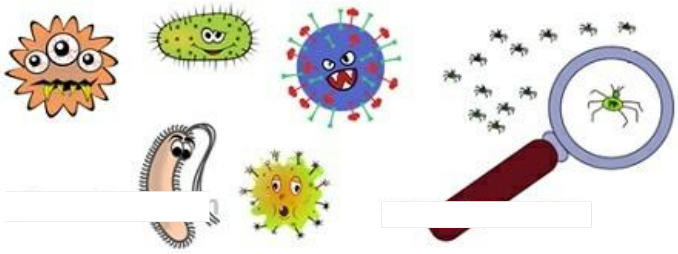
Class 8 Biology Microorganisms: Friend and Foe

Introduction

Introduction

Microbes are extremely small organisms that cannot be seen with naked eyes. They are also called 'Micro-organisms'. Examples: Bacteria, Fungi etc.



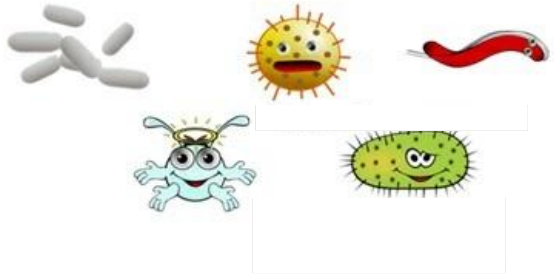
Microbes are not always harmful to us, but also helpful many a times. In this lesson, we will learn about both Friendly microbes as well as Harmful microbes.

Class 8 Biology Microorganisms: Friend and Foe Classification of Microbes

Classification of Microbes

Microbes are classified broadly into four groups:

- Bacteria
  - Bacteria are one of the oldest life forms
  - They are unicellular i.e. they are made up of one cell
  - They appear in a variety of shapes & sizes (Spherical, elongated, spiral etc.)



- They inhabit soil, water, radioactive waste & the deep portions of Earth's crust. In fact, they also live in plant /animal bodies
- They live in colonies
- Some of them are autotrophic (prepare their own food), while others are heterotrophic (depend on others for their food)

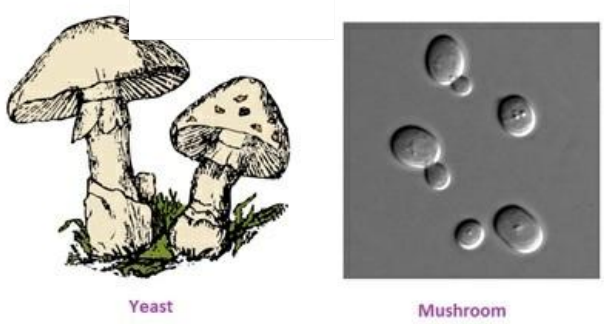
Bacteria inside human intestine

- Fungi

You would have seen fungi as a white layer on bread when you leave it outside at room temperature for quite a few days. Fungi get favorable conditions & therefore they grow.

But, the same bread when kept inside a refrigerator remains fresh for a longer period of time.

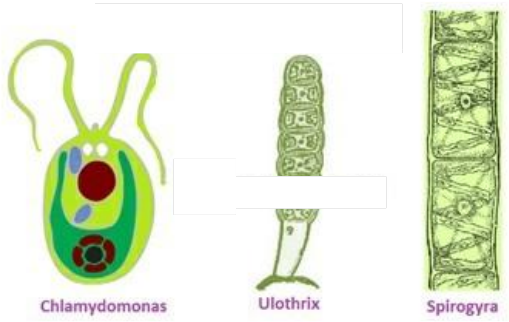
- Fungi are multicellular e. they are made up of multiple cells
- They are Heterotrophic (Depend on others for their food)
- They live in colonies and prefer warm & moist places to grow
- They are immobile
- Some common examples of fungi are: Yeast, Mushroom, Molds



- Protozoa
  - They are mostly Unicellular i.e. made of one cell
  - Some of them are autotrophic (prepare their own food), while others are heterotrophic (depend on others for their food)
  - They prefer moist & aquatic habitats
  - They can live singly, unlike bacteria & fungi
  - Some common examples of protozoa are: Amoeba, Paramecium, Trypanosoma

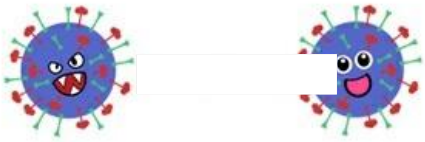
- Algae
  - They are multicellular i.e. Made of multiple cells
  - They prefer mostly aquatic habitats

- Some common examples of protozoa are: Spirogyra, Ulothrix, Chlamydomonas



Viruses: An exception

- Viruses are also microscopic, but they are not considered as micro-organism. They behave like non-living when outside host cell, and reproduce only when inside the host cell



Class 8 Biology Microorganisms: Friend and Foe Role of microbes in our life

Role of microbes in our life

You might know microbes only for causing harm to human beings by causing diseases and making us ill.

But, the truth is microbes are also beneficial to us in a variety of ways. They help in preparation of several household & industrial products like curd, cake, bread, antibiotics & beverages. They also help the environment acting as decomposers and biofertilizers. They play an important in sewage treatment as well.

Class 8 Biology Microorganisms: Friend and Foe Microbes role in Curdling of milk

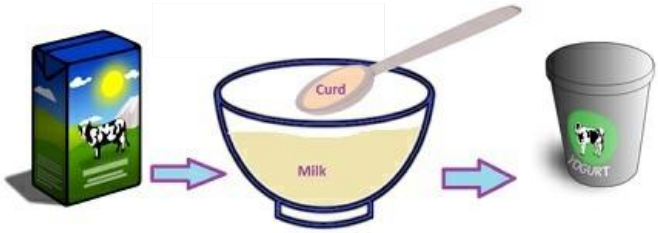
Microbes' role in Curdling of milk

Microbes play a vital role in preparing curd from milk. Curd contains a bacterium,***Lactobacillus***

Lactobacillus is a friendly-bacterium. It treats & prevents diarrhea, helps in food breakdown and absorption of nutrients.

Following changes lead to the formation of curd from milk:

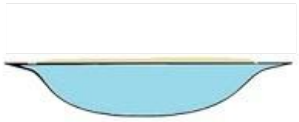
- A small amount of curd (starter) is added to milk
- ***Lactobacillus*** (present in curd) converts sugars in milk (Lactose) into lactic acid
- Lactic acid imparts sour taste to curd
- Increased acidity causes milk proteins (casein) to turn into solid masses. This changes the texture of curd.



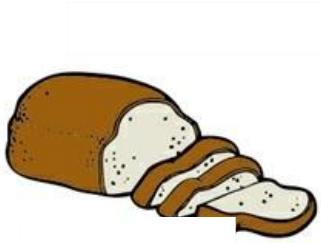
Class 8 Biology Microorganisms: Friend and Foe Microbes role in Baking

Microbes' role in Baking

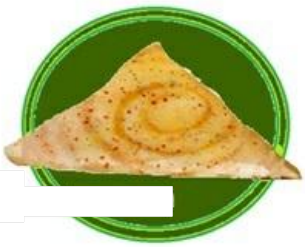
Yeast is used as a raising agent in baking. Most commonly used yeast is ***Saccharomyces cerevisiae*** .It is due to the action of yeast that the dough rises, if you leave it for sometime adding yeast to it during kneading.



Dough (Flour) contains carbohydrates. Yeast when added to it, converts carbohydrates into CO_2. Due the formation of CO_2, the dough rises. While preparing cake/ bread, the dough is baked. Once baked, the yeast dies. As a result, a soft and spongy baked product is formed.



Microbes also play a vital role in fermenting idli/dosa batter. Idli/ dosa batter contain Urad pulses. These Urad seeds contain Lactic Acid Bacteria (LAB). These bacteria lead to the formation of Lactic acid and CO_2. Formation of Lactic acid gives a sour taste to the batter. Therefore, the batter should not be fermented for too long, else it might turn too sour.



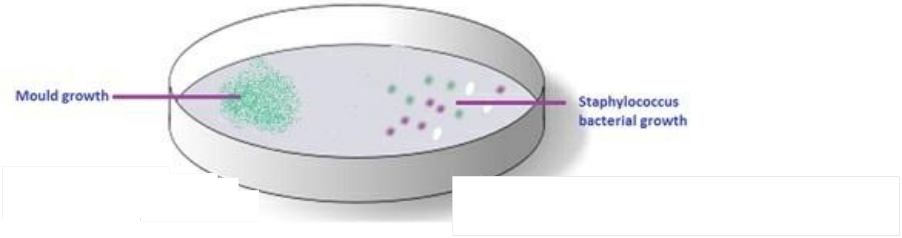
Class 8 Biology Microorganisms: Friend and Foe Microbes role in Antibiotics preparation

Microbes' role in Antibiotics preparation

Microbes are also used to prepare antibiotics, which are used to treat several bacterial infections. Antibiotics are chemical substances that kill disease-causing microbes. It is quite interesting to find that there are some microbes which cause diseases; on the other hand, some other microbes help in preparation of antibiotics, and thus, cure diseases.

Alexander Fleming, a Scottish scientist discovered the first antibiotic & named it 'Penicillin'.

Penicillin discovery was 'a chance' discovery. Fleming was experimenting with Staphylococcus bacteria. A petridish (cell culture dish) had been left open by mistake, was found to be contaminated by blue-green mold. This visible mold growth inhibited bacterial growth around itself.



Fleming concluded that mould released a substance that inhibited bacterial growth. This substance was the antibiotic which was named 'Penicillin' after the mold ***Penicillium notatum***.

- Penicillin was named after ***Penicillium notatum***

Class 8 Biology Microorganisms: Friend and Foe Role of Microbes in Vaccination

Role of Microbes in Vaccination

Vaccination is a process in which vaccine is given to improve the immunity of the body against a specific disease. Vaccine is a biological preparation that resembles a disease causing microbe. These vaccines are made up of dead or very weak microbes.

In vaccination, a memory of the disease causing organism is created inside the body, so that the body can fight back any further attack of the same disease-causing organism. Vaccine is introduced into the body which resembles a disease-causing organism, at the same time, very mild to cause any harm to the body. The body produces Antibodies in response to the vaccine. These Antibodies fight any further attack of the Antigen.

Antigen refers to any foreign substance inside the body. These can be chemicals, micro-organisms (bacteria, virus etc), Toxins, Pollen etc. Antigens trigger immune system to produce antibodies. Antibodies recognize & neutralize pathogens. Each antibody binds to a specific antigen.

Vaccination has been a huge success. Diseases like small pox are eradicated. Many diseases like polio, tetanus, and measles have been reduced to a large extent.

Class 8 Biology Microorganisms: Friend and Foe

Role of microbes in production of Beverages

Role of microbes in production of Beverages

Yeasts play an important role in the production of various alcoholic drinks.***Saccharomyces cerevisiae*** is popularly termed as Brewer's yeast.

Saccharomyces cerevisiae ferment fruit juices & malted cereals. Molecules like glucose, fructose and sucrose are converted into C_2H_5OH and CO_2 and release energy. Yeasts perform this conversion in absence of oxygen.

$C_6H_{12}O_6$ --> $2C_2H_5OH + 2CO_2$

This reaction takes place in presence of enzyme Zymase. Alcohol (Ethanol) is produced as a result if this reaction. CO_2 released is used as raising agent in making bread.

Class 8 Biology Microorganisms: Friend and Foe

Role of Microbes in preparation of chemicals

Role of Microbes in preparation of chemicals

Several chemicals are produced by Microbes like organic acids, enzymes and alcohol. Some of the examples of microbes which produce various organic acids are as follows:

- Lactobacillus Lactic acid
- Acetobacter aceti Acetic acid
- Clostridium butylicum Butyric acid
- Aspergillus niger Citric acid

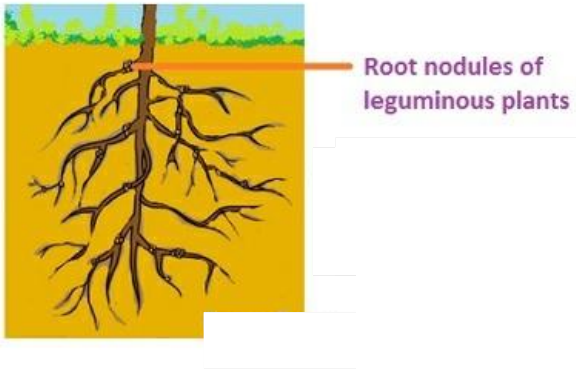
Class 8 Biology Microorganisms: Friend and Foe Microbes as Biofertilizers

Microbes as Biofertilizers

Fertilizers are substances added to enhance the soil fertility. This results in higher yields & healthier plants. Chemical fertilizers, however have several disadvantages like they are toxic to various life forms, can cause imbalance in soil ph, results in soil infertility, degrades ecosystem, plants become susceptible to many diseases, fruits & vegetables have high toxic residues. Excessive use of fertilizers can cause environmental pollution.

Use of biofertilizers is preferred as they do not include any of the disadvantages mentioned above. Biofertilizers are living organisms that enrich the soil nutrient quality. Some of the sources of biofertilizers are bacteria, fungi, cyanobacteria etc.

Rhizobium, is an example of a nitrogen fixing bacteria present in the root nodules of leguminous plants. Nitrogen is a macronutrient for the growth & development of plants. Rhizobium enriches soil with nitrogen.



Mycorrhiza, a symbiotic association between fungi & certain plants, also enhance the phosphorus content which in turn helps in better growth & development of plants. They are resistant to pathogens.

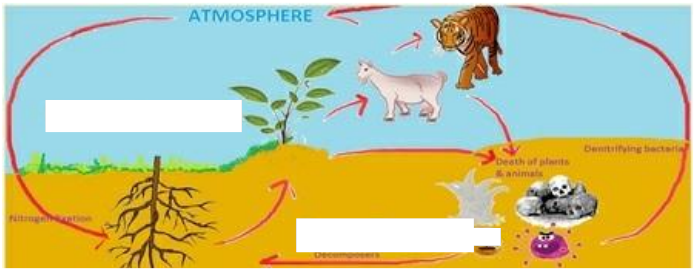
Class 8 Biology Microorganisms: Friend and Foe

Nitrogen Cycle

Nitrogen Cycle

Nitrogen cycle is all about the movement of nitrogen between various elements on Earth (like air, soil, living organisms etc.) The amount of nitrogen in the atmosphere remains constant.

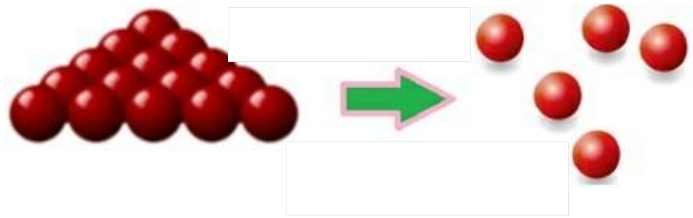
- Atmosphere has approx. 78% nitrogen.
- Atmospheric Nitrogen is fixed into the soil
  - N_2 fixing microbes convert atm. N_2 into nitrogen compounds like NH_3
- Plants utilize nitrogen from soil through their roots
- Animals utilize nitrogen, feeding on plants
- When Plants & animals die, Nitrogenous wastes are returned to soil
  - Decomposers convert some part to nitrogen compounds to be used by plants
  - Denitrifying bacteria convert into atm. N_2



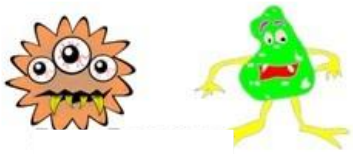
Class 8 Biology Microorganisms: Friend and Foe Microbes as Decomposers

Microbes as Decomposers

Decomposition is the Process in which complex organic matter is broken down into simpler forms. This process breaks down dead & decaying organic matter into simple inorganic forms.



Organisms which help in decomposition are termed as 'Decomposers'. Bacteria & Fungi are important Decomposers.



Decomposers help the environment to get rid of dead & decaying matter and also enrich the soil quality for better growth of plants.

Class 8 Biology Microorganisms: Friend and Foe Harmful Micro-organisms

Harmful Micro-organisms

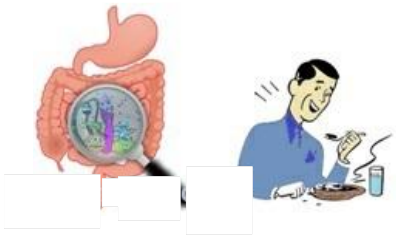
There are many microbes which cause several diseases in plants, animals & human beings. Such disease-causing organisms are called Pathogens. Pathogens include bacteria, viruses, fungi & protozoa.

In this section, we will discuss about the various diseases caused by various pathogens. 'Disease' is a disturbed ease. Disease results in a change in either the functioning or the appearance of one or more systems of the body for worse.

Diseases in Humans: Typhoid

- Pathogen
  - Bacteria, ***Salmonella typhi***

- Patho
  - Contaminated food & water
  - Primarily reach small intestine



- Symptoms
  - High fever
  - Headache
  - Weakness
  - Stomachache

- Constipation
- Loss of appetite

- Treatment
  - Diagnosed using Blood culture/ Urine culture or Widal test
  - Treated with a course of antibiotic medication

Diseases in Humans: Pneumonia

- Pathogen
  - Bacteria, ***Streptococcus pneumoniae***
  - ***Bacteria, Haemophilus influenzae***
- Pathogen's entry
  - Through contaminated air
  - Inhalation of droplets released by infected person
  - Primarily reach lungs
  - Alveoli gets infected

- Symptoms
  - High fever
  - Chills
  - Cough
  - Short of breath
  - Headache
  - Bluish lips & finger nails
  - Weakness

- Treatment
  - Diagnosed using Urine test/Mucous test/ Chest X-ray
  - Treated with a course of antibiotic medication

Class 8 Biology Microorganisms: Friend and Foe

Common Cold

Diseases in Humans: **Common Cold**

- Pathogen
  - Viruses (e.g: Rhino virus)

- Pathogen's entry
  - Through contaminated air/ objects
  - Inhalation of droplets released by infected person
  - Nose & respiratory passage gets infected
  - Lungs remain unaffected



- Symptoms
  - Sore throat
  - Cough
  - Headache
  - Nasal congestion
  - Nasal discharge
  - Hoarseness

- Treatment
  - Treated with medication like pain killers, cough syrups or nasal sprays
  - Antibiotics do not help a viral infection

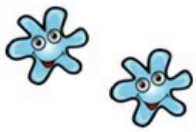
Class 8 Biology Microorganisms: Friend and Foe

Malaria

Diseases in Humans: Malaria

- Pathogen
  - Protozoa, Plasmodium

    (P. vivax, P. falciparum, P. malaria)



- Pathogen's entry
  - Through bite of female Anopheles mosquito
  - Female Anopheles mosquito acts as Transmitting agent
  - RBCs are ruptured

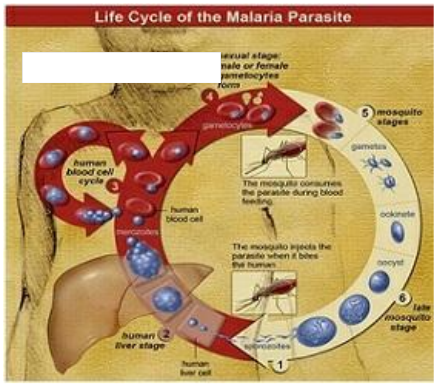
- Symptoms
  - High fever
  - Chills
  - Headache
  - Bodyache
  - Nausea
  - Vomiting

- Treatment
  - Diagnosed using Blood tests & Liver Function tests
  - Treated with anti-malarial drugs

Lifecycle of Malarial parasite

Plasmodium parasite has 2 hosts. This parasite spends half of its lifecycle inside human beings & the remaining half inside mosquitoes. Thus, Humans & mosquitoes are two hosts of Plasmodium parasite.

Mosquito bites an infected person
Takes up gametocytes
Development of gametocytes occurs in mosquito
Sporozoites are formed & stored in salivary glands of mosquitoes
The same mosquito then bites a normal person
Injects the sporozoites
Development of the sporozoites occur in liver cells inside the body of that person
RBCs rupture, the person thus suffers from malaria
Gametocytes are formed, which get picked up by mosquitoes when they bite this person again.



Class 8 Biology Microorganisms: Friend and Foe Cholera

Diseases in Humans: **Cholera**

- Pathogen
  - Bacteria, ***Vibrio cholerae***

- Pathogen's entry
  - Contaminated food & water
  - Pathogen releases toxin in intestine

- Symptoms
  - Watery diarrhea
  - Vomiting
  - Dehydration
  - Weakness
  - Muscle cramps
  - Thirst

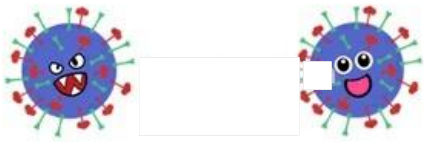
- Treatme
  - Oral/ intravenous solutions to compensate for dehydration
  - Extreme cases can be treated with antibiotic medication

Class 8 Biology Microorganisms: Friend and Foe

Measles

Diseases in Humans: **Measles**

- Pathogen
  - Virus, paramyxovirus



- Pathogen's entry
  - Transmitted through droplets from nose/ throat/ mouth
  - Highly infectious
  - Children are more prone to infection

- Symptoms
  - Dry cough
  - Watery eyes
  - Sneezing
  - Mild fever

- Treatment
  - Treated with medication like cough syrups, paracetamol or Vitamin A supplements
  - Antibiotics do not help a viral infection

Class 8 Biology Microorganisms: Friend and Foe Chicken pox

Diseases in Humans: **Chicken pox**

- Pathogen
  - Virus, varicella

- Pathogen's entry
  - Transmitted through droplets from sneeze/cough or contact
  - Highly infectious as long as rashes exist

- Symptoms
  - Itchy rash
  - Fever
  - Loss of appetite
  - Headache
  - Cough
  - Sore throat

- Treatment
- Treated with anti-viral; drugs
- Antibiotics do not help a viral infection

Class 8 Biology Microorganisms: Friend and Foe

Prevention of Infectious diseases in Humans

Prevention of Infectious diseases in Humans

As is rightly said “Prevention is better than cure”, we should take care of the following things to prevent the spread of infectious diseases.

- Maintain Personal cleanliness
- Ensure Clean drinking water
- Wash vegetables & fruits before consumption
- Proper disposal of excreta
- Avoid stagnation of water
- Use mosquito repellents
- Spraying insecticides in drainage areas



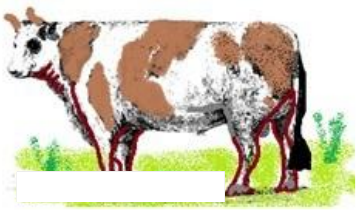

Class 8 Biology Microorganisms: Friend and Foe

Diseases in Animals: Anthrax

Diseases in Animals: Anthrax

- Pathogen
  - Bacterium, ***Bacillus anthracis***

- Pathogen's entry
  - Very common in farm animals (cattle)
  - Transmitted through direct contact, inhaling or ingesting the pathogen



- Symptoms
  - No prominent initial symptoms
  - Swollen affected area
  - Bleeding through body openings
  - Difficulty in breathing
  - Fever
  - Fatal & can cause death

- Treatment
  - Completely treated if medication given at an early stage
  - Effective vaccine available

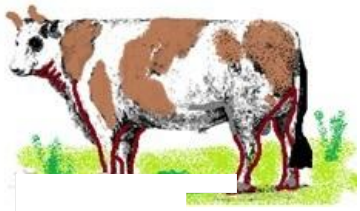
Class 8 Biology Microorganisms: Friend and Foe

Foot & Mouth disease

Diseases in Animals: **Foot & Mouth disease**

- Pathogen
  - Virus (7 types exists)

- Pathogen's entry
  - Transmitted through saliva, mucus, milk or faeces
  - Infection spreads through inhalation/ ingestion / direct contact
  - Common in cattle, pigs, sheep



- Symptoms
  - Fever
  - Decreased milk production
  - Weight loss
  - Loss of appetite
  - Lameness

- Treatment
  - Completely treated if medication given at an early stage
  - Vaccination available for prevention against certain stains of pathogen

Class 8 Biology Microorganisms: Friend and Foe Blackquarter

Diseases in Animals: **Blackquarter**

- Pathogen
  - Bacterium, ***Clostridium chauvoei***
- Pathogen's entry
  - Transmitted through soil/ food
  - Infection progresses extremely fast
  - Sometimes, survival only up to a couple of hours after symptoms are seen
  - Common in cattle, sheep, goats
- Symptoms
  - Fever
  - Swelling of limbs
  - Lameness
  - Inflammation of skeletal muscles
- Treatment
  - Completely treated only if medication is given at an early stage
  - Treated with antibiotics (penicillin)
  - Effective vaccine provides protective immunity

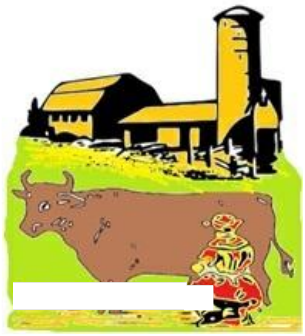
Class 8 Biology Microorganisms: Friend and Foe

Prevention of Infectious diseases in animals

Prevention of Infectious diseases in animals

Following things should be taken care to prevent the spread of infectious diseases in animals:

- Proper feeding of cattle
- Maintain hygiene
- Regular checkup by veterinary doctor
- Isolation of an infected animal
- Timely vaccination of animals



Class 8 Biology Microorganisms: Friend and Foe

Diseases in Plants: Rust of Wheat

Diseases in Plants: **Rust of Wheat**

- Pathogen
  - **Puccinia**rust fungus
    - ***Puccinia triticina***causes 'black rust',
    - ***recondita***causes 'brown rust'
    - ***striiformis***causes 'Yellow rust'

- Pathogen's entry
  - Transmission via soil through infectious spores

- Symptoms
  - Small elevated structures (pustules) on leaf blades
  - Patches formed in extreme cases
  - Pustules on stems

- Treatment
  - Applying fungicides at an early stage can be helpful

Class 8 Biology Microorganisms: Friend and Foe

Late blight of potato

Diseases in Plants: **Late blight of potato**

- Pathogen
  - Fungus-like organism***, Phytophthora infestans***
- Pathogen's entry
  - Infectious spores transmitted by water/ wind
  - Wet/ humid conditions favor infection
  - Affects potato, tomato etc.
- Symptoms
  - Potato leaf lesions
  - Reddish brown discoloration of potato tuber
  - Brown lesions on stem

- Treatment
  - Applying appropriate fungicides at appropriate time can be helpful

Class 8 Biology Microorganisms: Friend and Foe

Citrus Canker

Diseases in Plants: **Citrus Canker**

- Pathogen
  - Bacterium, ***Xanthomonas axonopodis***

- Pathogen's entry
  - Entry through stomata/ wounds on leaves
  - Infection can spread through rain/ wind or contaminated equipments
  - Affects citrus plants

- Symptoms
  - Premature fall of leaves
  - Lesions on leaves, stems & fruits
  - Premature drop of fruits

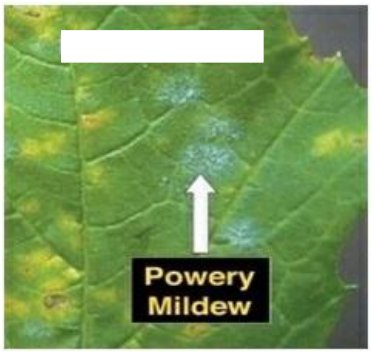
- Tı
  - No specific treatment procedure so far
  - Citrus farming becomes difficult & expensive

Class 8 Biology Microorganisms: Friend and Foe

Powdery mildew

Diseases in Plants: **Powdery mildew**

- Pathogen
  - Fungi
  - Many species of order Erysiphales
- Pathogen's entry
  - Infectious spores are transmitted through wind
  - Sensitive to extreme heat & sunlight
  - Affects many crops like beans, beet, carrot, lettuce, melons, peas etc..
- Symptoms
  - White powdery covering
  - Leaves curl
  - Appearance of lesions
  - Colored patches on leaves/ stems/ fruits



- Treatment
  - Applying fungicides/ oils/ sulfur can treat the disease

Food Poisoning

Food can be poisoned by microbes. Microbes produce toxic substances and thus, poison/ spoil the food. Consuming spoiled food can make us ill. Therefore it is very important to preserve food items so that microbes cannot grow & spoil them.

Microbes just don't attack any food item, they need a suitable environment to grow & survive. Only then, they can release toxic substances and thus spoil the food. Some factors which promote growth of microbes are moisture, warm temperature etc.

Let us now talk about how we can preserve food to protect them from microbes

Class 8 Biology Microorganisms: Friend and Foe Food preservation techniques

Food preservation techniques

There are various techniques of food preservation like using chemicals, salt, vinegar, sugar, oil etc. Heat & cold treatment also helps to preserve food. Proper storage is very important for preservation of food.

Preserve by chemicals

Chemicals prevent attack & growth of microbes. Some examples are as follows:

- Sodium benzoate
  - Fruit juices, syrups, jams, jellies
- Sodium metabishulphite
  - Dried fruits/ vegetables, syrups, fruit juices
- Acetic acid (Vinegar)
  - Pickles, sauces, ketchup
- Sodium chloride (Salt)
  - Meat, Amla, raw mango, fish
- Oils
  - Ph is such that spoilage bacteria can't survive
  - Fried food, pickles
- Sugar
  - Reduce moisture content, therefore inhibit bacterial growth
  - Jam, Jelly, Squash

Food should be stored in proper sealed packets or air tight containers. Microbes need moisture, air etc. for growth. Therefore, such containers would inhibit their growth.

Preservation by Heat & Cold treatment

- Food item can be heated to destroy micro-organisms that can otherwise spoil the food
- An example of heat treatment is Sterilization.

Sterilization is a process in which food is heated to a high temperature (greater than 100°C) for a sufficient time. In this method, both the container & content are sterilized.

For example, Feeding bottles of babies are sterilized to keep it free from germs.

Not only heat, cold temperatures also prevent growth of spoilage bacteria. That is why, bread kept inside a refrigerator lasts longer than the one kept at room temperature.

Pasteurization is a technique that makes use of heat & cold treatments to preserve food items. In this process, milk is heated to about 70°C for 15-30 sec & then suddenly chilled & stored. This technique was invented by Louis Pasteur (1864).

This technique destroys pathogens in milk, and reduces the number of spoilage microbes. Thus, it increases shelf life of milk.