



Master Lesson Plan

For

Microorganisms Friend and Foe

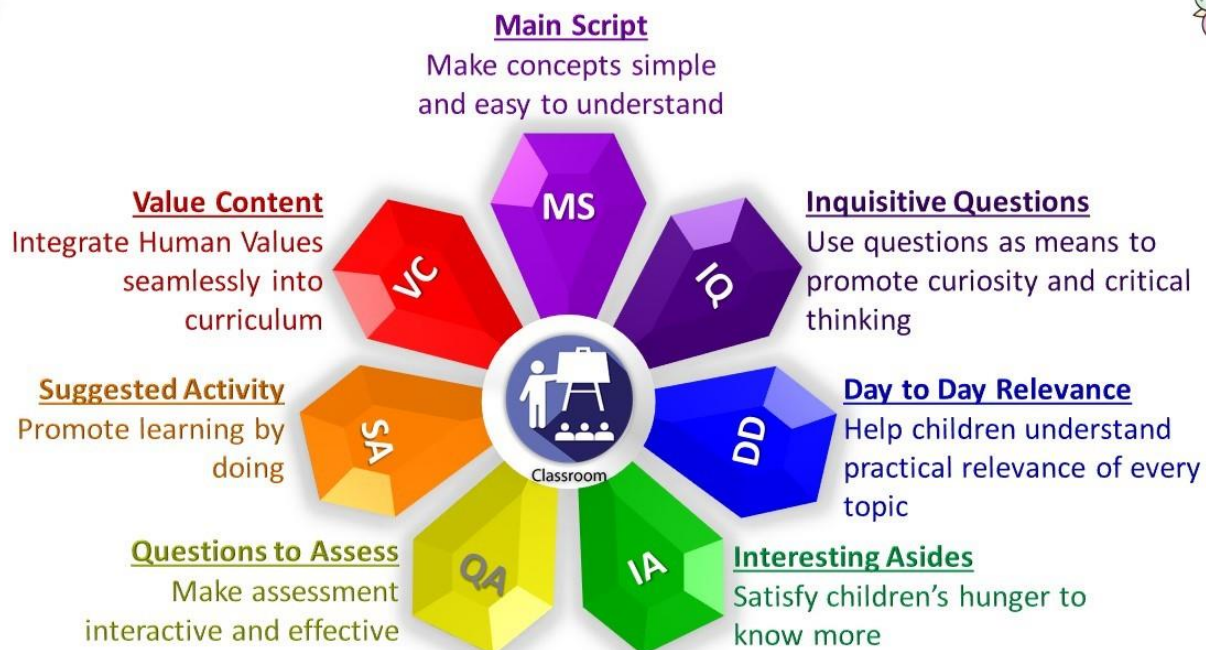
Board	Standard	Subject	Chapter	Language	Reference Link	Creation
CBSE	STD VIII	Science	Microorganisms Friend and Foe	English	Microorganisms: Friend and Foe	2020-12

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Master Lesson Plan (MLP) - Covers the entire chapter with the help of these 7 asset types



For more information on how to use the lesson plan effectively, please scroll to the guidelines at the end of this document.

Microorganisms Friend and Foe

1. MS_ Objectives_ Microorganisms: Friend and Foe

Notes to the teacher: This asset lays down the proposed plan for transacting this chapter. It states the asset objectives of the MLP. This asset is for teacher's reference and need not be taught to the students:

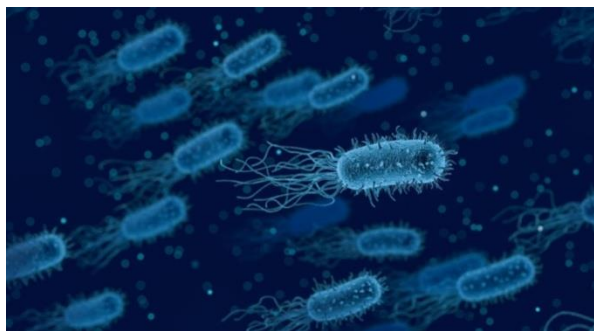
Students will be able to...

- recognize the glorious work of the microbiologists
- show the growth of fungi on a piece of bread
- explain about microorganisms
- notice the presence of lactobacillus in curd
- appreciate the contribution of Louis Pasteur in the field of microbiology
- show that yeasts react with sugar solutions producing carbondioxide gas
- discuss fermentation
- experiment a few activities on microorganisms
- examine the role of microbes in our environment
- trace the pathway of microbes
- differentiate between viruses and other microorganisms
- discover more about about vaccines
- recognize the role of microbes in medicine
- identify the diseases caused by microorganims
- outline the diseases caused by microorganisms in plants and animals
- extract the reasons for food poisoning and the problems associated with it
- analyse the different methods of food preservation
- differentiate between friend and foe
- describe the processes involved in the nitrogen cycle
- summarise the different concepts of the topic 'Microorganisms- Friend and Foe'

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Main Script	Micro organisms: Friends & Foes	

2. IA_ Microbiologists

The study of microorganisms is called microbiology. The scientists who study microorganisms are called microbiologists.



Heinrich Hermann Robert Koch

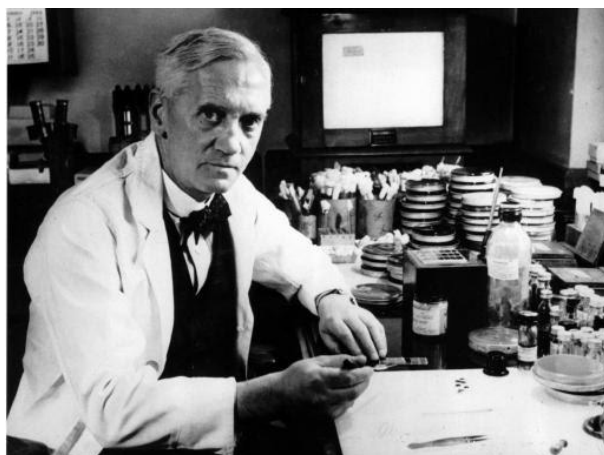


- Heinrich Hermann Robert Koch was a German physician and a microbiologist.
- He identified some microorganisms as a root cause of certain diseases, such as tuberculosis, cholera, anthrax.
- He provided proof for the concept of infectious diseases.
- He gave the germ theory of disease.

Christian Gram

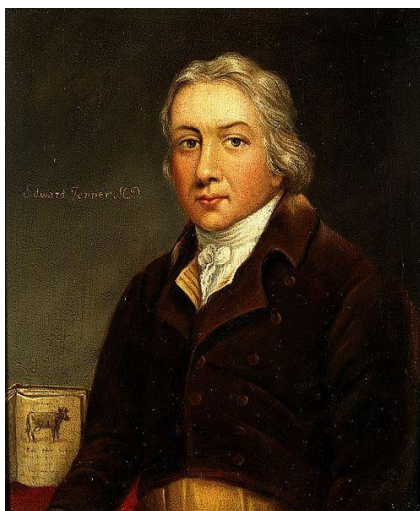
- Christian Gram was a bacteriologist who is popularly known for developing a stain technique called Gram stain technique.

Alexander Fleming



Alexander Fleming was a Scottish microbiologist who developed an antibiotic called Penicillin from *Penicillium notatus*, a fungus.

Edward Jenner



The small pox vaccine was the first successful vaccine to be developed. The process of vaccination was discovered by Edward Jenner in 1796, who worked on his observation that milk maids who caught the cow pox did not catch small pox.

Image source:

<https://pixabay.com/en/bacteria-medical-biology-health-3662695/>

https://en.wikipedia.org/wiki/Robert_Koch#/media/File:RobertKoch_cropped.jpg – Public domain

https://commons.wikimedia.org/wiki/File:Alexander_Fleming.jpg – Public domain

https://commons.wikimedia.org/wiki/File:Edward_Jenner._Oil_painting._Wellcome_V0023503.jpg (Attribution - https://wellcomeimages.org/indexplus/obf_images/63/06/f922c4b86c952df78a555cd9eba8.jpg)

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Interesting Asides	Micro organisms: Friends & Foes	

3. SA_A microbe on bread

Aim: To observe the growth of fungi on a piece of bread.

Resources required: 1 loaf of bread, microscope

Indoor (classroom activity)

Type of Activity: [Group activity] Students have to be divided into groups of 3 or 4.

**Procedure-**

1. The Teacher can get a loaf of bread .
2. This loaf of bread is placed in the classroom for about a week.
3. After one week, the teacher shows the powdery growth of fungus on the loaf.
4. The teacher then mounts mould under a microscope and shows it to the whole class.

Observation: The students observe black/green powdery spots on the top of the loaf.

Conclusion: This activity helps the students to understand the formation of fungi (Rhizopus) on the top of the bread.

Instruction to the teacher:

- Teacher poses questions to the students.
- The time limit can be ignored as it takes few days for the microbe to be formed on the bread.

Questions to ponder over:

1. What is the reason behind the colour change on the bread?

Suggested Answer: A black powdery spot with a network of thread like filaments called hyphaormycelium changes the colour of the bread.

2. What microbes form the bread mould?

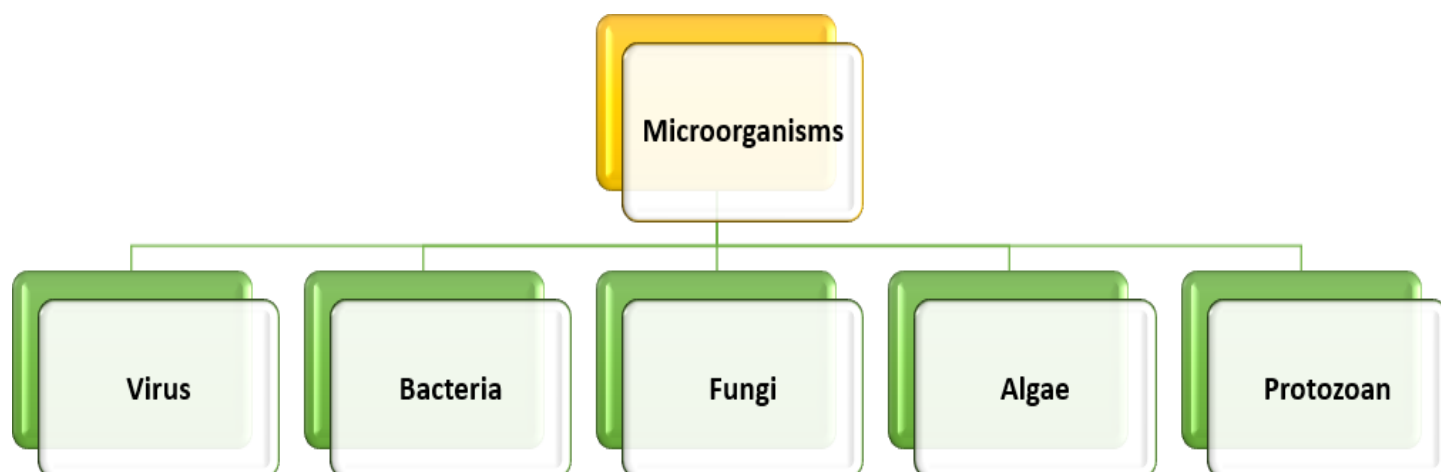
Suggested Answer: Fungus

Image source: https://commons.wikimedia.org/wiki/File:Moldy_old_bread.JPG

Time to teach	Asset Type	Theme	Sub Theme
20 Minutes	Suggested Activity	Micro organisms: Friends & Foes	Fungi (definition, habitat)

4. MS_ Tiny creatures the world of microbes

Micro-organisms are those organisms that are not visible to our naked eyes. They can only be seen through a microscope.



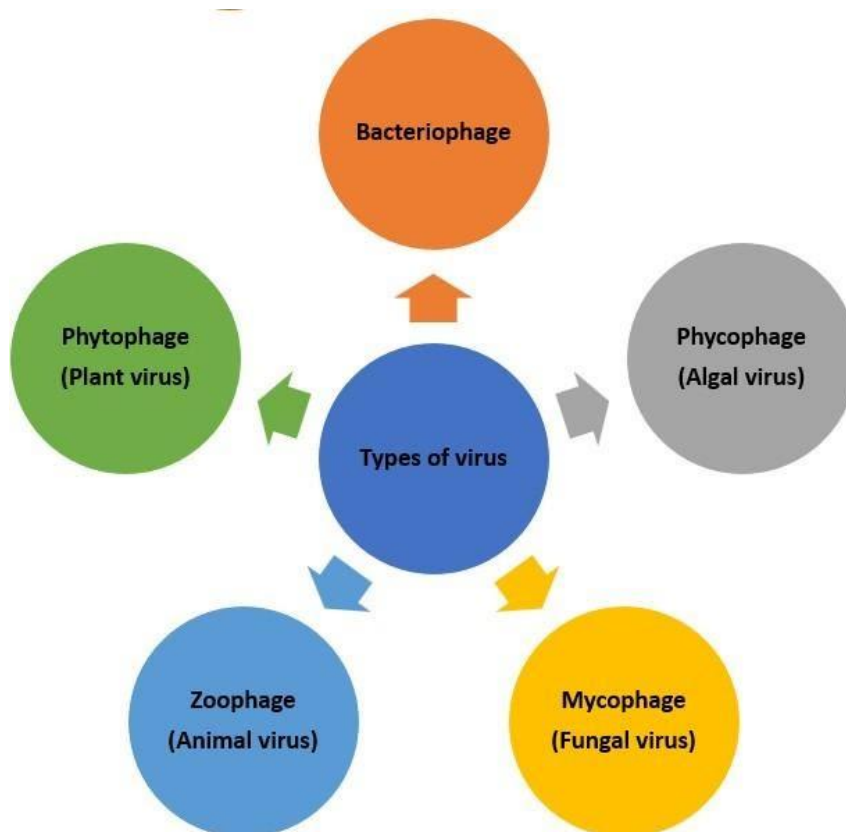
Micro organisms are classified as follows:-



Virus

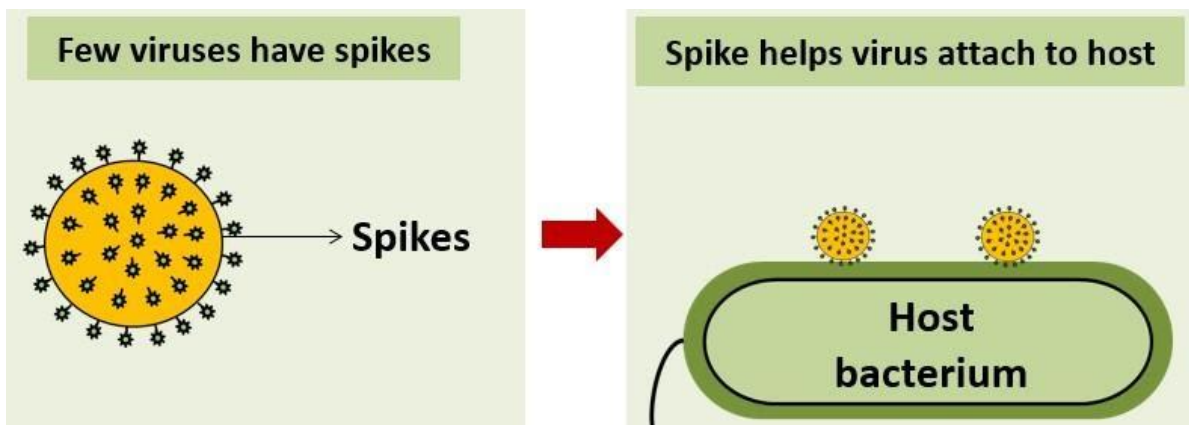


- Virus in Latin means POISON.
- It was coined by Beijerinck in 1897.
- They are very small compared to the smallest cell.
- They are measured in nano metres.
- The study of viruses is called virology.
- Viruses show both living and non living characteristics. Thus they are called obligate intra cellular parasites.
- Virus is a small infectious agent that can replicate only inside the living cells of organisms like bacteria, plants and animals.
- Viruses can be seen only through an electron microscope.
- Virus is a non-cellular particle made up of genetic material and protein that can invade living cells.
- They are of different shapes. Some may be helical, polyhedral, complex shaped viruses, etc.
- Based on their host, viruses are classified into five types.



Structure of a Virus:

- Virus is made up of a protein coat called capsid. It is non-cellular.
- The virus has a nucleic acid core containing DNA and RNA making it possible to reproduce only when inside the host.
- When the virus is outside a living host it behaves as non-living.
- They do not have ribosomes and enzymes thus making them inactive.
- They depend on the host cells to carry on their metabolic activities.
- Some viruses are enclosed in an envelope.



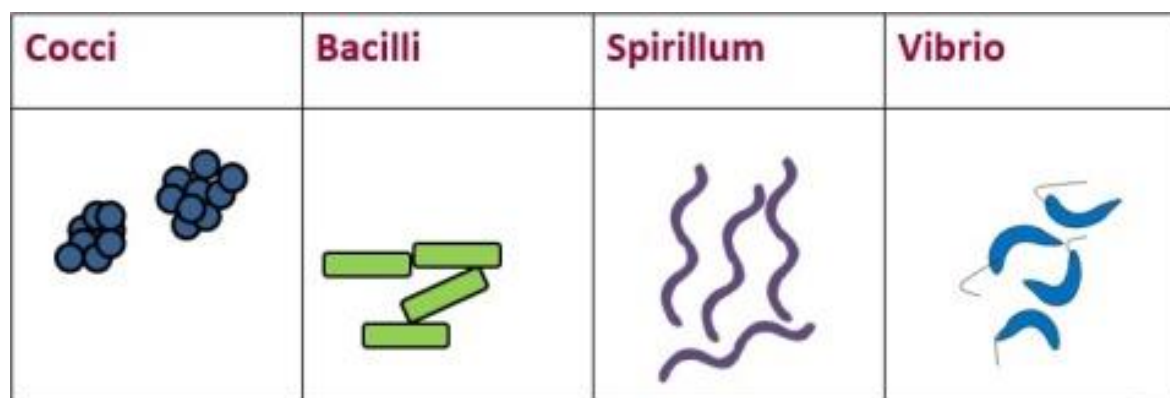
- Few viruses also have spikes. These spikes help the virus to attach to their hosts.

Types of Viruses:

Helical	Polyhedral	Spherical	Complex
			
Tobacco Mosaic Virus	Polio Virus	Influenza Virus	Bacteriophage Virus

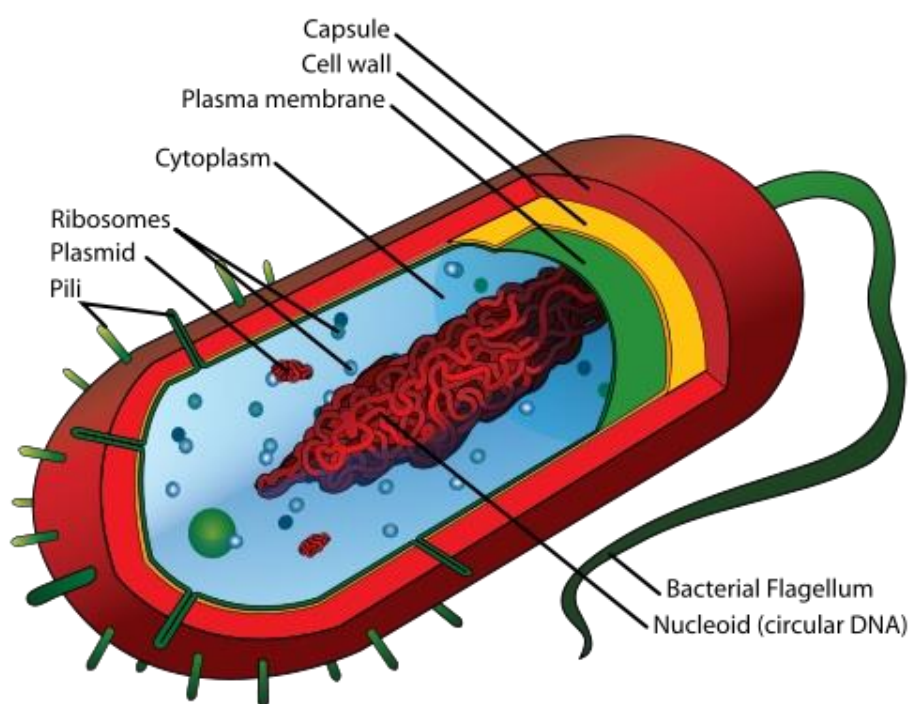
Bacteria

- Bacteria were first observed by Dutch scientist - Antonvan Leeuwenhoek in the year 1676.
- The study of bacteria is known as Bacteriology.
- They are one of the oldest living organisms on the earth.

Structure of bacteria:

- Bacteria are single – celled organisms (unicellular).
- Their size ranges from 0.1 to 15 micron.
- Bacterial cell is a prokaryotic cell because they do not have a nucleus.
- It consists of a cell wall, cytoplasm and nuclear material. Many bacterial species have an outer covering called a capsule outer to the cell wall, which protects the bacteria from adverse environments.
- Inner to the cell wall is plasma membrane lining cytoplasm, which is called as semi permeable membrane. In the cytoplasm there are rich DNA granules which form the nuclear material.
- DNA is also called bacterial chromosomes.
- Nucleolus is absent.
- Flagella are found on the surface of the cell and come out through the cell wall. They are the organs of locomotion. Chloroplasts are absent, but some bacteria have bacterio chlorophyll pigments.

Bacteria come in different shapes and sizes. They are as follows:



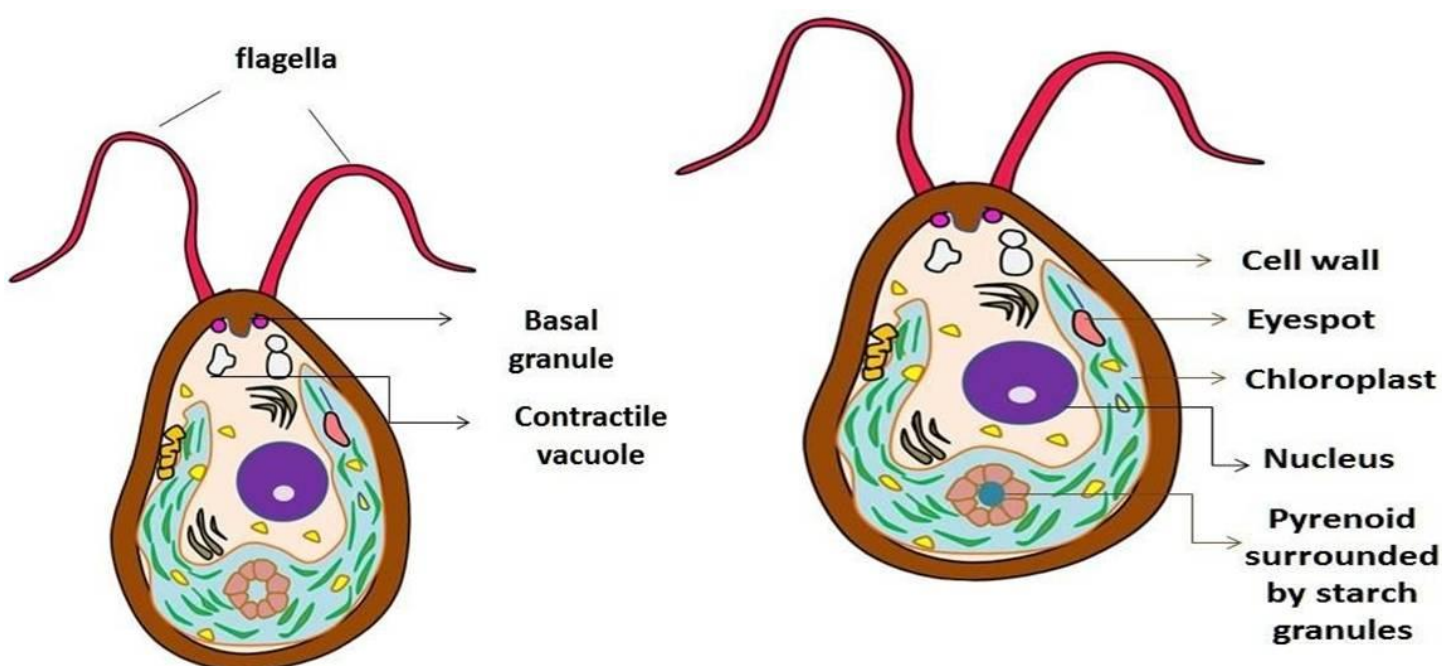
1. Cocci shaped bacteria are spherical or oval in shape.
2. Bacilli bacteria are rod-like with or without flagella. If flagella is present, it may be at one end, or both ends, or entire cells.
3. Spirillum bacteria have a twisted shape and have flagella at one or both ends.
4. Vibrio bacteria are small and look like commas. They can move and have flagella at one end.

Algae

Algae are a group of simple, typically autotrophic organisms, ranging from unicellular (chlamydomonas) to multicellular forms (giant kelp). The study of algae is known as Phycology. They carry out photosynthesis. They live in damp soils, water or rocks.



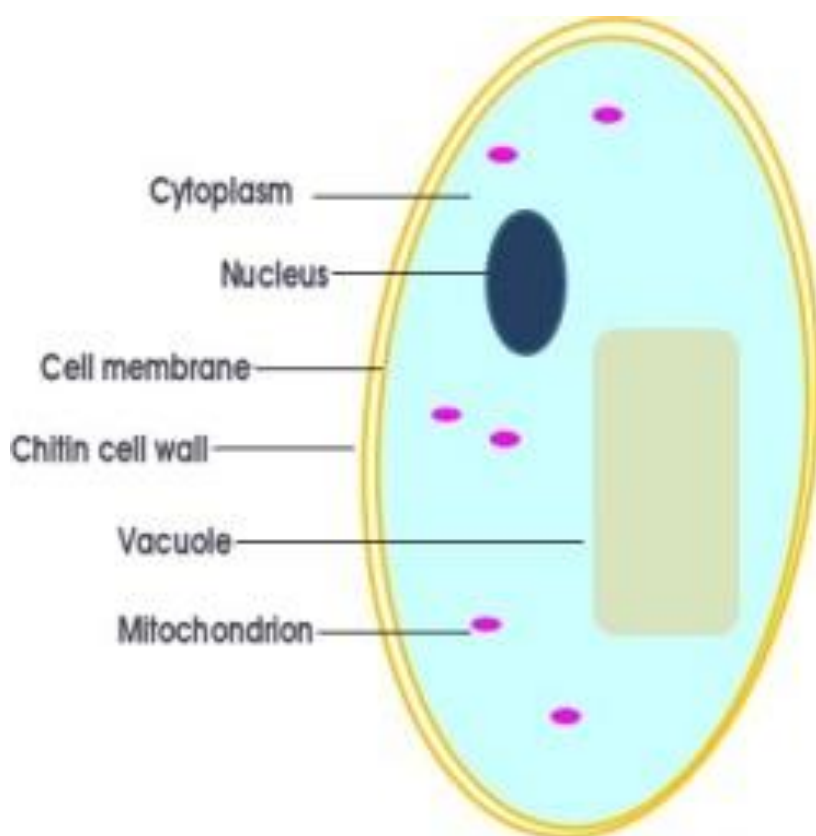
Structure of Chlamydomonas:



- Chlamydomonas is single celled green algae found in standing water of ponds, pools and ditches.
- Each cell has two flagella which help in locomotion.
- It is oval or spherical in shape.
- The cell wall is made up of cellulose or pectin sheath.
- Flagella originate from a basal granule located in the cytoplasm.
- Contractile vacuoles are found near the bases of flagella.
- Cup shaped chloroplast is present which has the nucleus
- Pyrenoid (protein) with starch sheath is present below the chloroplast.
- Eye spot is present above the chloroplast.

Yeast

- Fungi are eukaryotic organisms. Example: Yeasts, moulds and mushrooms.
- Study of fungi is called Mycology.
- Fungi could be a parasite or a saprophyte, as they lack chlorophyll.
- Plant body of fungus is called mycelium.
- It is composed of thread like structures known as hyphae. E.g. yeast, bread mould (rhizopus).



Structure of yeast cell

- Yeast is a microscopic organism.
- It is unicellular.
- The size of the fungus varies from 2-25 micron in length and 1-5 micron in width.
- Each cell is oval in shape which is surrounded by a cell wall.
- The cell-wall is made up of chitin.
- Inner to the cell wall, there is a cell membrane, which surrounds the protoplasm, mitochondria, golgi apparatus.
- The reserve food is found in the form of glycogen, oil globules.

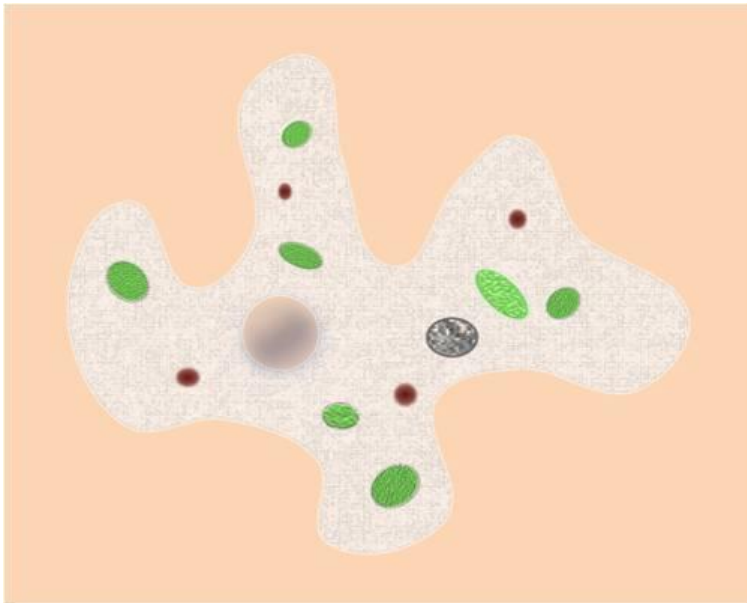
- A large vacuole is present at the centre of the cell.
- Each cell has a well developed nucleus.
- Nutrition is saprophytic. It depends on sugar containing nutrients from its habitat.
- Reproduces vegetatively, asexually and sexually.

Protozoa

- Protozoans are single-celled organisms.
- They are microscopic
- E.g: Amoeba, Euglena and Paramecium.

Amoeba

- The name amoeba means change. It comes from a Greek word "amoibe"
- The amoeba is a single celled microscopic organism.
- They are found in freshwater, salty water, wet soil and in animals.



- It has cytoplasm, nucleus, cell membrane and a variety of inclusions in the cytoplasm and exhibits all the essential functions of any living organism.
- The cytoplasm is divided into two regions. The colourless region is called the ectoplasm and a granular region called the endoplasm.
- It has a round eukaryotic nucleus.
- Cell organelles like mitochondria, food vacuoles and contractile vacuoles are found in the cytoplasm.
- The amoeba moves with the help of finger-like projection called the pseudopodia.
- Pseudopodia helps amoeba to engulf the food.
- Food is digested in the food vacuole.
- Amoeba excretes its wastes and excess water with the help of the contractile vacuole.

Image source:

<https://pixabay.com/en/virus-microscope-infection-illness-1812092/>

<https://freessvg.org/microbiologist>

Spikes: rushmish@gmail.com

Types of viruses: OC: rushmish@gmail.com

Shapes of bacteria: OC: rushmish@gmail.com

bacteria: https://commons.wikimedia.org/wiki/File:Average_prokaryote_cell-_en.svg (Attribution - Author, [LadyofHats](#))

Algae: SSSVV Gallery

Chlamydomonas: Original contribution - rushmish@gmail.com

Structure of yeast cell: OC: puttyrevankar@gmail.com

Amoeba: <https://pixabay.com/vectors/amoeba-tiny-cell-microscopic-life-944118/>

Time to teach	Asset Type	Theme	Sub Theme
20 Minutes	Main Script	Micro organisms: Friends & Foes	Viruses (definition, habitat) Protozoa (definition, habitat) Fungi (definition, habitat) Bacteria (definition, habitat) Algae(definition, habitat) Viruses (definition, habitat)

5. SA_ Bacillus in curd

Aim: To notice the presence of lactobacillus in curd.



Materials required: curd, slide, dropper, cover slip, crystal violet(stain), microscope

Setting for the activity: (Indoor)

Indoor (classroom activity)

Type of Activity: [Demonstration]

Procedure:

1. Take a drop of curd on a slide.
2. Add crystal violet stain. Cover it with a cover slip.
3. Observe the slide under the microscope.



Observation: The students will be able to see stains of bacillus bacterium under the microscope.

Conclusion: This activity helps the students to understand that bacteria is present in curd.

Question to ponder

What does the lactobacillus bacteria do to the milk, for it, to become curd?

Lactobacillus bacteria converts lactose in the milk to lactic acid, which makes it curd.

Instructions to the teacher include:

- ✓ The activity is a demonstration
- ✓ The teacher should see that proper care is taken while handling the microscope.

Troubleshooting:

Precaution:

- ✓ Do not let air bubbles enter the specimen while covering it with the cover slip.

Image Source:

SSSVV Gallery

<https://pixabay.com/en/microscope-lab-diagnosis-white-1817641/>

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Suggested Activity	Micro organisms: Friends & Foes	Bacteria (definition, habitat)

6. IA_ Louis Pasteur



- In 1854 Pasteur became the Dean and Professor of Chemistry.
- He was a French biologist.
- When he became the Dean and Professor of Chemistry he worked on alcoholic fermentation.
- He lived in a town named Lille in France which had a number of distilleries and factories.
- One distiller named M. Bigot, took Pasteur's help in manufacturing alcohol by fermentation.

Pasteur explained that :

- The yeast cells found in the fermenting tubs of wine remained healthy as long as normal production of alcohol continued but when lactic acid formed, the yeast cells gets mixed with rod-like microbes.
- He also said that along with alcohol, other complex organic compounds were also produced during fermentation.



Based on his observations, Pasteur concluded that the fermentation process was carried out by living cells, the yeasts. The fermentation turned sour when the yeast was contaminated with other microorganisms.

To prevent the fermentation from going sour Pasteur suggested that yeast, the organism which helps in fermentation, should be allowed to work but not other microorganisms. So he suggested to heat the wine a little bit so that the other organisms get killed once the fermentation is over. He also advised to close the container after heating.

This process of killing undesirable microorganisms is now called pasteurisation.

These findings by Pasteur help a wide industry such as vinegar, beer, milk and cheese, etc.

Image source:

Louis pasteur: SSSVV Gallery

Louis pasteur: <https://pixabay.com/vectors/louis-pasteur-man-line-art-french-5279536/>

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Interesting Asides	Micro organisms: Friends & Foes	Principles of treatment, prevention, Infectious diseases (Agents, means of Immunization, Disease causes microorganisms,

7. MS_ Fermentation

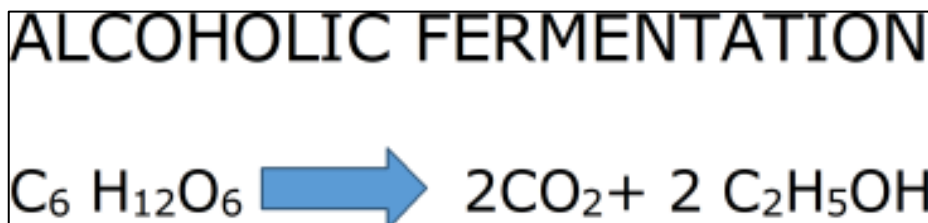
Fermentation is a process that man has been using since ages. Fermentation usually implies that the action of microbes is desirable, and the process is used to produce alcoholic beverages such as wine, beer, and cider. Fermentation is also employed in the leavening of cake, bread, idli & dosa batter, and for preservation techniques to create lactic acid in sour foods.

It is mainly concerned with harnessing the wastes of bacteria or other microorganisms such as yeast, for products that are used by humans.

Cellular Respiration: It is a process of using glucose to make energy ATP (Adenosine Tri-Phosphate) for the cell.

Aerobic Cellular Respiration (in the presence of oxygen) Aerobic Cellular Respiration takes place in the mitochondria of cells. It provides upto 38 molecules of ATP per molecule of glucose.

Anaerobic Cellular Respiration (without oxygen) is also known as fermentation.



Products of Alcoholic Fermentation



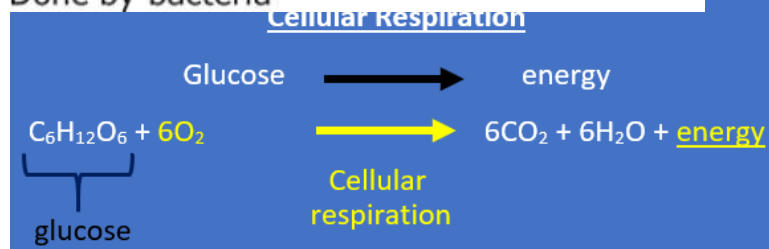
LACTIC ACID FERMENTATION

Glucose $\longrightarrow$ carbondioxide + Lactic acid

Provides 2 molecules ATP per glucose

Done by muscle cells

Done by bacteria



Products of lactic acid fermentation



Other products of fermentation - fermented by both yeast and bacteria..... idli, dosas, breads, cakes, chutney etc.



Image source:

<https://pixabay.com/vectors/bottles-wine-alcohol-drink-glass-4261777/>

https://www.srisathyaivaividyaahini.org/alfresco/d/direct/workspace/SpacesStore/4c73d1bc-0adb-42b0-ab55-27e1203dc369/board-cheese-6678?ticket=TICKET_23f1329eb2ec9aa21ead10ffdc95374c19322648

https://www.srisathyaivaividyaahini.org/alfresco/d/direct/workspace/SpacesStore/6aa1e279-942b-40a5-9a74-2b76ed04b36c/curd-6946?ticket=TICKET_23f1329eb2ec9aa21ead10ffdc95374c19322648

https://www.srisathyaivaividyaahini.org/alfresco/d/direct/workspace/SpacesStore/3d81fdf9-535e-4bcd-8523-d0526ae8cf8c/dosa-6673?ticket=TICKET_23f1329eb2ec9aa21ead10ffdc95374c19322648

https://www.srisathyaivaividyaahini.org/alfresco/d/direct/workspace/SpacesStore/0e67a940-577f-49d4-bc0c-147d72bc2759/idli-6940?ticket=TICKET_23f1329eb2ec9aa21ead10ffdc95374c19322648

Time to teach	Asset Type	Theme	Sub Theme
8 Minutes	Main Script	Micro organisms: Friends & Foes	Fermentation

8. SA_ Yeast Air Balloons

Aim: To show the reaction of yeast on sugar solution.



Materials required: sugar solution, yeast, balloon, bottle, beaker, glass rod

Setting for the Activity [Indoor]

Indoor (classroom activity)

Type of Activity: [Group activity]

Procedure:

1. Take a bottle.
2. Fill it with a sugar solution.
3. Add yeast to it.
4. Put a balloon at the opening of the bottle.
5. Mix well till all the yeast dissolves.
6. Place the bottle in a warm and dry place for 4-5 hours.
7. Observe the balloon after sometime.



Observation: We see that the balloon inflates.

Conclusion: This activity helps the students to understand that yeast feeds on sugar and releases carbon dioxide gas.

Questions to Ponder over:

1. Why did the balloon inflate?

Answer: As the yeast feeds on the sugar, it produces carbon dioxide. With no place to go but up, this gas slowly fills the balloon.

2. What is the chemical reaction between sugar solution [glucose] and yeast?

Answer : Yeast has an enzyme called zymase and this triggers the fermentation process.

Glucose $\xrightarrow{\text{zymase}}$ Ethanol + carbondioxide

$\text{C}_6\text{H}_{12}\text{O}_6 (\text{aq}) \rightarrow 2\text{C}_2\text{H}_5\text{OH}(\text{aq}) + 2\text{CO}_2(\text{g})$

Instructions to the teacher include:

- ✓ The activity is team-based.
- ✓ The teacher should distribute the materials among the groups.
- ✓ Teacher makes the groups depending on the number of students in the class.

Image Source:

<https://pixabay.com/en/salt-bread-herbs-oil-spoon-flour-2484344/>

<https://pixabay.com/en/balloon-red-birthday-party-885715/>

<https://pixabay.com/en/bread-food-bake-bakery-wheat-2559313/>

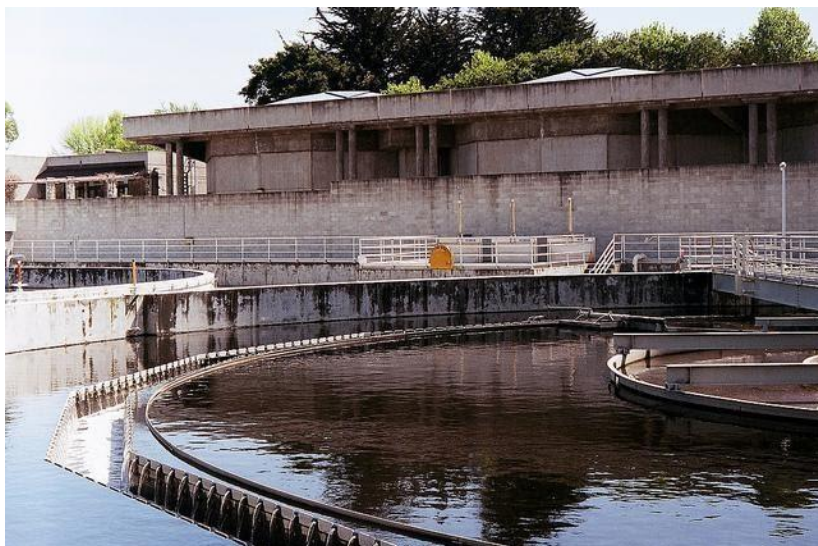
Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Suggested Activity	Micro organisms: Friends & Foes	Fungi (definition, habitat

9. DD_ Microbes in everyday life**Microbes & Environment**

Today, we live in an era where there is a dire need to restore the environment to its original glory and it has to be done in a sustainable manner. The magic remedy for it, is the use of microorganisms for environmental management which is also the most natural method.

**ROLE OF MICROBES IN WATER PURIFICATION**

The term 'bacteria' makes us think that it is harmful especially when found in water causing various water borne diseases. But there are strains of bacteria which can help in water purification. Colonies of bacteria use the contaminants present in the water as food and thrive on them and these bacteria are finally removed through the filtration process to produce pure drinking water.



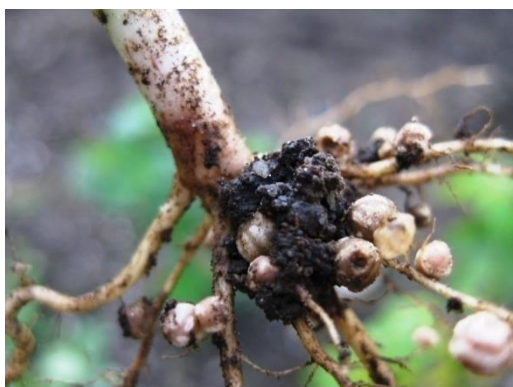
ROLE OF MICROBES IN SEWAGETREATMENT

Water pollution levels can be greatly reduced by treating the waste water with microbes before letting it out into the river or sea. During sewage treatment, air is pumped into it to create an environment in which microbes like certain bacteria, rotifers and protozoa can live. They feed on the pollutants and get settled at the bottom and are finally pumped out and disposed of.

ROLE OF MICROBES IN RECYCLING OF SOIL NUTRIENTS

Recently, people are becoming more aware of organic farming and there is so much demand for bio fertilisers to replenish the soil nutrients. Biofertilisers are mainly made of bacteria, fungi and cyanobacteria.

1. Rhizobium bacteria fix atmospheric nitrogen into organic forms which can be easily utilized by the plants.



2. Cyanobacteria such as *Nostoc*, *Anabaena* and *Oscillatoria* also fix atmospheric nitrogen and add organic matter.



Fig. Cyanobacteria

3. Certain fungal species of the genus *Glomus* absorb phosphorus from the soil and pass it on to the plant. These microbes are commercially available as biofertilisers in order to reduce the dependency on chemicals.

Microorganisms in the food industry.



Microorganisms are used in the production of fermented food and beverages. E.g. Yeast, Penicillium, Lactobacillus.

1. Curing of tea/Coffee: *Bacillus megaterium* acts on the leaves of tea/tobacco and also on beans of coffee and gives it its characteristic flavour.
2. Making of Curd: *Lactobacillus lactis* (lactic acid bacteria) converts milk protein into curd.
3. Production of Vinegar: Vinegar is manufactured from sugar solution employing *Acetobacter aceti* by the fermentation process.
4. Production of Alcohol : Butyl alcohol, methyl alcohols are prepared from molasses by the fermentation activity of *Clostridium acetobutylicum*.
5. Production of Oxalic acid: Oxalic acid is formed by fermentation of a fungi called *Aspergillus niger*.

Microorganisms in the pharmaceutical industry.

Microorganisms are extensively used in the field of medicine. They are used for the production of antibiotics, vaccines, insulin, growth hormones and diagnostic kits. E.g. *E. coli*, Poliovirus.



Microorganisms in biotechnology industry

Microorganisms are used in the production of industrially important acids, enzymes, pigments etc. E.g. *Aspergillus niger*, *Bacillus subtilis*.



Microorganisms in bio fuels

Microorganisms have evolved as a potential alternate source of energy. Microorganisms are used to produce biofuels like biodiesel, bio alcohol and also microbial fuel cells. E.g. Algae.

Microbes for cleaning up the mess

In a process called Bio-remediation, help is provided by microbes, fungi and plant stores the natural environment after contamination. Mixtures of microbes that can digest different chemicals in the contaminated area are used, followed by plants that can bio-accumulate lead, cadmium and other heavy metals. The metals are then incinerated or recycled for further use.



Cleaning the environment

The plant waste is converted into manure by the action of microbes. The microorganisms decompose dead organic wastes of plants and animals converting them into simple substances which can be used by the plants and animals. Microorganisms can be used to degrade the harmful and smelly substances there by cleaning up the environment.

Image source:

Factory: <https://openclipart.org/detail/276858/factory>

Fig. A water treatment plant: <https://www.flickr.com/photos/-adam/5647869964/> (Attribution - Adam Freidin)

Rhizobium: SSSVV Gallery

Cyanobacteria: <https://www.flickr.com/photos/archesnps/8094886300/>

Wine glass: <https://www.pexels.com/photo/wine-in-wine-glass-near-green-glass-bottle-162784/>

Cheese: <https://pixabay.com/en/cheese-with-holes-2704448/>

Chocholate: <https://pxhere.com/en/photo/1379627>

Curd: SSSVV Gallery

Antibiotic: <https://pixabay.com/en/addiction-antibiotic-capsule-care-71575/>

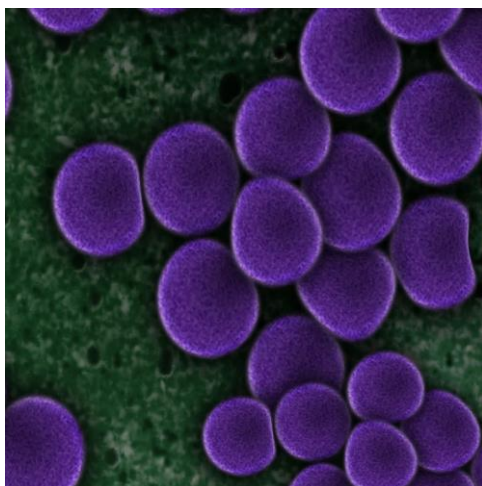
DNA: <https://pixabay.com/en/dna-string-biology-3d-1811955/>

Microbiologist: <https://pixabay.com/en/analysis-biology-biotechnology-2025786/>

Oil: <https://pixnio.com/nature-landscapes/waves/an-oil-slick-from-the-oil-spill>

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Day-to-day Relevance	Micro organisms: Friends & Foes	Nitrogen fixation, Cleaning

10. SA_ Activities on microorganisms



Activity I

Aim: To observe the growth of fungus.

Materials required:

- Lemon
- Compound microscope
- Microscopic glass slides
- Cover slips
- Knife

Setting for the Activity [Indoor]

Type of Activity: [Demonstration]

Procedure

1. Teacher has to cut a lemon in to two halves and keep it exposed to air up to 48hours. The lemon will develop a bushy material on the exposed surface.
2. Prepare a wet mount of the bushy material and observe it under a compound microscope using glass slides and cover slips.

Observation: After 48 hours a bushy material is seen on the fleshy side of lemon pieces. The organism is blackish in colour and does not contain chloroplast.

Conclusion: It is inferred that the organism grown on the fleshy side of lemon pieces does not contain chloroplast. So it should be a fungus. As they lack chlorophyll, they live either as a parasite or saprophyte. The cells of this fungus contain eukaryotic nuclei.



Question to ponder

What feature of the bushy growth observed confirms, it is fungus?

The organism grown is fungus since it lacks chlorophyll.

Instructions to Teacher:

1. The lemon should be cut and kept 48 hours before the activity.
2. Avoid air bubbles while placing the cover slip on the slide.

Activity II

Aim: To observe the structure of a yeast cell.

Materials required:

- Yeast powder,
- beaker
- Microscopic slides
- Methylene blue
- Compound microscope
- Water

Setting for the Activity [Indoor]

Type of Activity: [Demonstration]

Procedure: Make a suspension of yeast using yeast powder and water. Take a drop of this suspension and prepare a smear on a microscopic slide. Stain the smear using methylene blue. Observe the

smear under a compound microscope.

Observation: Under high power microscope yeast cells appear as oval shaped structures.

Conclusion: From this activity, it is inferred that yeast cell is oval or elliptical in shape enveloped by a cell wall. Inner to the cell wall is cell membrane, which surrounds the protoplasm and cell organelles. A large vacuole surrounded by a single unit membrane occurs at the centre of the cell. The nucleus is distinct.

Question to ponder?

How does yeast cell multiply?

By budding.

Instructions to Teacher:

1. Wait till the yeast has risen well.
2. Avoid air bubbles while placing the cover slip on the slide.

Activity III

Aim: To observe the structure of amoeba using our own specimen under a high power microscope.

Materials required:

- Pond weeds
- Petri dish
- Microscope slides
- Cover slips
- Medicine dropper
- Compound microscope

Setting for the Activity: [Indoor]

Type of Activity: [Demonstration]

Procedure:

- i) Place the pond weed in a petridish.
- ii) Cover the pond weed with water and place it in a location where there is no sunlight.
- iii) Let it stand until a brown scum appears. This brown scum contains a number of amoebas.
- iv) Transfer some of the amoeba to a microscope slide with a medicine dropper.
- v) Put a cover slip over the amoeba to protect the microscope objective from the living biological specimen.

Observation: Under a high power microscope, the amoeba looks like a colourless jelly with an irregular shape.

Conclusion: It is observed that amoeba is a unicellular organism and it has a cell membrane, a nucleus and small vacuoles in the cytoplasm.

Question to ponder

Where do amoeba reside generally ?

Generally amoeba live in soil, ponds, lakes, forests and rivers. If you scoop up a handful of dirt in the woods, it will probably contain hundreds of thousands of them.

Instruction to the teacher:

1. Collect pond weeds one day before.
2. Avoid air bubbles while placing the cover slip on the slide.

Image Source:

<https://pixabay.com/photos/lemon-rotten-fruit-yellow-green-2146987/>

<https://pixabay.com/illustrations/bacteria-bacterial-species-imitation-108897/>

Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Suggested Activity	Micro organisms: Friends & Foes	

11. IQ_ Viruses and other microorganisms

[Notes to the teacher - Teacher may enable the students to think and come out with as many answers as possible before giving out the right answer/ answers]

What is the difference between viruses and other microorganisms?

Viruses do not grow out. They grow only in other organisms. They do not need food when they are out.

They even do not carry out the activities which other organisms perform when they are out.

Virus is non-living and is found in air, water, or soil. When it enters the host and starts replicating, using the DNA/RNA of the host, it becomes a living organism, a virus. All viruses are pathogenic because they enter cell and cause adverse effects.



Image Source:

<https://pixabay.com/illustrations/virus-microscope-infection-illness-1812092/>

<https://pixabay.com/illustrations/virus-germ-blood-count-174051/>

Time to teach	Asset Type	Theme	Sub Theme
5 minutes	Inquisitive Questions	Micro organisms: Friends & Foes	Viruses (definition, habitat)

12. SA_ Pathway of Microbes

Aim: To enable the students trace the illness caused by tissue specific and organ specific microbes and the line of treatment through activities.

1. Fact file on ‘The Father of Microbiology’:



- Louis Pasteur was born on December 27, 1822 in Dole, France.
- He was a French chemist and a microbiologist.
- He was known for his discoveries on vaccination, microbial fermentation and pasteurisation.
- His discoveries provide support for the germ theory of disease.
- He is remembered for even today because he discovered the causes and prevention of wide varieties of diseases.
- His discoveries have saved millions of lives ever since. He created the first vaccines for rabies and anthrax.
- He invented the technique of pasteurisation.
- He is one of the three main founders of bacteriology, and is popularly known as the 'father of microbiology'.
- In 1856 the Royal Society of London presented him the Rumford Medal for his discovery of the nature of racemic acid.
- In 1874 he got the Copley Medal for his work on fermentation.
- The French Academy of Sciences awarded him the Montyon prizes in 1859 for experimental physiology, and the Jecker Prize in 1861 and the Al Humber Prize in 1862 for his experiment on spontaneous generation.
- He died on September 28, 1895, in Marnes-la-Coquette, France.

Using the above information complete the details:
Fact file on 'The Father of Microbiology'

1.	<i>Name</i>
2.	<i>Born on</i>
3.	<i>Nationality</i>
4.	<i>Fields</i>
5.	<i>Discoveries</i>
6.	<i>Vaccines</i>
7.	<i>Founder of</i>
8.	<i>Popularly known as</i>
9.	<i>Notable Awards</i>
10.	<i>Died on</i>

1. Make connections with the disease to the respective agent and affected tissue /organ:

Instruction to the teacher - Give the disease. Let the students find out the microbes causing the disease and the affected tissues/organs

Match

Disease	Microbe	Tissue / organ
1. <i>Amoebiasis</i>	<i>Dengue virus</i>	<i>Lungs</i>
2. <i>Pneumonia</i>	<i>Bacterium staphylococcus</i>	<i>Liver</i>
3. <i>Malaria</i>	<i>Streptococcus pneumoniae</i>	<i>Large intestine</i>
4. <i>Dengue</i>	<i>Entamoeba histolytica</i>	<i>Skin</i>

2. Statistical Data: Harmful Invaders

Bacteria in a kitchen:

	Objects	Percentage of Homes
1.	Dish Towel	97.5 %
2.	Hand Towel	98.6 %
3.	Sink Faucets	94.0 %
4.	Sink Surface	97.2 %
5.	Drain Board	99.4 %
6.	Washing Machine	89.6 %
7.	Refrigerator	90.4 %
8.	Cloth / sponge for wiping counters	100.0 %

Present a Bar Graph here using the given information.

3. Role Play:

Instruction to the teacher- Select the students and allot their role before hand.

Do a 'role play' on microbes that affect the organs/tissues in humans. An example is given for you:

Hi! I am Plasmodium vivax, a protozoan parasite and a human pathogen. I am one of the most frequent and widely distributed causes of recurring malaria and I am one of the 5 species of malaria parasites that infects humans. I am less virulent than Plasmodium falciparum, the dead lies of the 5, but the malaria caused by me can lead to several diseases and death due to splenomegaly (enlargement of spleen). As many as eight US presidents including George Washington, Abraham Lincoln are afflicted due to me and I helped to kill Genghis Khan. I am carried by the female anopheles mosquito, since it is the only female of the species that bites.

Image source: SSSVV Gallery

Time to teach	Asset Type	Theme	Sub Theme
20 Minutes	Suggested Activity	Micro organisms: Friends & Foes	Disease causing microorganisms

13. IQ Vaccine

[Notes to the teacher - Teacher may enable the students to think and come out with as many answers as possible before giving out the right answer/ answers]

1. How can a simple vaccine provide immunity for so many years?

Suggested Answer: When a vaccine containing the weakened or killed germs is introduced into our body, our immune system reacts to the vaccine by producing antibodies. These antibodies destroy the vaccine germs just as they would do to the disease germs— like a training exercise. The antibodies then stay in our body and act as watch men for that particular disease and remain prepared to fight if the disease reappears. Hence, if we are exposed to the real disease even after many years, the antibodies are there to protect us.



2. Why is serious disease not caused even though the live virus or bacteria is introduced in the body?

Suggested Answer: A killed or inactivated pathogen or only a portion of the live virus or bacteria is injected into the body to get the immune system to recognize it. Since the pathogen is weakened or inactivated, the antibodies produced by the body can easily destroy it and thus will not cause the actual disease.

3. Why are vaccines considered safer than getting immunity naturally by going through the disease?



Suggested Answer:

	VACCINATION	NATURAL IMMUNITY
1.	Vaccination safely develops immunity without having to suffer from any of the complications of the disease. Vaccines are also repeatedly tested for safety before they are injected.	Natural infection can produce serious complications and can even be deadly. One has to undergo a lot of struggle before getting the immunity.
2.	Vaccines often provide immunity against multiple strains of the disease.	Natural infection provides infection only against a particular strain of the disease.

4. Is the reaction of our body's immune system different for a vaccine and a natural pathogen?

Suggested Answer: Yes. It is different because the mode of entry of the pathogen is different. In normal circumstances, most pathogens enter a person through the nose or mouth. In most vaccinations, the pathogen enters through an injection into the bloodstream, completely by passing the normal lines of the immune system's defence.

Image Source:

<https://pixabay.com/photos/microbiologist-scientist-pathologist-1332292/>

<https://pixabay.com/da/illustrations/vaccine-sygeplejerske-covid-19-5454099/>

https://commons.wikimedia.org/wiki/File:Fluzone_vaccine_extracting.jpg – Public domain

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Time to teach	Asset Type	Theme	Sub Theme
8 Minutes	Inquisitive Questions	Micro organisms: Friends & Foes	Immunization

14. MS_ Microorganisms and Diseases



Human disease	Causative micro organisms	Mode of Transmission	Preventive measures
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation. The personal belongings of the patients should be kept away.
Measles	Virus	Air	Avoid contact with measles patient; vaccination
Chicken Pox	Virus	Air/contact	Avoid contact with chicken pox patient; vaccination
Polio	Virus	Air/water	Vaccination
Cholera	Bacteria	Water/food	Maintain personal hygiene and good sanitary habits.
Typhoid	Bacteria	Water	Avoid drinking contaminated water; eat food in hygienic places
Hepatitis-B	Virus	Water	Drinking boiled water and vaccination
Leprosy	Bacteria	Contact(vector)	Early diagnosis and treatment of people who are infected.
Athlete's feet	Fungi	Spores in water and in ground/physical contact	Keep feet clean, wear shoes/sandals. Keep the feet dry.
Tetanus	Bacteria	Cuts and wounds	Vaccination
Jaundice	Virus	Air/water/direct contact	Vaccination, no alcohol, Avoid caffeine
AIDS	Virus	Sexual contact	Safe sexual contact, used syringes should be avoided
Influenza	Virus	Air/water/direct contact	Wash hands regularly, vaccination, cover your mouth while coughing
Malaria	Protozoa	Mosquito	Use mosquito net and repellents
Aspergillosis	Aspergillus niger	Spreads by inhaling spores of aspergillus niger	Avoid dirty and unhygienic place

Image Source:

<https://pixabay.com/illustrations/bug-research-female-insect-beetle-2546072/>

<https://pixabay.com/vectors/influenza-flu-fever-grippe-cold-156098/>

<https://pixabay.com/photos/mosquito-malaria-gnat-bite-insect-1548947/>

Time to teach	Asset Type	Theme	Sub Theme
7 Minutes	Main Script	Micro organisms: Friends & Foes	Infectious diseases (Agents, spread)

15. DD_ Microbes in Medicine

Antibiotics



Whenever we fall ill the doctor prescribes some antibiotic tablets, capsules or injections. The source of these injections are microorganisms.

Antibiotics are basically kinds of medicines which destroy microbes that cause disease. Streptomycin, tetracycline and erythromycin are some of the commonly known antibiotics. These medicines kill or stop the growth of the disease-causing microorganisms. Antibiotics are also used for live stock, poultry and plants.

Vaccine



When a microbe that carries a disease enter our body, our body produces antibodies to fight against that microbe. Our body also get strained and remember how to fight against this particular microbe if it enters again. So if a dead or a weakened microbe is introduced in our body, then our body fights

against these introduced microbes also, by producing antibodies. All the antibodies will remain in our body and will fight if the microbe enters. In this way our body gets protected by disease causing microbes. This is how the vaccine works. Vaccine is the dead or the weakened form of the microbe. Several diseases like cholera, tuberculosis, chicken pox, hepatitis can be prevented by vaccination.

Image Source:

<https://www.maxpixel.net/Drug-Fork-Antibiotics-Encapsulate-Eat-Tablets-3532308>

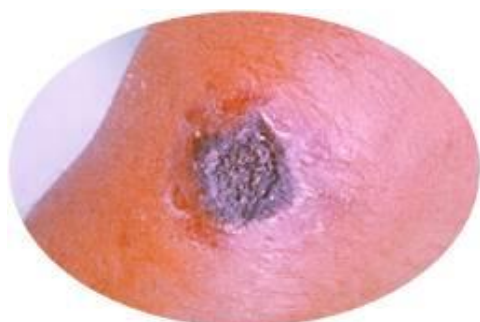
<https://pixabay.com/en/vaccine-vaccination-shoulder-3741296/>

Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Day-to-day Relevance	Micro organisms: Friends & Foes	Immunization

16. MS_ Diseases in plants and animal

Diseases in Animals

Name of the disease	Micro organism	Animals affected
Anthrax	Bacteria	cattle, sheep, goats, camels, antelope
Pneumonia	Bacteria	mammals, reptiles, birds
Black leg of cattle	Bacteria	Cattle, sheep, goats
Foot and mouth disease	Virus	Cattle
Swine flu	Virus	Pigs, humans
Bird flu	Virus	Birds, humans



ANTHRAX



FOOT AND MOUTH DISEASE



SWINE FLU

Diseases in Plants

Name of the disease	Micro organism	Plants affected
Crown galls	Bacteria	grape vines, walnuts, apple, raspberry and other fruit and nut trees
Fire blight	Bacteria	Apples, pears, pome fruit trees etc
Ring rot of potato	Bacteria	Potato
Citrus canker	Bacteria	Citrus fruits such as lime, orange, grape fruit
Black rot of cabbage	Bacteria	Cabbage, crucifer crops
Rust of Wheat	Fungus	Wheat, rye, barley
Yellow vein mosaic of Okra	Virus	Okra (Bhindi)
Cucumber mosaic disease	Virus	squash, melons, peppers, beans, tomatoes, carrots, celery, lettuce, spinach and beets
Blast disease of rice	Fungus	Rice
Bunchy top of Banana	Virus	Banana
Tobacco mosaic disease	Virus	Tobacco
Tikka Disease of Groundnut	Fungus	Groundnut



CROWN GALL



FIRE BLIGHT



RING ROT OF POTATO



RUST OF WHEAT



TOBACCO MOSAIC DISEASE

Image source

Anthrax : https://commons.wikimedia.org/wiki/File:Anthrax_PHIL_2033.png – Public domain

Foot and Mouth disease of Cattle : https://commons.wikimedia.org/wiki/File:Foot_and_mouth_disease_in_mouth.jpg – Public domain

Crown Gall : <https://www.flickr.com/photos/scotnelson/32589809932> - Public domain

Fire Blight: <https://www.flickr.com/photos/jamesrbowe/3691478876> – CC BY 2.0 - [James Bowe](#)

Wheat Fungus : https://en.wikipedia.org/wiki/Ug99#/media/File:Stem_rust_close_up.jpg – Public domain

Tobacco Mosaic : https://commons.wikimedia.org/wiki/File:Turnip_yellow_mosaic_virus.jpg– CC BY 2.5 - Own workAuthorPhotograph:[Michal Mañas](#)

Swine flu : <https://pixabay.com/en/pigs-domestic-animals-fauna-pork-387204/> - CC0

Ring Rot of Potato : <https://pixabay.com/en/age-bacteria-bio-biology-breakfast-1238308/> - CC0

Time to teach	Asset Type	Theme	Sub Theme
8 Minutes	Main Script	Micro organisms: Friends & Foes	Diseases in plants due to microbes Disease causing microorganisms diseases and poor health

17. IQ Food poisoning

[Notes to the teacher - Teacher may enable the students to think and come out with as many answers as possible before giving out the right answer/ answers]

1. What happens if we eat cooked rice, curry, the next day, without keeping it in the refrigerator?

Suggested Answer: It spoils.

2. How does it get spoilt?

Suggested Answer: The food gets spoilt because microorganisms grow on them.



3. How do you know that the food is spoilt?

Suggested Answer: Spoiled food emits bad odour and has bad taste and colour.

4. How do microorganisms spoil the food?

Suggested Answer: The microorganisms such as bacteria, virus, fungi grow on them and contaminate the food. The contaminated food releases toxic substances on them.



5. What happens if we eat such food?

Suggested Answer: Consuming food that is spoilt leads to food poisoning.

6. What could be the symptoms, if you had food poisoning?

Suggested Answer:

- a) Nausea
- b) Diarrhoea
- c) Vomiting
- d) Stomachache
- e) Fever



Image Source:

<https://www.maxpixel.net/Health-Risk-Food-Spoiled-Macro-Mold-Schimmelpilz-2636720>

<https://pixabay.com/en/rotting-potatoes-food-decay-old-185928/>

<https://pixabay.com/en/figure-vomit-orange-human-309910/>

Time to teach	Asset Type	Theme	Sub Theme
8 Minutes	Inquisitive Questions	Micro organisms: Friends & Foes	Food poisoning

18. MS_ Food Preservation

Food preservation is a process by which certain foods like fruits and vegetables are prevented from getting spoilt for along period of time. The colour, taste and nutritive value of the food are also preserved.

Preserving food increases the shelf life of fresh, seasonal foods that makes it last longer. Fresh fruit and vegetables will not be good for more than a week or so depending on how they are stored, but dried, canned, or frozen fruit and vegetables can last for months, even years.

Food is so important to survival so preservation of food has been practiced from olden days by human beings.

The most ancient and commonly practiced method of food preservation is drying. People started using this method from the beginning. They have dried herbs, vegetables, meats and fruits to store them.

They used this method to either:

- Slow down the growth of bacteria ; or
- Kill the bacteria altogether.

Canning and bottling



Canning is one of the most commonly used modern methods of processing and preserving food. It is used to preserve fruits, vegetables and meats. Both cans and glass jars are suitable for canning. It was a method invented by the Frenchman Nicolas Appert. In this method the foods are cooked, sealed in sterile cans or jars and the containers are boiled so as to kill or weaken any remaining bacteria. But there is a risk involved in this type of preservation. The food may get spoilt once the can or jar is opened. So more care is taken during the process so that no water or microorganisms can get inside the can or the jar. In this process, air is removed and vacuum is created inside the jar when the jar is cooled and sealed. We should never buy a damaged can from the market. Today it is very cheap and found in super markets all over the world. From a nutritional aspect it is a good method since most products keep their nutritional qualities.

Pasteurisation is a process of heat treatment of milk, beer and some other beverages. This method requires a lot of time because it has to destroy the microorganisms that are involved in food spoilage. It also has to ensure that the nutritional value of the food is not lost. In this method the food is heated to a specific temperature for a specific time and then rapidly cooled.

For e.g. normally milk is pasteurized at 62.8°C for at least 30 minutes or at 71.7°C for at least 15 seconds. This extends its storage time but does affect the taste.



The use of low temperature

Cold Treatment:

Cold treatment can stop the multiplication and metabolic activities of microorganisms. The necessary condition for successful preservation by cold is that the food must be clean before starting the process..

Chilling involves reducing food temperatures, but only to approximately -1°C. Refrigerators for cold storage/chilling are normally used at 0°C to +8°C for preservation of food products.

Freezing

Freezing is one method which is used to preserve many kinds of foods. Freezing does not alter the flavour, colour and appearance of the food.

Vegetables that are to be frozen are first put in boiling water for a very short time. They are then dried and later frozen. For example: Frozen peas

Fruits can be frozen dry or in sugar syrup.

By freezing the enzymatic activity and the growth of the microorganisms slows down. It is always advised to freeze below -12°C so that the food stays for a longer period of time and the flavor also does not get affected

If vegetables have a lot of water content in them, then they don't freeze well and become soft. So boiling these vegetables helps to reduce the enzymatic activity and after which they can be frozen well.



Boiling



Boiling is the process of applying heat to water until the temperature reaches about 100°C. When foods are boiled in water the microorganisms present in it are killed. As a result the food doesn't get spoilt quickly.

Drying

In this method the food items are kept under sun to reduce moisture content so that microorganism does not spoil the food items.

This is the most ancient method of food preservation. Foods such as herbs, fruits, vegetables and meats can be preserved by drying. From the olden days people depended on sun and nature to remove the moisture content from the foods. This practice is used throughout the world.

For example, Southern Italy is known for drying tomatoes while India is known for drying chilies, mangoes and a host of spices.

Herbs are tied together and hung in a sunny spot. Fruits and vegetables are spread in the backyards of their houses for a few weeks.



Chemical Preservation (curing)

Our mothers use many traditional methods to preserve food items at home. Substances such as sugar, salt, vinegar, spices and wood smoke are safe and used as natural preservatives. Salting, sugaring and smoking are all methods of curing foods.

Pickling

Vegetables can be pickled raw or cooked. They are stored in vinegar, which is a weak acid, and this prevents bacteria from spoiling the food. Even eggs can be cooked and pickled in vinegar and spices. Pickled onion, beetroot and cucumbers (as gherkins) are more common.



Making jams and jellies

Fruit is cooked and softened, sugar is added and the mixture is boiled. When a certain temperature is reached, the jam can be taken off the heat and poured into jars. As it cools, it sets. Jellies are strained jams, without pips or whole fruits.



Image Source:

<https://pixabay.com/photos/pickles-billet-cucumbers-1799731/>

Refridgerator: <https://pixabay.com/photos/bottles-food-gallon-inside-light-1868175/>

Milk boiling: <https://pixabay.com/photos/boiling-over-of-milk-ceramic-hob-2474181/>

Dried fish: <https://pxhere.com/en/photo/915844>

Dried tomatoes: <https://pixabay.com/en/sun-dried-tomatoes-tomatoes-tomato-1334369/>

Dried chilli: <https://pixabay.com/en/chili-peppers-red-dried-edible-61898/>

Apricots: <https://pixabay.com/en/jam-apricots-apricot-cook-2444958/>

Pickle: Original contribution – jai.sai.sudar@gmail.com

Pickle: <https://pixabay.com/photos/canning-relish-pickle-626204/>

Pasteurisation: <https://www.pxfuel.com/en/free-photo-jzdcz>

Time to teach	Asset Type	Theme	Sub Theme
15 Minutes	Main Script	Micro organisms: Friends & Foes	Food preservation

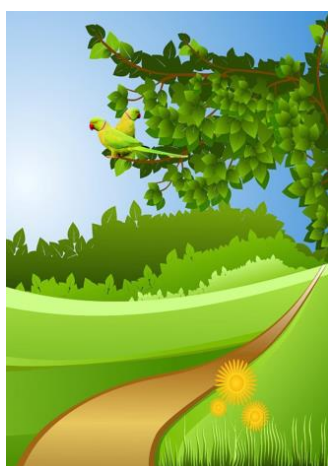
19. VC_ Friend and Foe

Learning domain - Classroom

Microorganisms play an important role in our lives. Some of them are beneficial in many ways where as some others are harmful and cause diseases.

This world is a mixture of both good and not so good people. As students you must be able to exercise caution and discrimination while choosing friends.

There were two parrots on a tree.



A hunter trapped them and sold them, one to a cruel butcher and the other to a sage who resided in a hermit.



After a few years, the hunter was passing by and he was surprised to find that the butcher's bird spoke very unkind words, while the one with the sage recited the name of God in a sweet musical tone, which captivated the listeners.



The hunter realized it was because of the different types of company that the parrots behaved differently.

Notes to teacher:

The teacher may ask the following question to the class and elicit the answers from children.

1. How would you choose a friend?
2. What are the characteristics you would look for in a friend?
3. What are the characteristics you would NOT look for in a friend?
4. What can you do to be a good friend, and to avoid spreading toxic thoughts or words to your friends?

To be explained by the teacher:

Children! Care has to be taken to see that you select and stick to the proper company. We have a popular saying "One bad apple can spoil the whole box." If one apple goes bad in a box it can very quickly cause the ones around it to go bad as well. It holds good for friendship too. One bad company can spoil the entire group of friends.

Good company does not only mean only associating yourself with good people. It also means:

1. Reading good books
2. Listening to good things and
3. Making friends with Nature & protecting them
4. Eating good food to nourish our body.

Image Source:

<https://pixabay.com/en/road-field-summer-design-trees-163551/>

<https://pixabay.com/en/birdcage-birds-colorful-cage-3748898/>

<https://www.youtube.com/watch?v=9imd8Z0crA4> (Attribution - Funny Kidz TV Hindi)

<https://www.youtube.com/watch?v=PlnV1IE6F5U>

<https://www.youtube.com/watch?v=ny4MXOvShIM>

Time to teach	Value Type	Value Sub Type	Value Attribute
5 Minutes	Love	Good Company	Stories

20. MS_ Nitrogen cycle

All plants need nutrients to grow. Nitrogen, phosphorus, potassium are the main plant nutrients. These nutrients are present naturally in the soil. All the plants derive these nutrients with the help of roots. But when the same plant is grown again and again in the same soil, the amount of nutrients present in the soil decreases. As a result, the plants do not get enough nutrients for their growth. The plants show retarded and stunted growth.

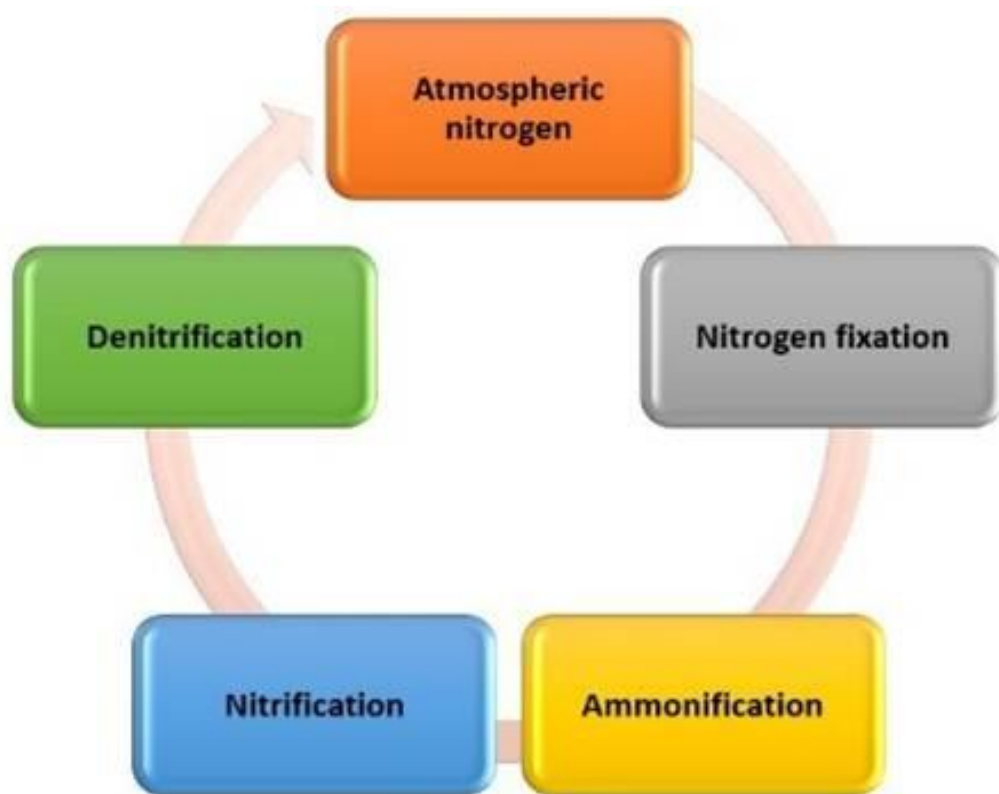
78% nitrogen is present in our atmosphere. Nitrogen is present in proteins, chlorophyll, nucleic acids and vitamins. Plants and animals cannot take in the nitrogen from the atmosphere directly. There are certain organisms such as bacteria, blue green algae present in the soil which fix nitrogen from the atmosphere and convert into compounds of nitrogen.

These organisms convert the nitrogenous wastes present in dead and decayed animals and plants into nitrogenous compounds to be used by plants again.

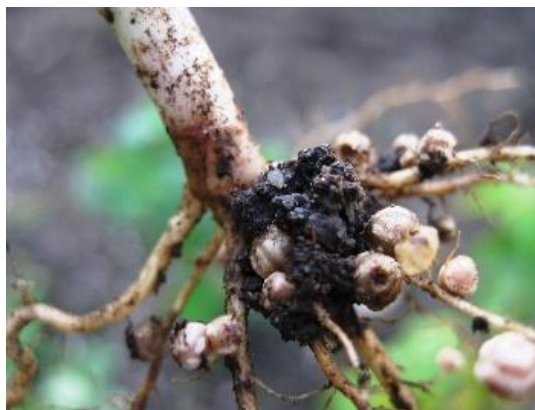
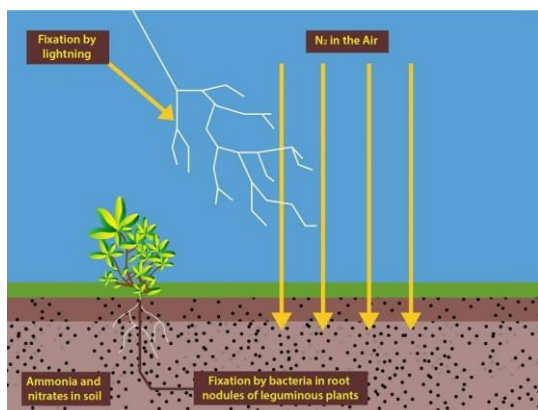
The microorganisms that live in the root nodules of leguminous plants fix the atmospheric nitrogen into the soil, thereby increasing the soil fertility.

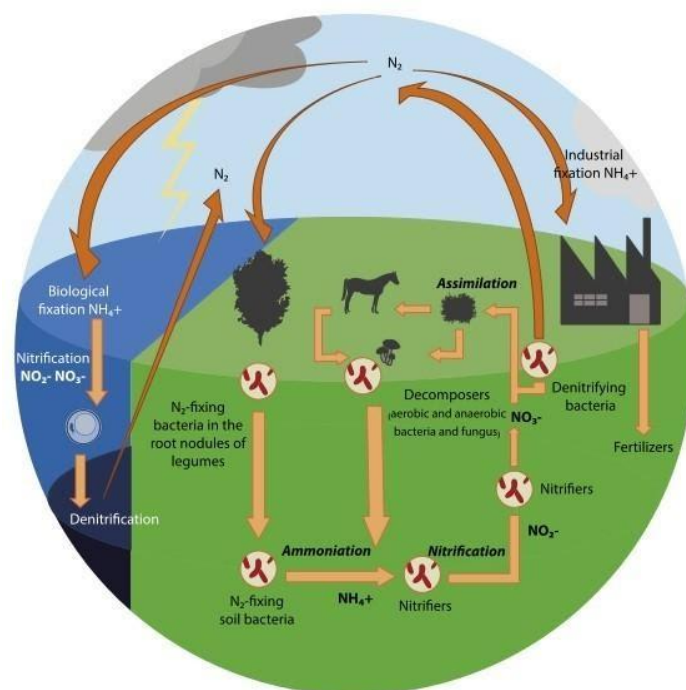
Nitrogen cycle is a biogeochemical cycle in which the nitrogen gets converted into many forms. In this cycle the nitrogen passes from the atmosphere to the soil to the organisms and back to the atmosphere.

The whole cycle undergoes the following steps:



1. Nitrogen fixation: Nitrogen fixing plants are called legumes. The roots of leguminous plants such as peas, groundnuts, beans, etc have a small rounded structure called root nodules. These root nodules contain a nitrogen fixing bacteria called rhizobium. This bacteria has a symbiotic relationship with the legume plants. The legume plants are not able to absorb the free atmospheric nitrogen, so the rhizobium bacteria present in the root nodules converts the atmospheric nitrogen to ammonia. This ammonia is then used by the plant. This is the first stage of the nitrogen cycle in which nitrogen gets fixed in the soil. Many times nitrogen also gets fixed in the soil because of lightning.





2. Ammonification: Animals excrete out nitrogen in the form of urea, ammonia and uric acid. As the plants or animals die, their proteins are decomposed by microorganisms (bacteria or fungi) to ammonia and this phenomenon is referred to as ammonification.

3. Nitrification: More species of bacteria in the soil are involved in the next stage. *Nitrosomonas* is one such species. These bacteria convert the Ammonia in the soil to Nitrites. This kind of oxidation process of ammonia is known as nitrification.

Thus the process of nitrification begins with Ammonium ions and the end product, Nitrate (NO_3^-) is the form that can now be assimilated by plants. This prevents the soil from being saturated with nitrates. The nitrates that are assimilated by plants get decomposed when the plant dies or get consumed by animals and then get decomposed when the animal dies.

4. Denitrification: Some denitrifying bacteria like *Pseudomonas* present in the soil reduce the ammonia compounds like nitrate and nitrite into nitrogen gas, which goes back into the atmosphere. As a result, the percentage of nitrogen in the atmosphere remains more or less constant.

Image Source:

Nitrogen cycle: https://en.wikipedia.org/wiki/File:Nitrogen_Cycle_1.svg

Nitrogen cycle: SSSVV Gallery

Root nodules: SSSVV Gallery

Time to teach	Asset Type	Theme	Sub Theme
10 Minutes	Main Script	Natural resources	Nitrogen cycle

21. QA_ Microorganism - A recap

WHO AM I?

Question 1 : Who am I?

I contain a core of nucleic acid (DNA or RNA) surrounded by a covering layer of protein (no cytoplasm, cell membrane or anything else).

x) Bacteria y) Virus z) Protozoa

Answer: y) Virus

2 : Who am I?

I live in water and in damp soil. I am green in colour.

x) Virus y) Protozoa z) Algae

Answer: z) Algae



Question3 : Who am I?

I am used in baking breads.

x) Amoeba y) Chlamydomonas z) Yeast

Answer: z) Yeast

Question 4: Who am I?

I am a single celled organism with true nucleus and a cell membrane

x) Fungi y) Protozoa z) Virus

Answer: y) Protozoa

Question 5: Who am I?

I am the reason for Malaria

x) Protozoa y) Virus z) Bacteria

Answer: x) Protozoa

Question 6: Who am I?

I am the reason for cold, chickenpox and measles

x) Virus y) Protozoa z) Fungi

Answer: x) Virus

Question 7: Who am I?

I am the reason for tuberculosis, anthrax

x) Bacteria y) Virus z) Fungi

Answer : x) Bacteria

Question 8: Who am I?

I am the reason for ringworm and athlete's foot

x) Fungus y) Bacteria z) Protozoa

Answer: z) Fungus

Question 9: Who am I?

I am living and non living

x) Virus y) Protozoa z) Fungi

Answer: y) Virus

Question 10: Who am I?

I am a single celled organism only visible with a light microscope

x) amoeba y) mushroom z) plants

Answer: y) amoeba

II. Assessment questions on acute and chronic diseases, causes of diseases, infectious diseases, immunization with answers.

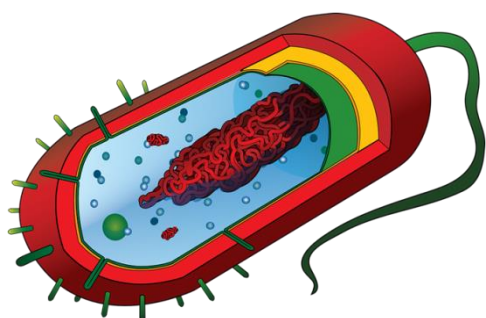
Question 1 : Microbes can enter the body through the four sites. What are they?

Answer:

- a) Respiratory tract (mouth and nose)
- b) Gastro intestinal tract (mouth oral cavity)
- c) Urogenital tract
- d) Breaks in the skin surface

Question 2: What is a pathogen ?

Answer: A pathogen is a microorganism that has the potential to cause disease. We often refer to the min everyday, non-scientific terms as 'germs' or bugs.



Question 3: What is an infection?

Answer: An infection is the invasion and multiplication of pathogenic microbes in an individual or population.

Question 4: What is disease?

Answer: Disease is when the infection causes damage to the individual's vital functions or systems.

Question 5: Can you identify me?

Answer: Athlete's foot

Athlete's foot is a form of dermatophytosis, caused by dermatophytes, fungi which inhabit dead layers of skin (or nails or hair) and feed on keratin.

Question 6: Can you identify me?

(Clue) I am known as 'the Father of Microbiology'.

Answer: Antonie Philips vanLeeuwenhoek

I am best known for my work on the improvement of the microscope and for my contributions towards the establishment of microbiology.

Question 7: What is pasteurisation?

Answer: Food preservation method, in which moderately high (62°C to 100°C) temperatures are used (for about 15 to 30 minutes) to inactivate certain enzymes and kill certain other microorganisms (such as those that cause tuberculosis), especially in milk.

Question 8: How can we prevent microbes?

Answer: Wash your hands.

- 1.Before preparing or eating food
- 2.After coughing or sneezing
- 3.After using the bathroom
- 4.After changing a diaper

This will wash away cold and flu viruses and staph and strep bacteria as well as many other disease-causing microbes.

Question 9: What is a vaccine?

Answer: A vaccine typically contains an agent that resembles a disease-causing microorganism and is often made from weakened or killed forms of the microbe, its toxins or one of its surface proteins. This agent stimulates the body's immune system to recognize the agent as foreign, destroy it, and keep a record of it, so that the immune system can more easily recognize and destroy any of these microorganisms that it later encounters.

Question 10: Can you identify me?

(Clue) I am known as "the father of immunology".

Answer: Edward Jenner. I was the pioneer of the smallpox vaccine, the world's first vaccine.

Question 11: Give examples for common chronic diseases

Answer: Common chronic diseases include arthritis, asthma, cancer, COPD, diabetes and HIV/AIDS.

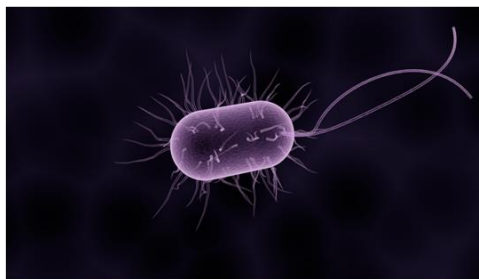
Question 12: Give examples for acute Diseases

Answer: Acute leukemia, gastro enteritis, and acute hepatitis.

Question 13: Give some ways for microbes transmission

Answer:

- Some microbes can travel through the air
- Close contact can pass germs to another person
- You can pick up and spread germs by touching infectious material
- A healthy person can carry germs and pass them on to others
- Germs from your house hold pet can make you sick
- You can get microbes from tiny critters (creatures in general) or vectors which are living creatures
- Transplanted animal organs may harbor germs
- Some microbes in food or water could make you sick

Question 14. How can you differentiate viruses, bacteria and fungi?***Virus******Bacteria******Fungi***

Answer: Differences between fungi, bacteria and viruses

The table shows some of the similarities and differences between the three types of microbes.

Features	Fungi	Bacteria	Viruses
Cell Membrane	Yes	Yes	No
Cell Wall	Yes (Hard)	Yes (Soft)	No (Protein Coat)
Cell Nucleus	Yes	No (Circle)	No (Strand)

Question 15: Mention some diseases caused by bacteria

Answer:

1. tuberculosis, TB (affects the lungs)
2. typhi or typhoid (causes food poisoning)
3. whooping cough (affects the lungs)

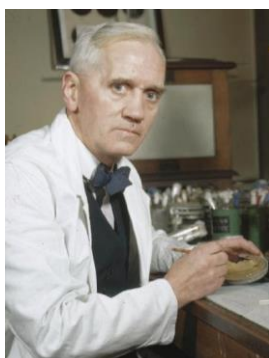
Question 16: Mention some diseases caused by viruses

Answer:

1. chickenpox (affects skin and nerves)
2. common cold
3. influenza, flu
4. measles (affects skin and lungs)
5. mumps (affects salivary glands)
6. rubella, german measles

Question 17: Mention some diseases caused by fungi**Answer:**

1. athlete's foot
2. thrush

Question 18: Who discovered Penicillin?**Answer :** It was discovered by Alexander Fleming**Image source:**

https://commons.wikimedia.org/wiki/File:Athletes_foot.JPG

<https://commons.wikimedia.org/w/index.php?curid=84356554>

<https://commons.wikimedia.org/w/index.php?curid=84356782>

https://commons.wikimedia.org/wiki/File:Synthetic_Production_of_Penicillin_TR1468_crop.jpg – Public domain

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<https://pixabay.com/vectors/pathogen-causative-agent-germ-virus-296502/>

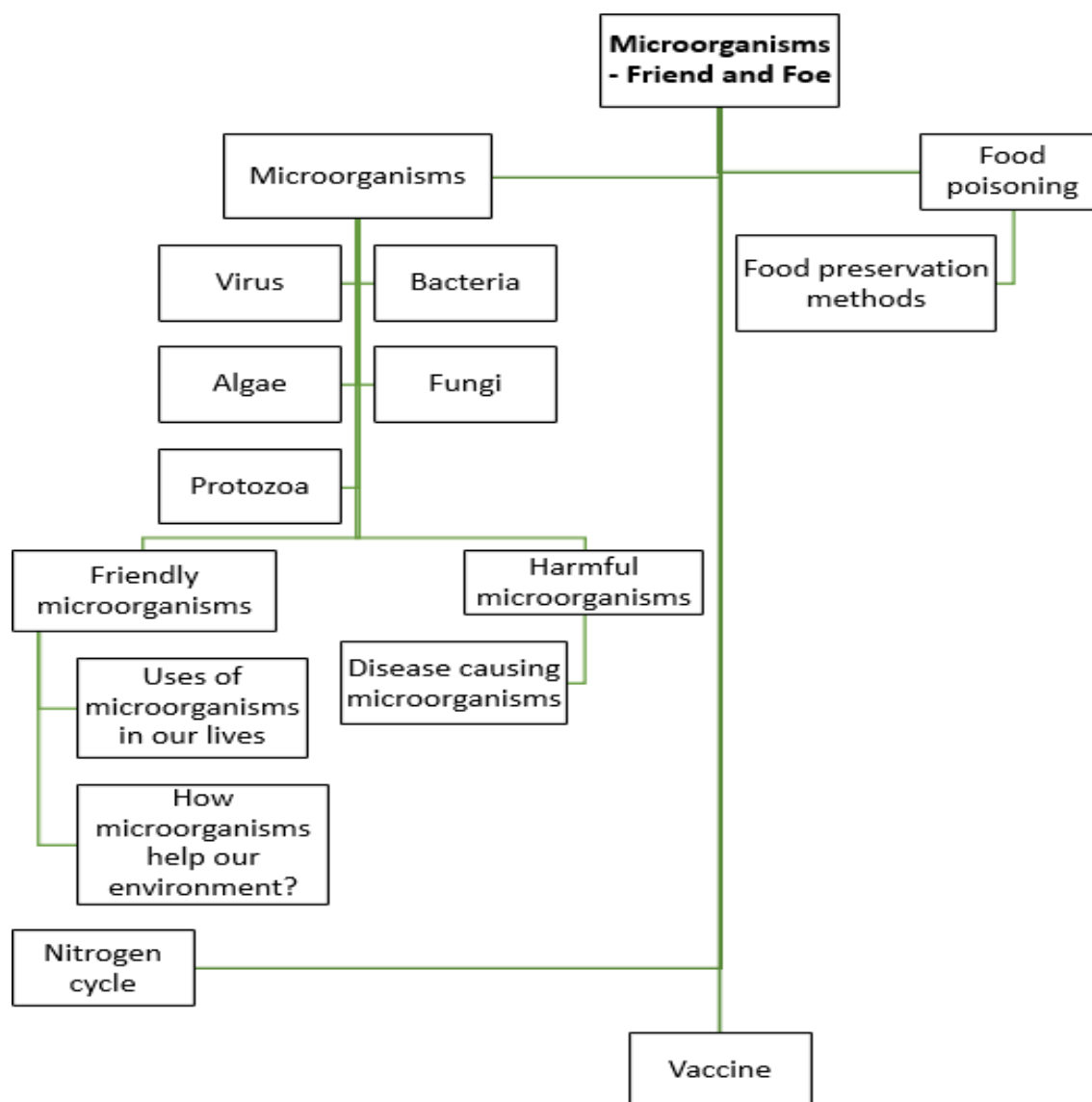
<https://pixabay.com/illustrations/virus-microscope-infection-illness-1812092/>

<https://pixabay.com/illustrations/bacteria-bacterium-microbiology-1832824/>

<https://pixabay.com/photos/fungus-forest-mushroom-wild-2158028/>

Time to teach	Asset Type	Theme	Sub Theme
20 Minutes	Assessments	Micro organisms: Friends & Foes	Diseases in plants and Animals due to Microbes, Immunization, Food Preservation, Food Poisoning

22. MS_Summary_Microorganisms: Friend and Foe



Time to teach	Asset Type	Theme	Sub Theme
5 Minutes	Main Script	Micro organisms: Friends & Foes	Microorganisms, Diseases in plants and Animals due to Microbes, Immunization, Food Preservation, Food Poisoning

Master Lesson Plan

Seven Asset Methodology for MLP	
What is the purpose of this Master lesson Plan?	This Master Lesson Plan (MLP) prepared by Sri Sathya Sai Vidya Vahini, covers the entire chapter for the given board. The chapter given in the textbook is broken down into smaller modules known as assets. One of seven teaching methods is applied to each asset. Several different assets together complete the entire chapter. Each asset is supported by a teaching aid such as animated presentation, audio, video, worksheet; that the teacher can use in the class, while teaching that module. The MLP is for the teacher's preparation and the teaching aids are for use in the classroom.
How to use it?	You can prepare for your class with this MLP by following 3 simple steps:1. Read your textbook; 2. Go through the information given in the assets (document & multimedia); 3. Prepare your teaching notes. Great! Now you are ready to transact the chapter.
Duration	Kindly note the duration given for each asset. Due care has been taken in planning the assets, to ensure the chapter is completed within the time specified by the Board. Note: Preparation time is not included in the asset duration. The teaching time depends on the duration of the teaching aids and is not impacted by the length of the MLP.
What is a 'Main Script' (MS) Asset?	The Main Script asset is there for explaining the main concepts of the chapter clearly. The information given in the textbook is simplified, organised and structured to give more clarity. Additionally, you may find a video or mnemonics or a graphic organiser to deepen the understanding of the concept.
How to teach using the MS asset?	Please use the blackboard, slides and interaction to develop the concept.
What is an 'Inquisitive Questions' (IQ) asset?	The Inquisitive Questions asset uses questions to promote higher order thinking like the n^{th} why, what-if, new perspectives, cause-effect, and others, creating curiosity.
How to teach using the IQ asset?	You may use the questions to connect with the students, encourage exploration to engage them in the learning process. You may allow multiple responses and instead of rejecting any of the responses, ask why, before revealing the suggested answer or hints.
What is a 'Day to day Relevance' (DD) Asset?	The Day to Day Relevance asset helps students understand the practical relevance of every topic, making them eager participants in the classroom. If students connect the concepts to their environment, they would learn meaningfully without dislike or simply memorizing for exams.

How to teach using the DD asset?	You may use the asset by asking questions about their experience and use it to establish why they are learning the topic. If necessary you may substitute with a recent or local example.
What is an 'Interesting Aside' (IA) asset?	The Interesting Aside asset uses attention grabbing titbits or anecdotes to bring joy and satisfy the child's hunger to know more. This is a quick/short asset intended to bring attention back to the main concept being taught.
How to teach using the IA asset?	You may use this asset to give a piece of interesting information relevant to the topic, without prolonged explanation/discussion. You may suggest appropriate books for further reading.
What is a 'Suggested Activity' (SA) Asset?	The Suggested Activity asset provides a detailed step by step procedure for the teacher to conduct a hands-on activity. This promotes Activity Based Learning.
How to teach using the SA asset?	You may use this asset to energise your students to learn by doing simple, fun-filled activities based on the topic. The asset includes - preparation, activity, and follow-up. You may engage the students in the preparation and follow-up stages to develop collaboration and responsibility. You could try it once, yourself, before the actual delivery to be more comfortable with it. Note: The duration mentioned in the asset is usually for the activity part only.
What is a 'Value Content' (VC) Asset?	The Value Content asset integrates Universal Human Values (such as empathy, inclusivity, respect for nature that translates into responsible behaviour) seamlessly into the curriculum, as the "End of education is character".
How to teach using the VC asset?	You may use this asset to engage with the students to bring out their innate values and connect with the intrinsic values in the topic/concept. The asset includes pointers on the specific pedagogical technique followed.
What is a 'Questions to Assess' (QA) asset?	The Questions to Assess asset uses an interactive approach to check learning of different types of learners, and provides feedback to the teacher for appropriate action. The questions cater to all the levels of Bloom's Taxonomy. Questions from 'Apply' level and above enable students to reflect on their learning.
How to teach using the QA asset?	You may go through the slides to understand its flow and know when to click for the answer (slides include suggested answers). While presenting in the class, you may display the question and encourage multiple responses, before revealing the answer. In some cases, this asset may include extra questions/worksheet that can be given as homework.