosome? (AS 5)
5. Ramu was affected with small pox. What advice do you give Ramu for not spreading the disease? (AS 6)
6. How do you appreciate the role of vaccine in preventing disease? (AS 6)
7. Prepare a questionnaire to collect the information from your local health worker about spreading of diseases? (AS 6)
8. How many times did you fall ill in the last one year? What were the illnesses? (AS 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.
9. 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)

LEARNING OUTCOMES

BIOLOGY

CLASS 8

The learner....

- Differentiates organisms
  Such as plant & animal cells,
  viviparous & oviparous animals on the
  basis of their properties, structure & functions.
- Classifies organisms based on characteristics.
  Ex. Kharif & Rabi crops, useful & harmful microorganisms,
  Asexual & Sexual reproductions.
  Exhuastible & in exhaustible natural resources.
- Conducts simple investigations to seek answers to queries.
  e.g., Why do we add Salt / Sugar in pickles, jams, & murabbas?
- Relates processes & Phenomenon with causes.
  E.g smog formation with the presence of pollutants in air,
  deterioration of movements with acid rains etc.
- Explains processes & phenomenon. Eg. reproduction in
  human & animals.
- Prepares slides of microorganisms, Onion peel human
  check cells etc. and describes their microscopic features.
- Draws labelled diagrams / flow charts. E.g., Structure of
  cell, human reproductive organs.
- Applies learning of scientific concept in day to day life.
  E.g Segregating biodegradable & non-biodegradable
  wastes increasing crop prodution, challenging myths &
  taboos regarding adolescence.
- Discuss & appreciates stories of scientific discoveries.
- Makes efforts to protect invirronment.
  Eg. Using resources judiciously, making controlled use of
  fertilizers & pesticides.