

# Module 1



# **Microorganisms : Friend And Foe**

- **Introduction To Microorganisms**

We see **several kinds of plants and animals around us.**

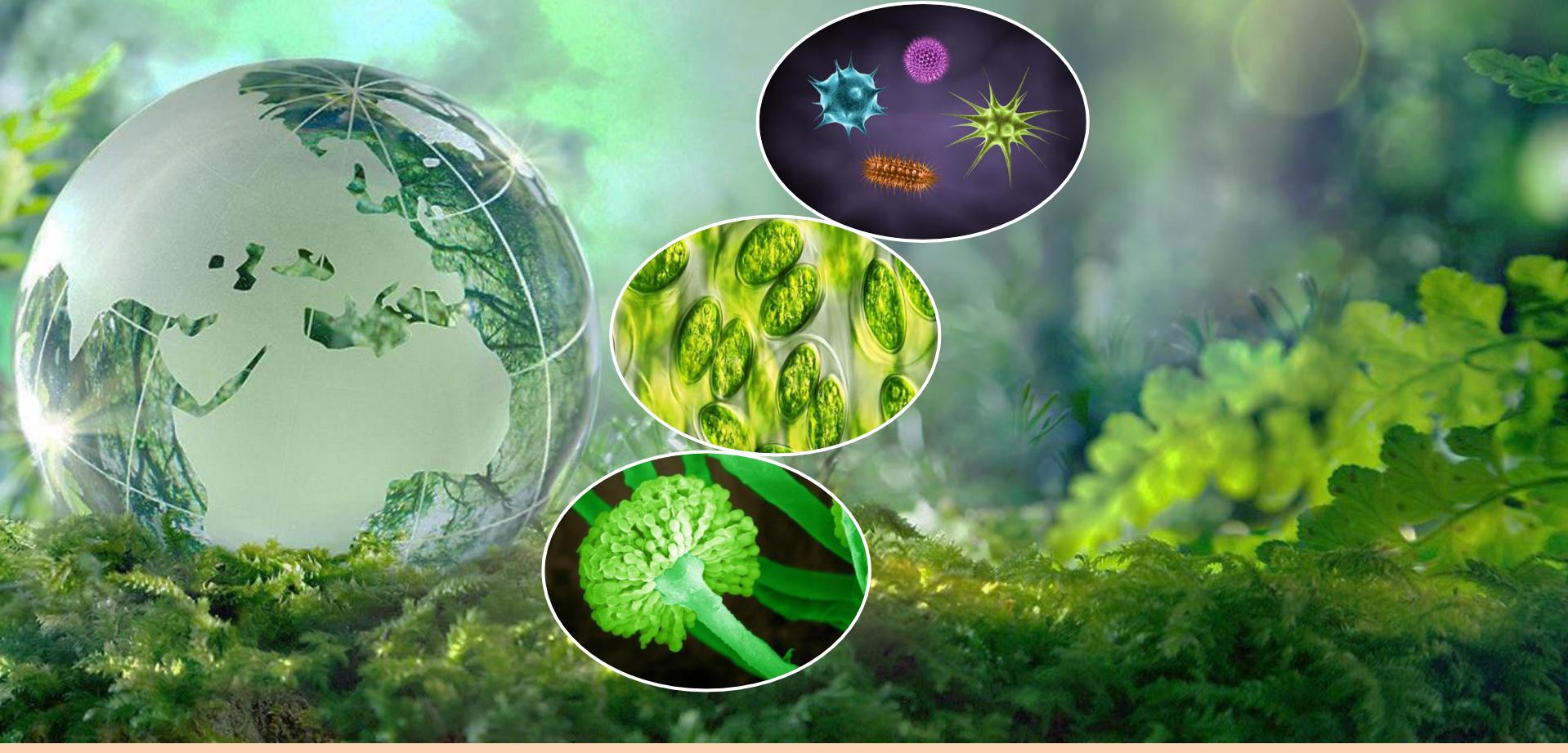


However, there are other living organisms around us

which we cannot see with eyes alone.



**These are called microorganisms or microbes.**





You might have observed that During Rainy Season

Moist Bread gets Spoilt and its surface gets covered with Greyish White Patches.





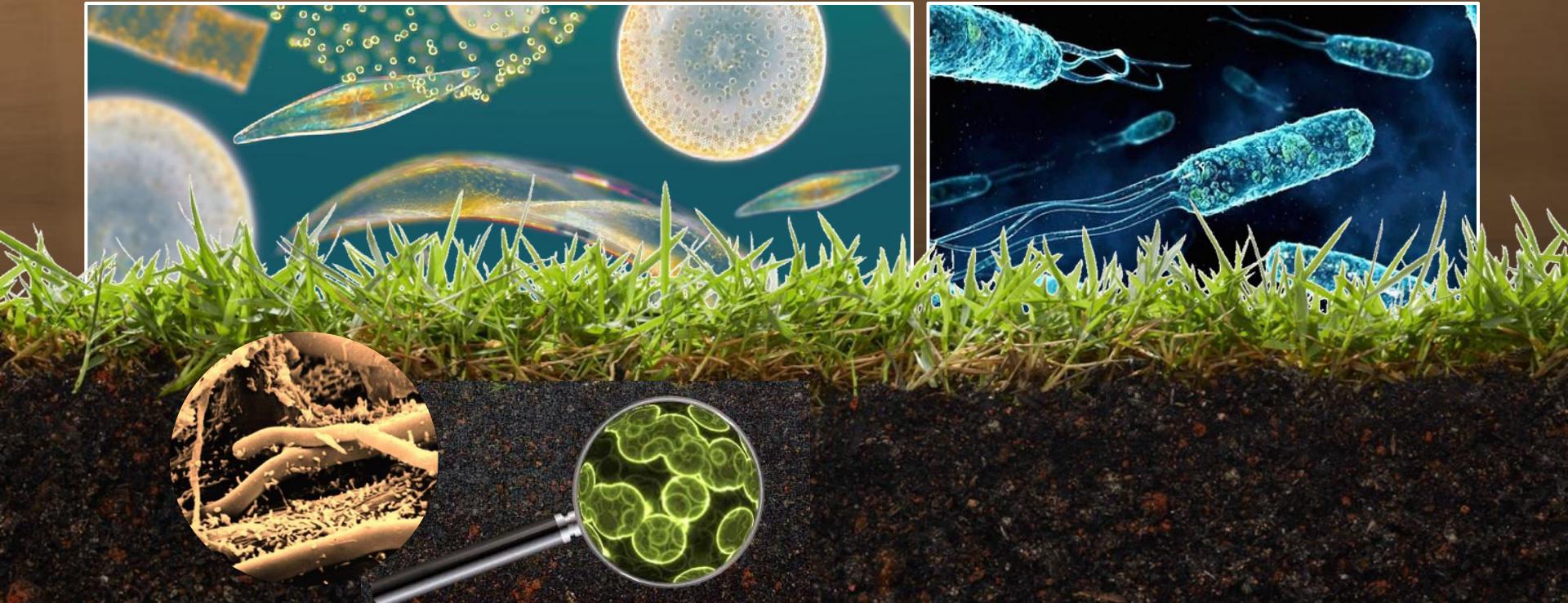
When these patches are observed  
through A Magnifying Glass,

We see Tiny, Black Rounded Structures.



# MICROORGANISMS

**WATER and SOIL** are Full Of Tiny Organisms,  
though not all of them fall into the category of microbes.



# MICROORGANISMS

These microorganisms or microbes are so small in size  
that they cannot be seen with the unaided eye.





Some of these, such as the fungus that grows on bread, can be seen with [A Magnifying Glass](#),



Other ~~This~~ can be seen with ~~the~~ the help  
Microorganisms or **Microbes.**



# *Biology*



## Microorganisms are classified into Four Major Groups.

These groups are

*Prokaryotes*

*Archaea*

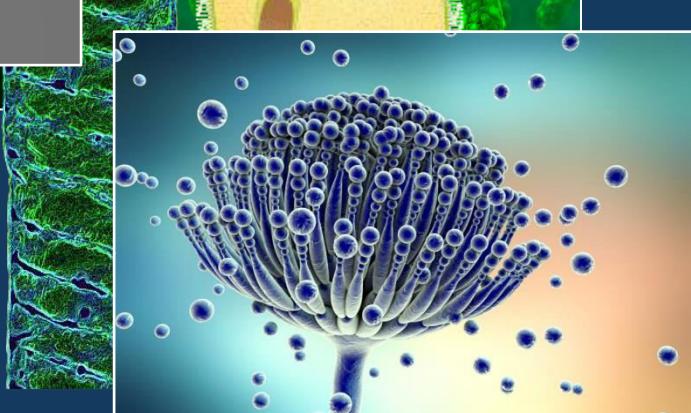
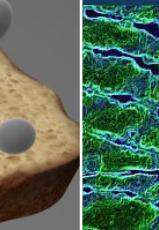
*Eukaryotes*

*Fungi*

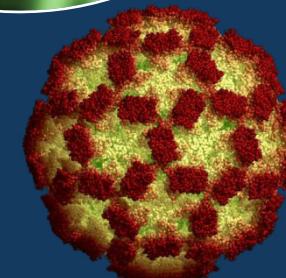
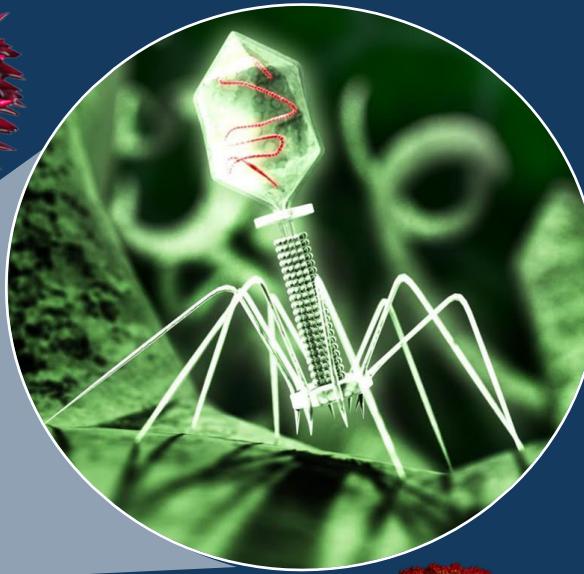
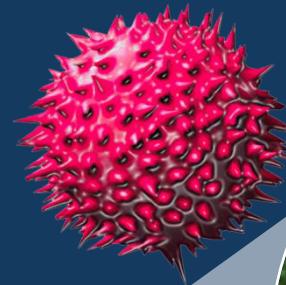
*Spirogyra*

*Paramecium*

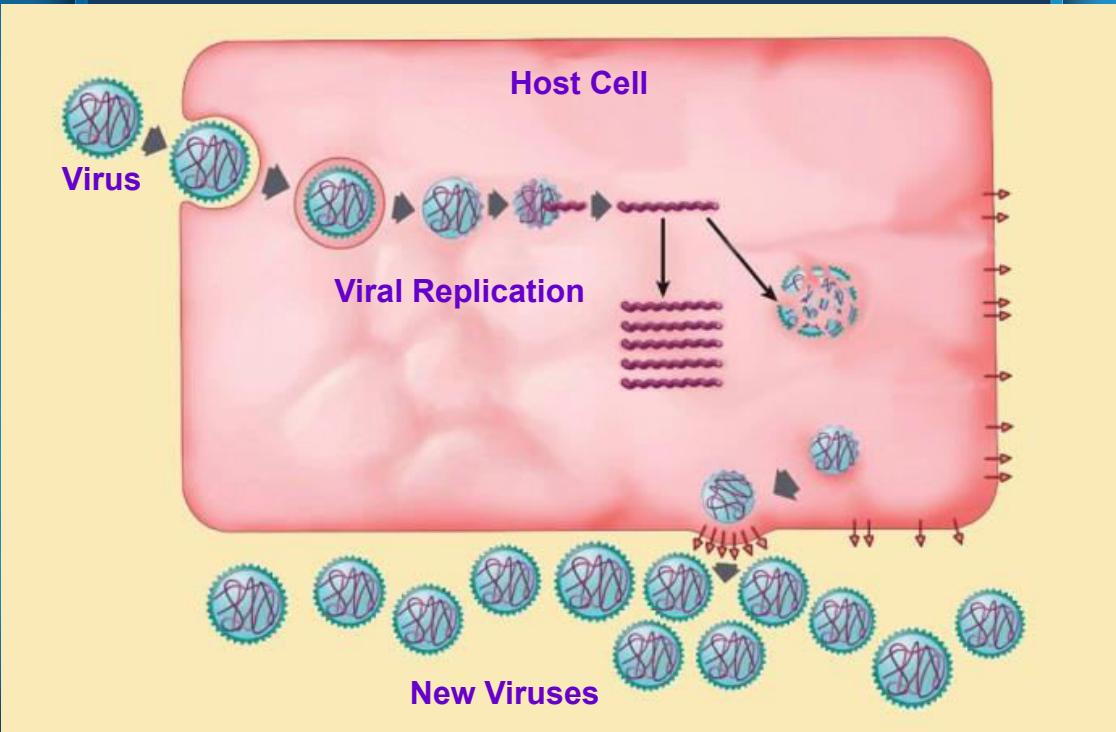
*Penicillium*



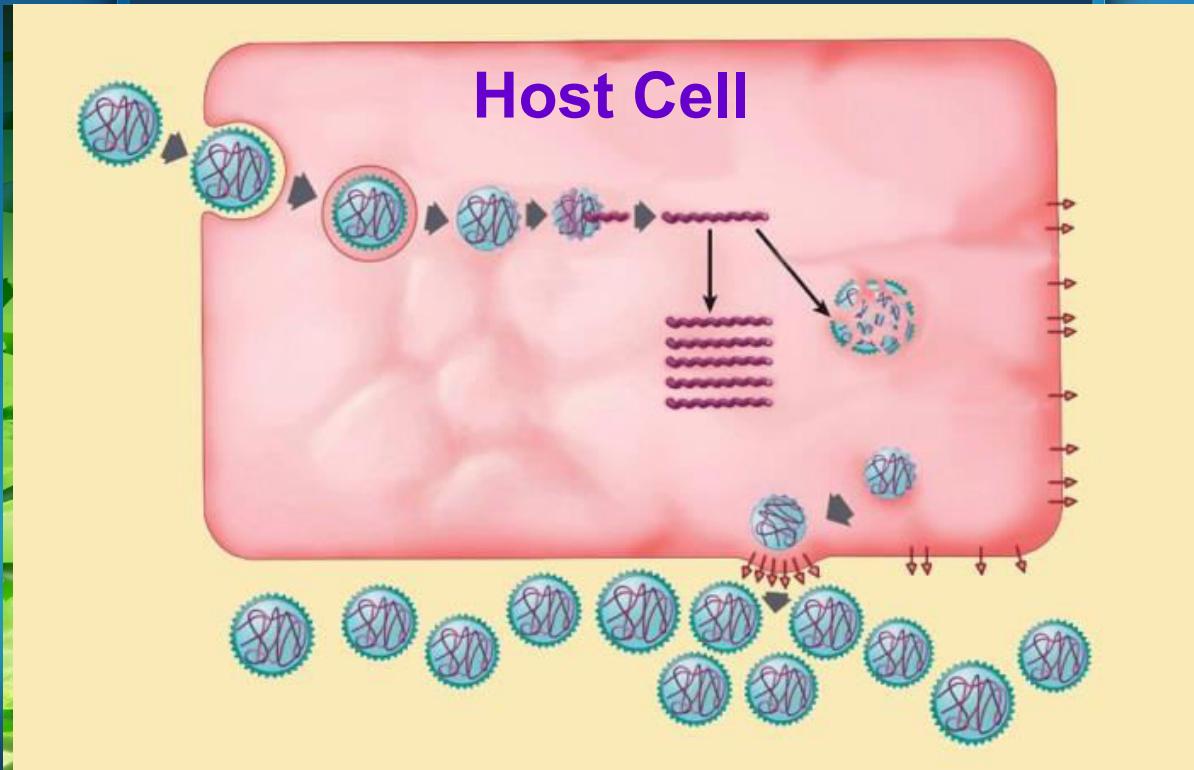
**Viruses are also Microscopic.**



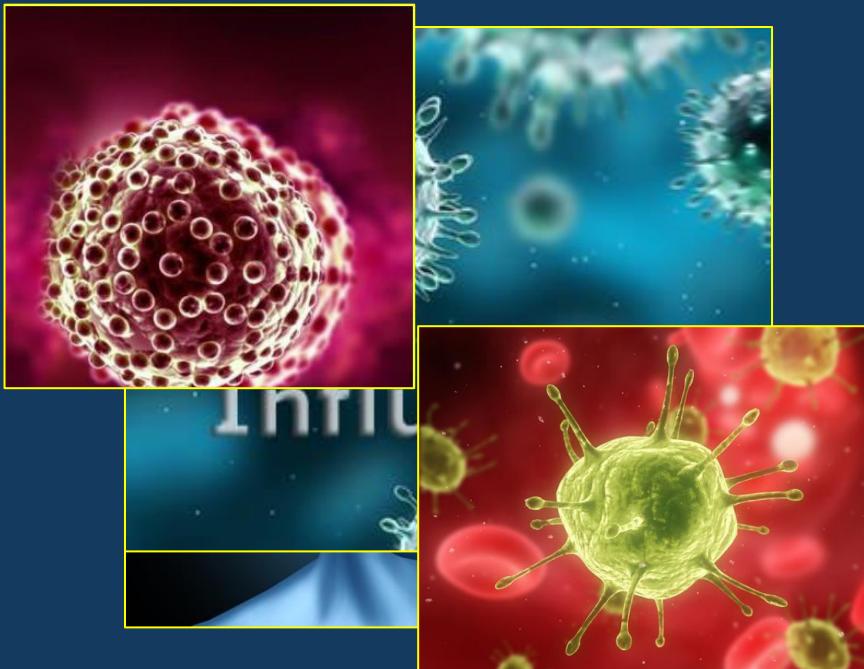
## Viruses Reproduce Only Inside the Cells of the Host Organism.



The **Host Organism**, may be a **Bacterium**, **Plant** or **Animal**.



**Common ailments like Cold, Influenza (flu) and most Coughs are caused by Viruses.**



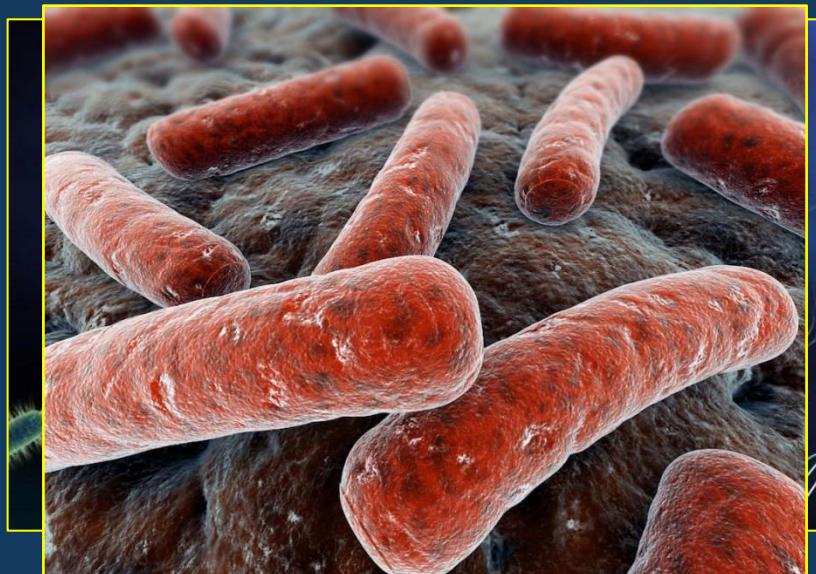
**Serious diseases like Polio and Chicken Pox  
are also caused by Viruses.**



Diseases like **Dysentery** and **Malaria** are caused by **Protozoans**.



Diseases like **Typhoid** and **Tuberculosis (TB)** are caused by **Bacteria**.



# Module 2



# **Microorganisms : Friend And Foe**

- **Where Do Microorganisms Live ?**

# Where do Microorganisms Live ?



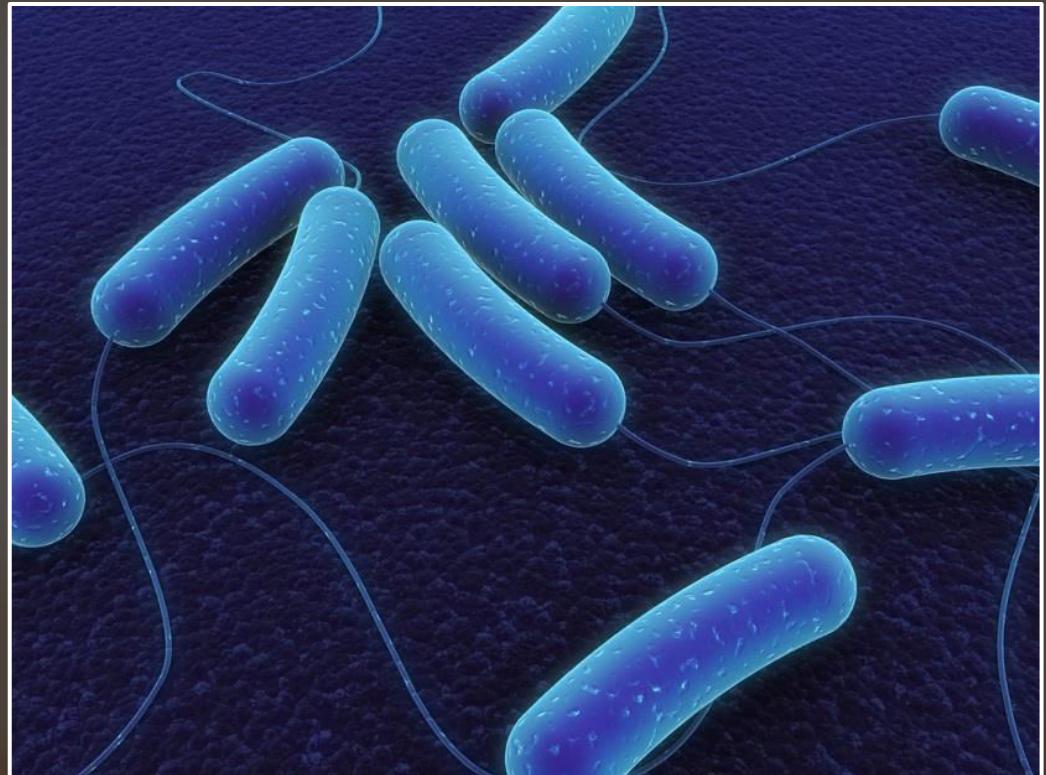
## MICROORGANISMS

**Unicellular**  
(single-celled)

**BACTERIA**

**SOME ALGAE**

**PROTOZOA**



# Where do Microorganisms Live ?



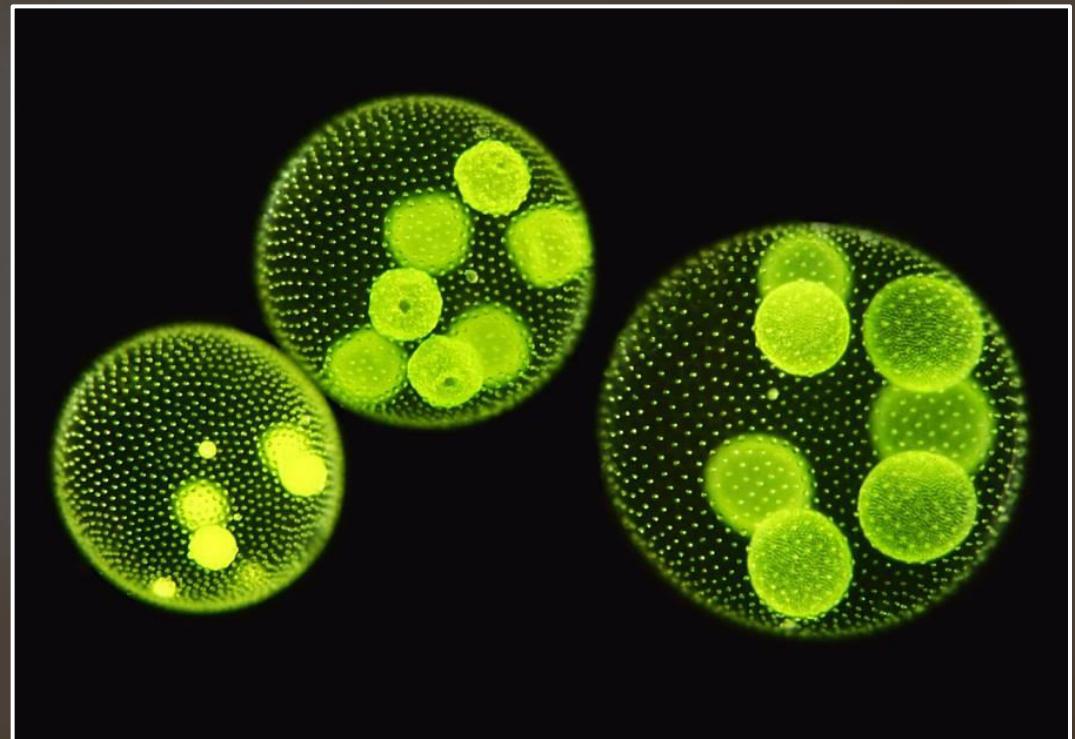
## MICROORGANISMS

**Unicellular**  
(single-celled)

**BACTERIA**

**SOME ALGAE**

**PROTOZOA**



# Where do Microorganisms Live ?



## MICROORGANISMS

**Unicellular**  
(single-celled)

**BACTERIA**

**SOME ALGAE**

**PROTOZOA**



# Where do Microorganisms Live ?



## MICROORGANISMS



**Multicellular**  
(many-celled)



**ALGAE**  
**FUNGI**

# Where do Microorganisms Live ?



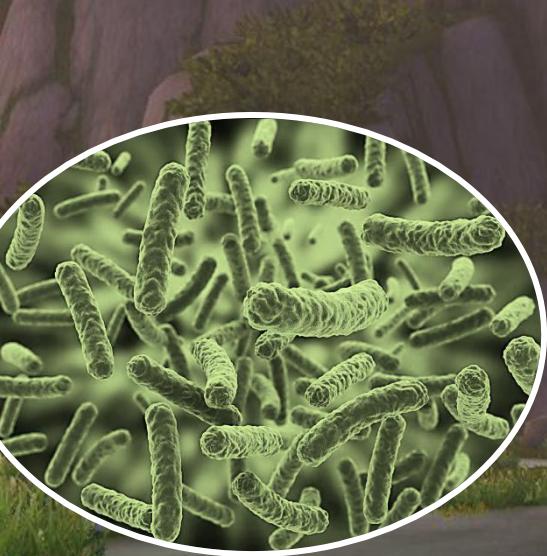
## MICROORGANISMS



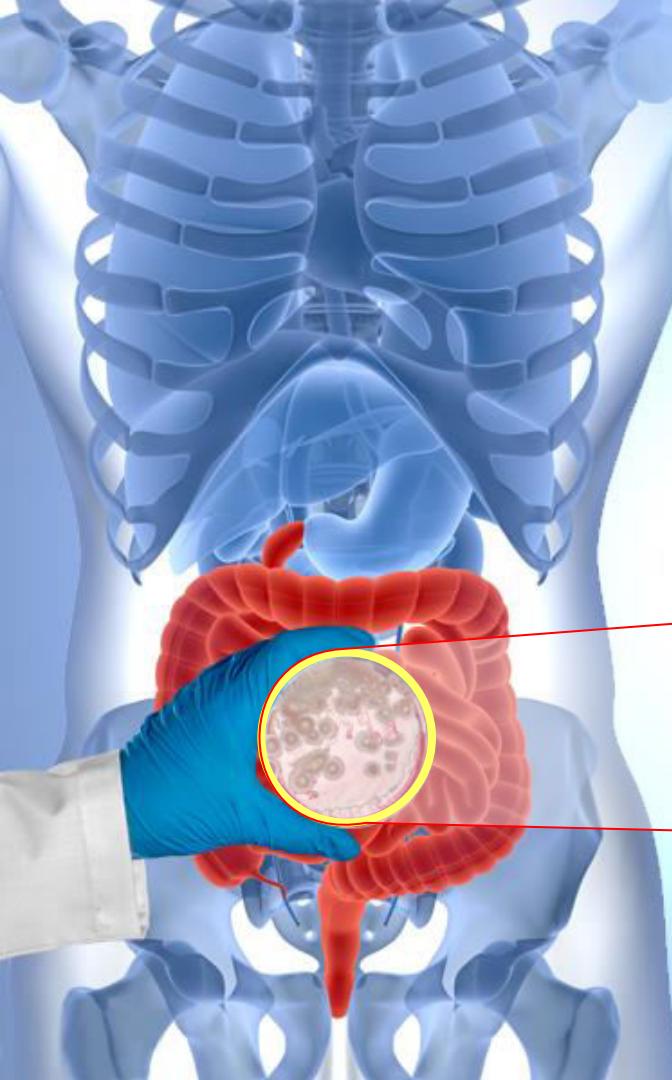
**Multicellular**  
(many-celled)



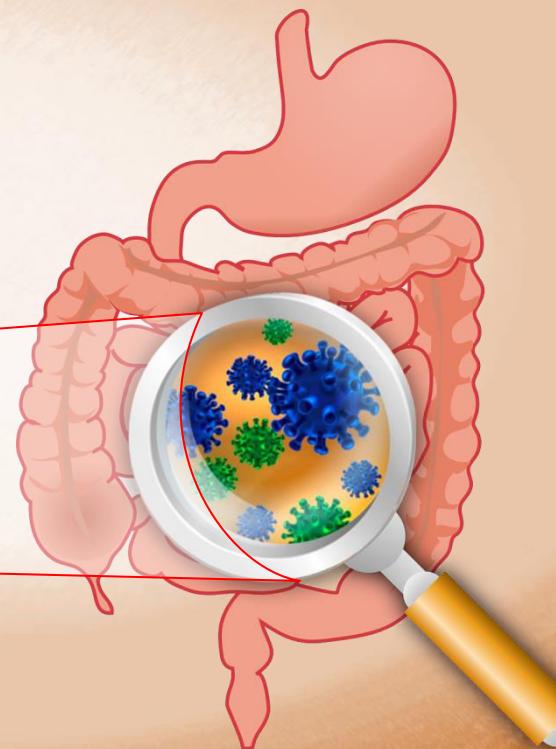
**ALGAE**  
**FUNGI**



**Marshy lands**



**Microorganisms are also found Inside The Bodies Of Animals including Humans.**



# Where do Microorganisms Live ?



Some **Microorganisms Grow**

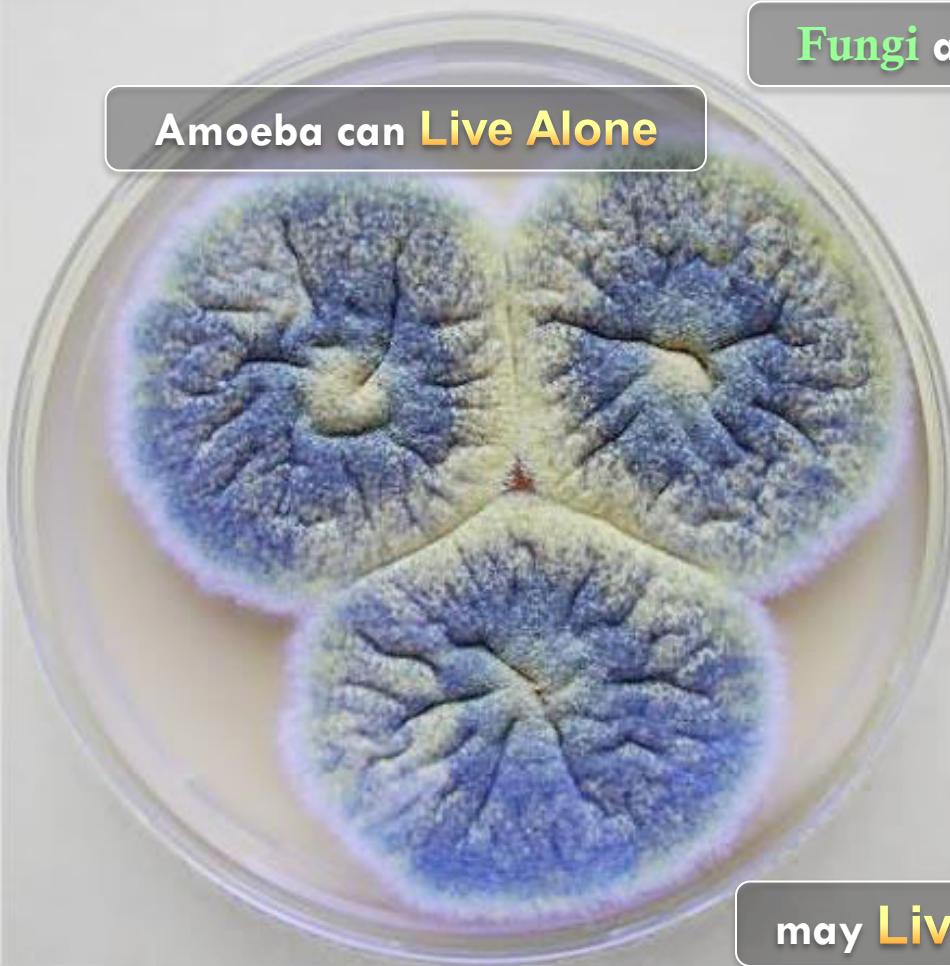
**On The Body** of other organisms

**Inside The Body** of other organisms

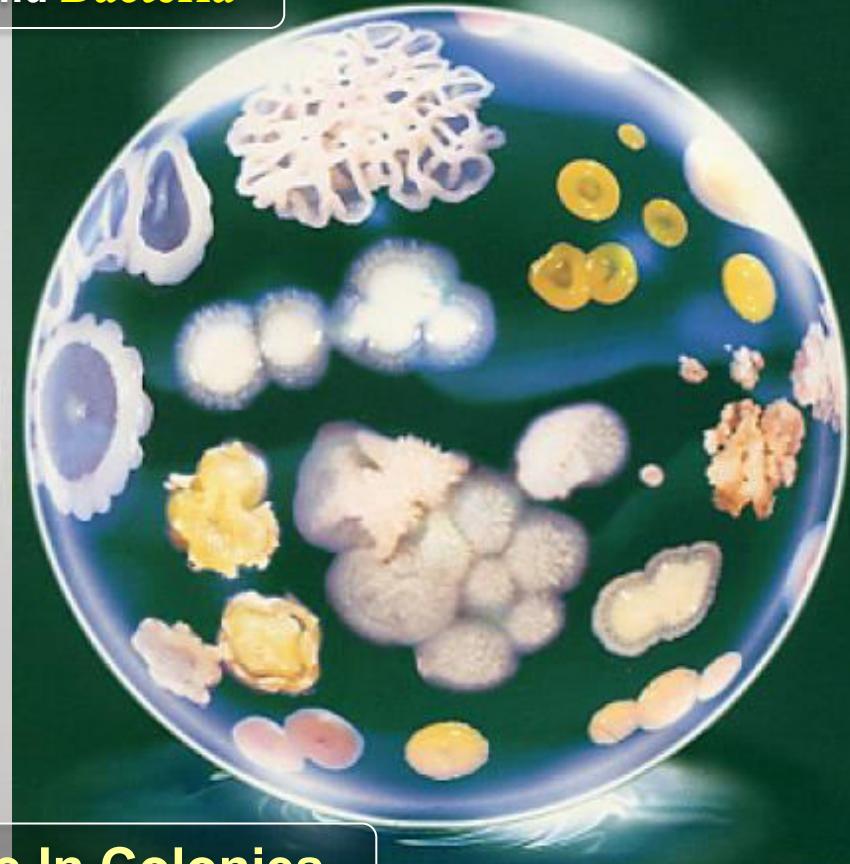


## Fungi and Bacteria

Amoeba can **Live Alone**



may **Live In Colonies.**



# Module 3

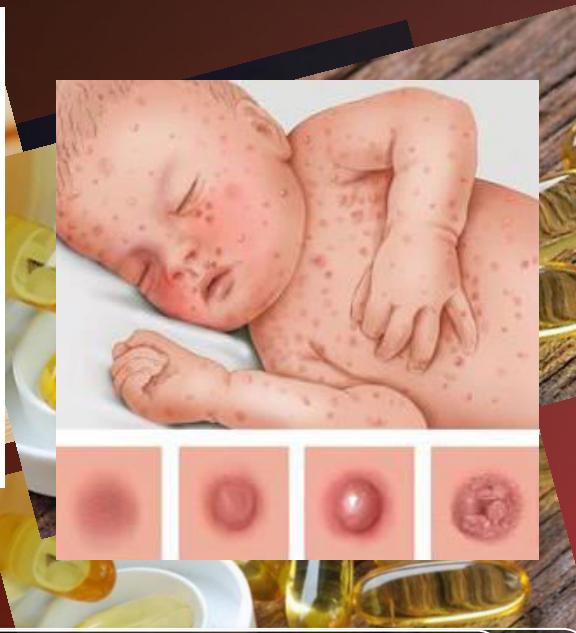


# **Microorganisms : Friend And Foe**

- Microorganisms And Us
- Friendly Microorganisms
- Making Of Curd And Bread

# MICROORGANISMS AND US

We can find **Harmful** and **Useful** Microorganisms.



The year called  
**Harmful (FOE) Microorganisms.**



# FRIENDLY MICROORGANISMS



Microorganisms are Used For  
Various Purposes.



## FRIENDLY MICROORGANISMS

They are used in the preparation of **curd, bread and cake.**



# FRIENDLY MICROORGANISMS

**Microorganisms have been used for the Production Of Alcohol Since Ages.**



# FRIENDLY MICROORGANISMS

They are also used in Cleaning Up Of The Environment. For example, the Organic wastes (Vegetable Peels, Remains Of Animals, Faeces, etc.) Are Broken Down By Bacteria into Harmless and Usable Substances.



# FRIENDLY MICROORGANISMS

**Bacteria are also used in the Preparation Of Medicines.**



# FRIENDLY MICROORGANISMS

In agriculture they are used to Increase Soil Fertility By Fixing Nitrogen.



# MAKING OF CURD AND BREAD

Curd contains several **Micro-organism**.

Of these, the **Bacterium, Lactobacillus** promotes the formation of curd.

It multiplies in milk and **Converts It Into Curd**.



# MAKING OF CURD AND BREAD

Bacteria are also involved in the making of Cheese, Pickles and Many Other Food Items.



# MAKING OF CURD AND BREAD

Yeast Reproduces Rapidly and Produces Carbon Dioxide during respiration.

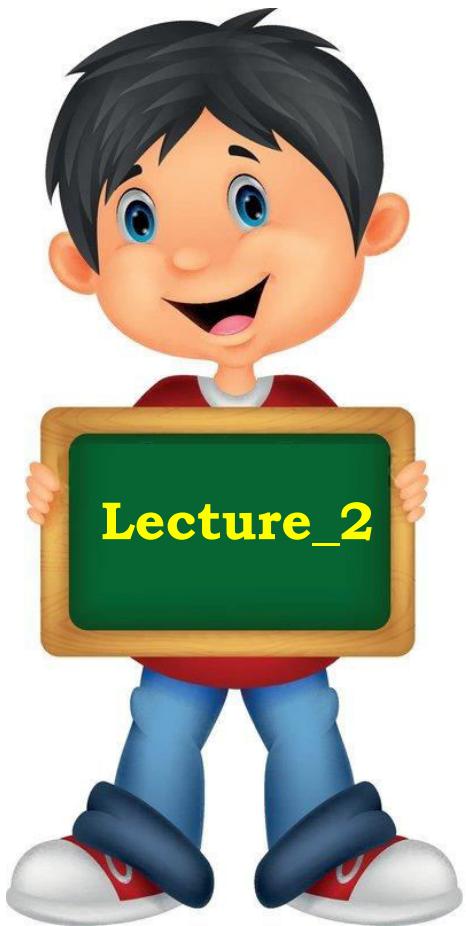
Bubbles of the Gas Fill The Dough and Increase Its Volume.



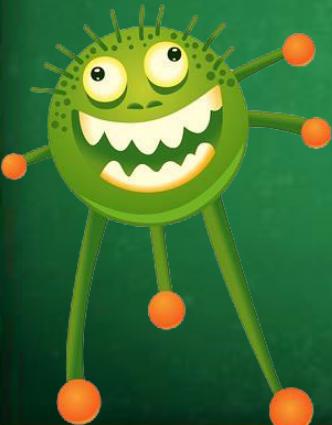
# MAKING OF CURD AND BREAD

This is the basis of the use of *Yeast In The Baking Industry* for making  
**Breads, Pastries And Cakes.**





# Module 4



# **Microorganisms : Friend And Foe**

- **Commercial Use Of Microorganisms**
- **Medicinal Use Of Microorganisms**

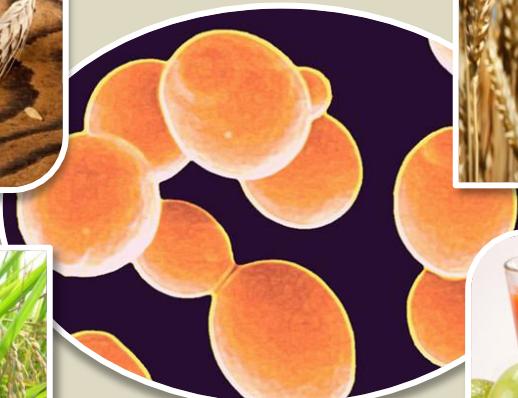
## COMMERCIAL USE OF MICROORGANISMS

Microorganisms are used for the large scale production of Alcohol, Wine And Acetic Acid (Vinegar).



# COMMERCIAL USE OF MICROORGANISMS

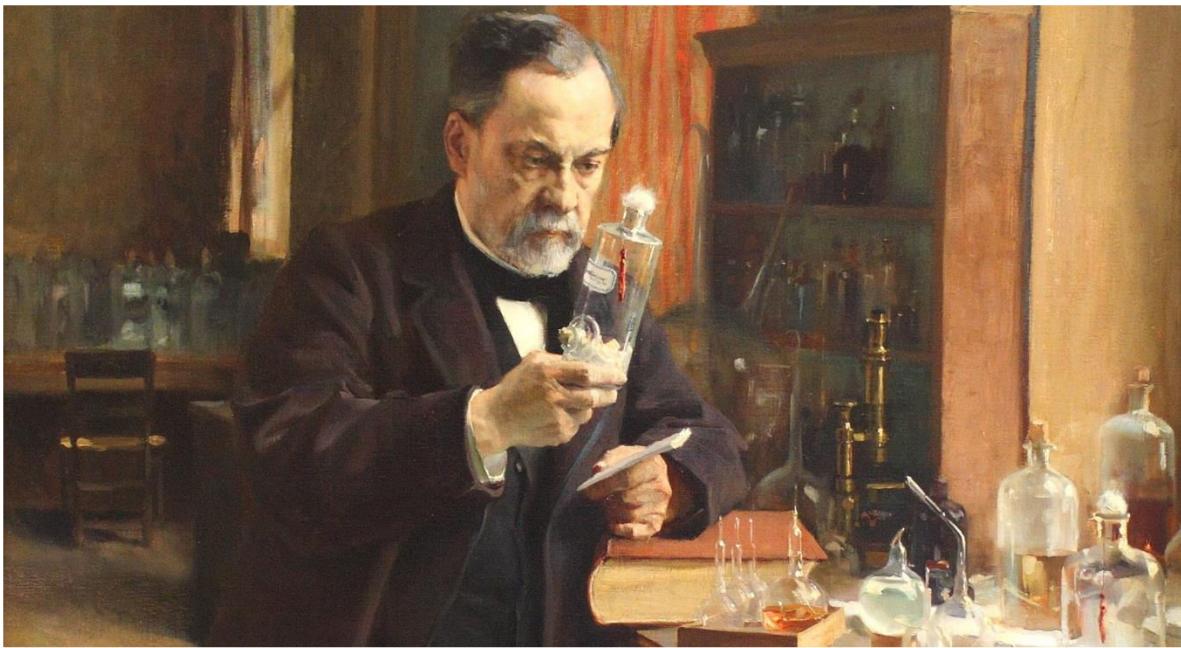
For this purpose *Yeast* is grown on natural sugars present in grains like Barley, Wheat, Rice, Crushed Fruit Juices, etc.



## COMMERCIAL USE OF MICROORGANISMS

The typical smell of alcohol is due to the  
Conversion Of Sugar Into Alcohol By Yeast.

Louis Pasteur discovered fermentation in 1857.



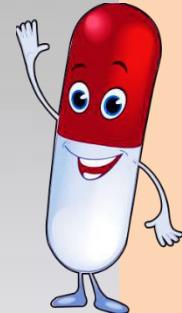
*This process of conversion of sugar into alcohol is known as 'FERMENTATION'.*

# MEDICINAL USE OF MICROORGANISMS

Whenever you Fall ill the doctor may give you some Antibiotic Tablets,

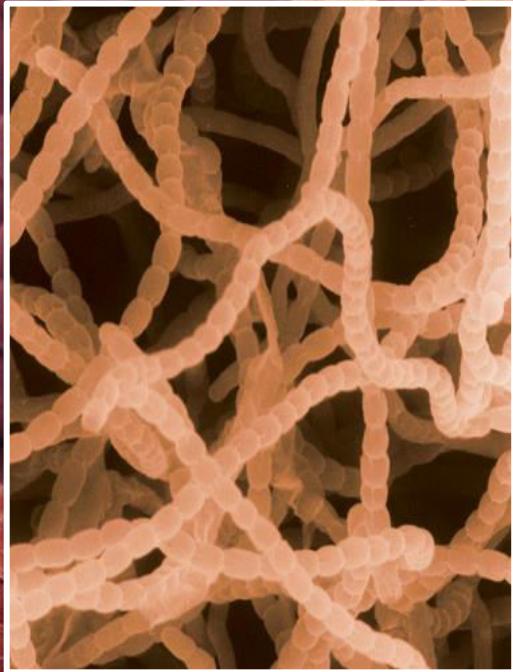


*Capsules Of Injections Such as Of Pencillin.*



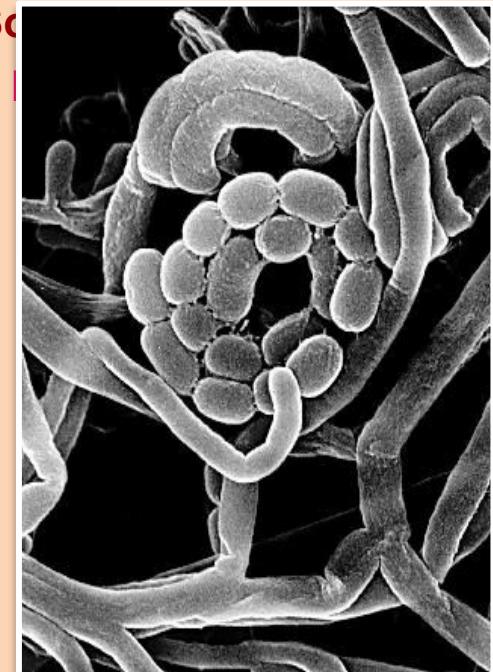
# MEDICINAL USE OF MICROORGANISMS

These medicines Kill Or Stop The Growth Of The Disease-causing Microorganisms.



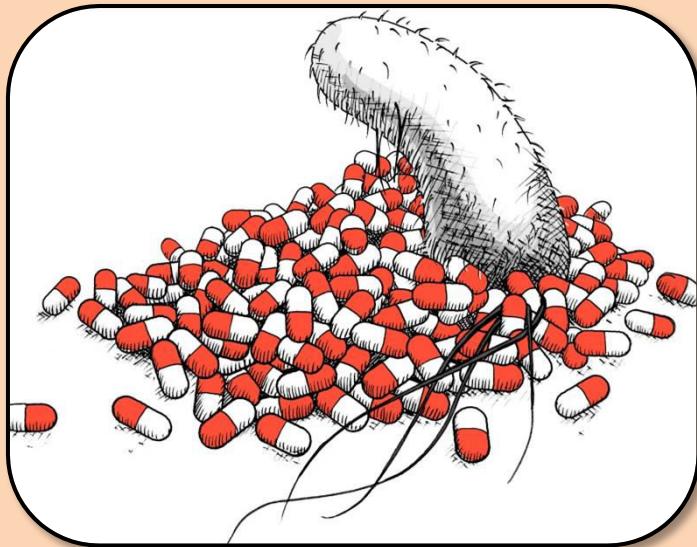
*Such medicines are called  
'ANTIBIOTICS'.*

The So



# MEDICINAL USE OF MICROORGANISMS

These days a number of Antibiotics Are Being Produced from **Bacteria** and **Fungi**.



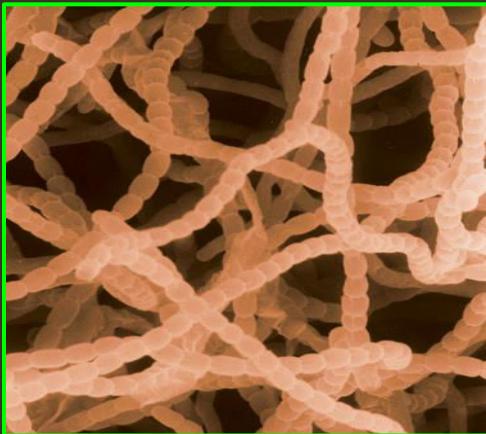
**Bacteria**



**Fungi**

# MEDICINAL USE OF MICROORGANISMS

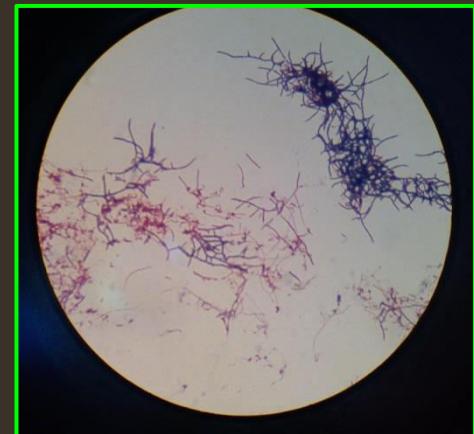
Some of the commonly known antibiotics  
which are made from *Fungi* and *Bacteria* are



STREPTOMYCIN



TETRACYCLINE



ERYTHROMYCIN

# MEDICINAL USE OF MICROORGANISMS

The antibiotics are manufactured by growing **Specific Microorganisms** and are used to cure a **Variety Of Diseases.**



# MEDICINAL USE OF MICROORGANISMS

**ANTIBIOTICS** are even **Mixed With The Feed** of **livestock and poultry** to **Check Microbial Infection** in animals.

**They are also used to control many Plant Diseases.**



# MEDICINAL USE OF MICROORGANISMS

It is important to remember that **Antibiotics Should Be Taken Only On The Advice Of A Qualified Doctor.**

**Also you must Complete The Course prescribed by the doctor.**



# MEDICINAL USE OF MICROORGANISMS

Also antibiotics taken unnecessarily may Kill The Beneficial Bacteria In The Body.



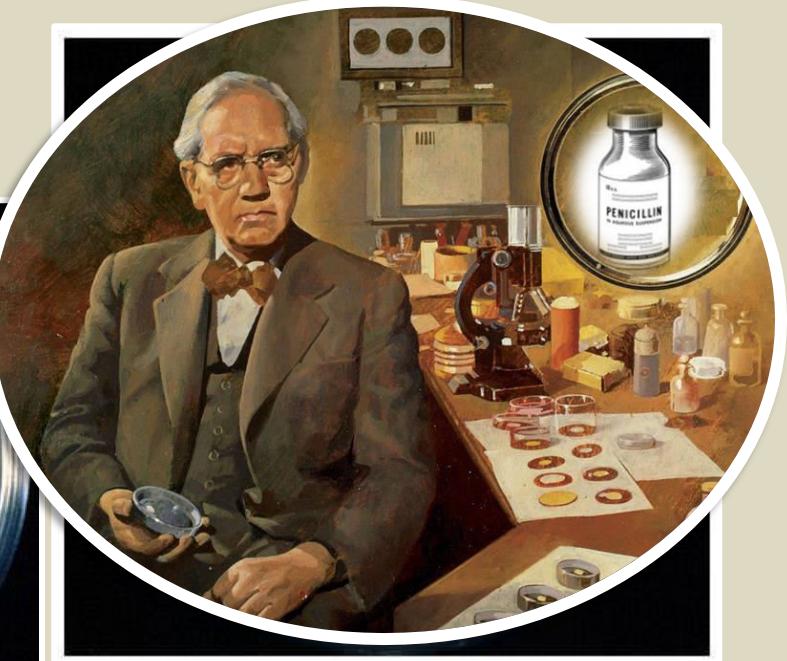
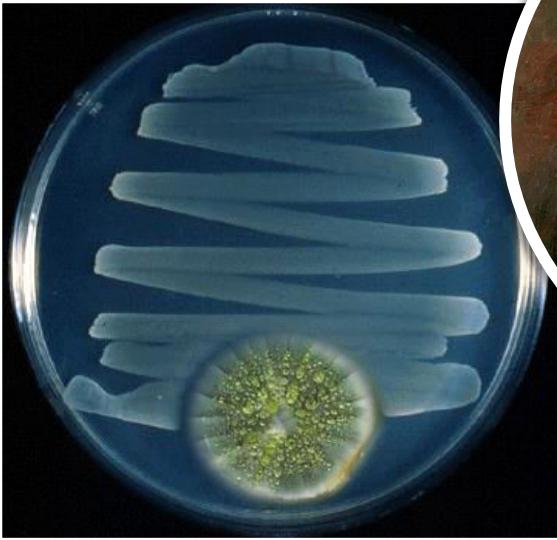
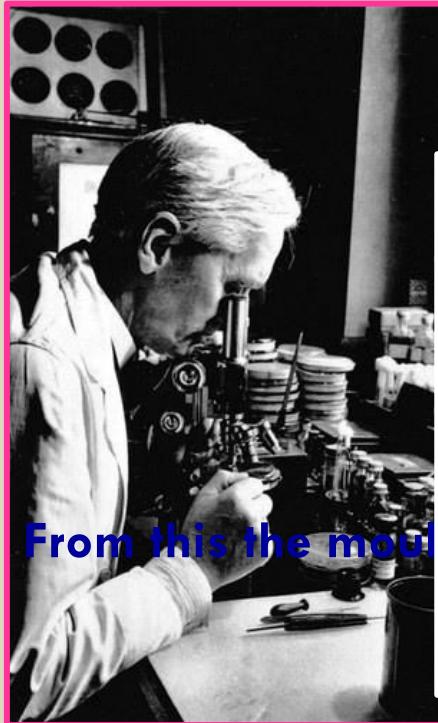
# MEDICINAL USE OF MICROORGANISMS

Antibiotics, however, are not effective against cold and flu as these are caused by viruses.



# MEDICINAL USE OF MICROORGANISMS

In 1929, Alexander Fleming was working on a culture of disease causing bacteria.

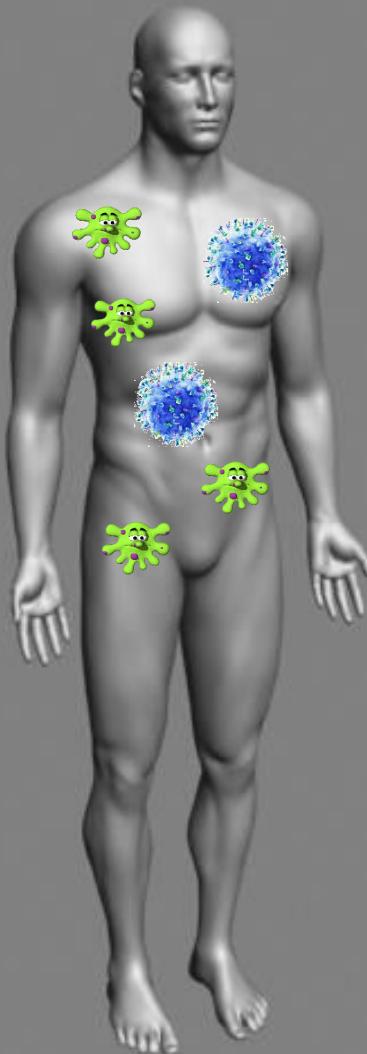


# Module 5

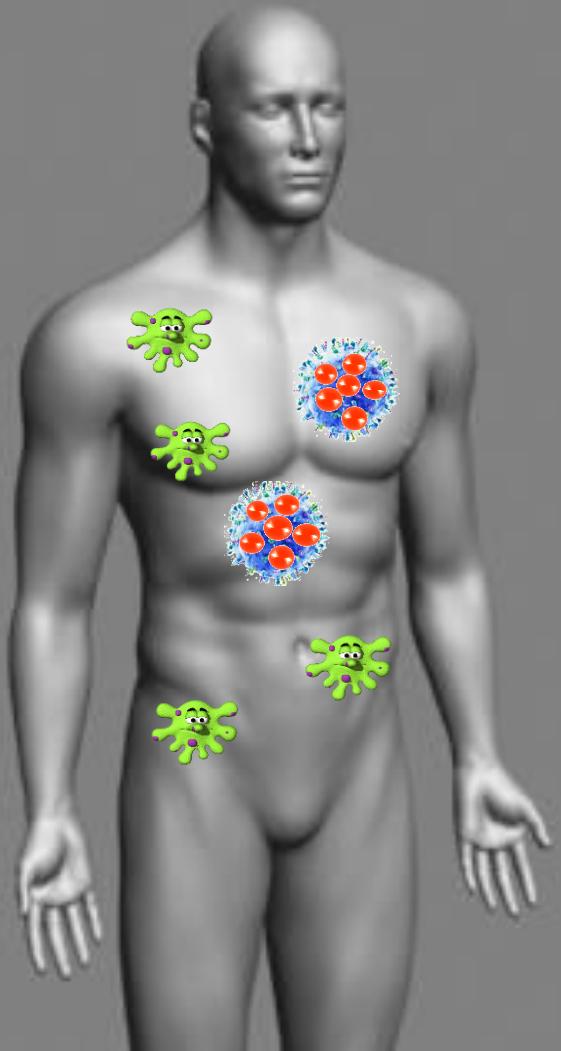


# **Microorganisms : Friend And Foe**

- **Vaccine**



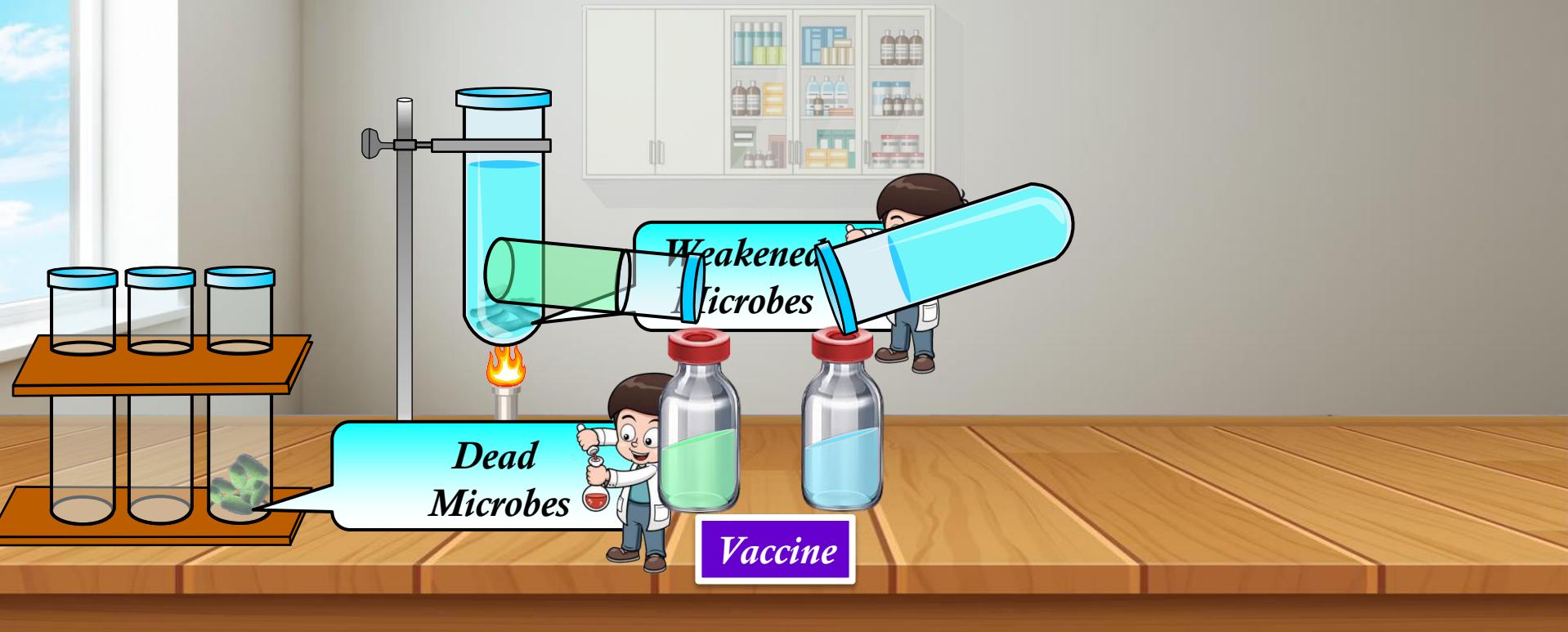
arrying Microbe Enters Our Body,  
If The Microbe is ~~Antibodies~~ fighters again.



If **The Microbe** enters again,  
**The body also Remembers How To Fight**  
**the microbe.**

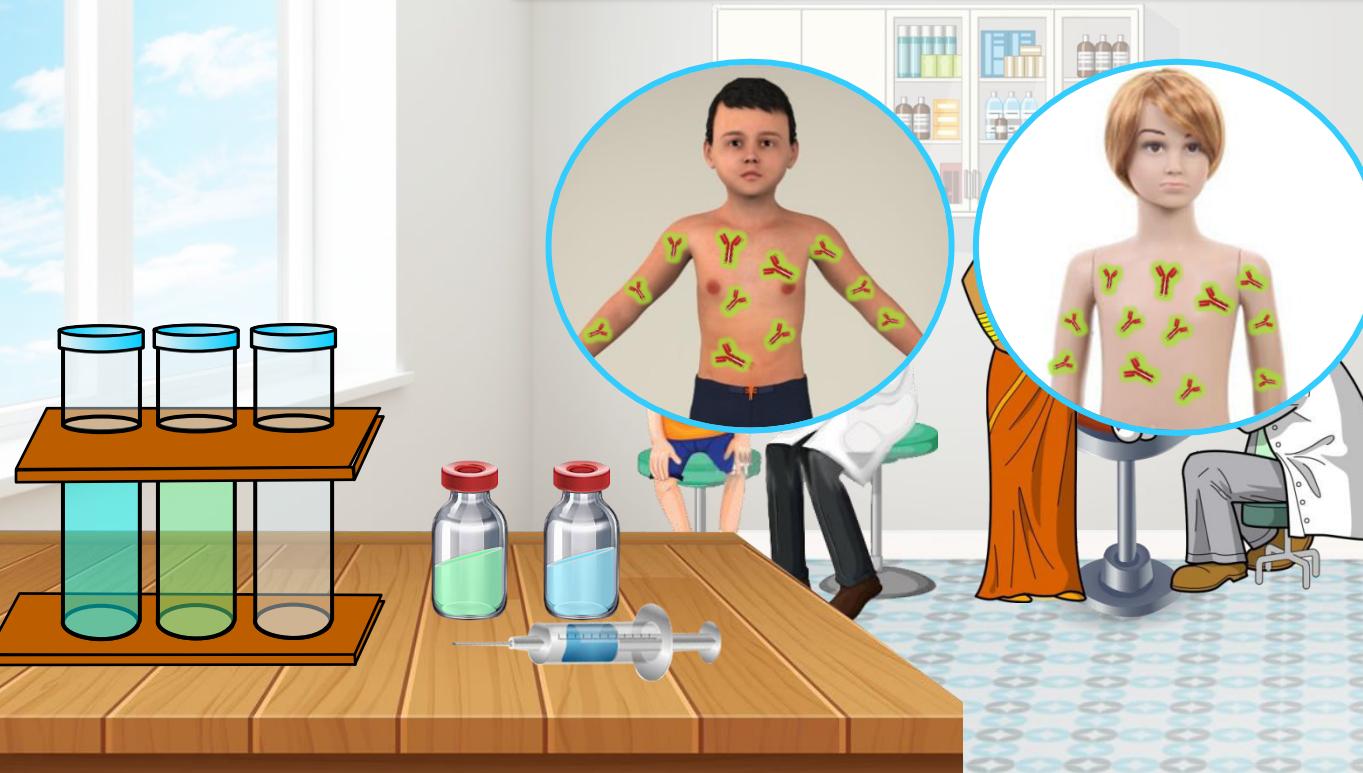
# VACCINE

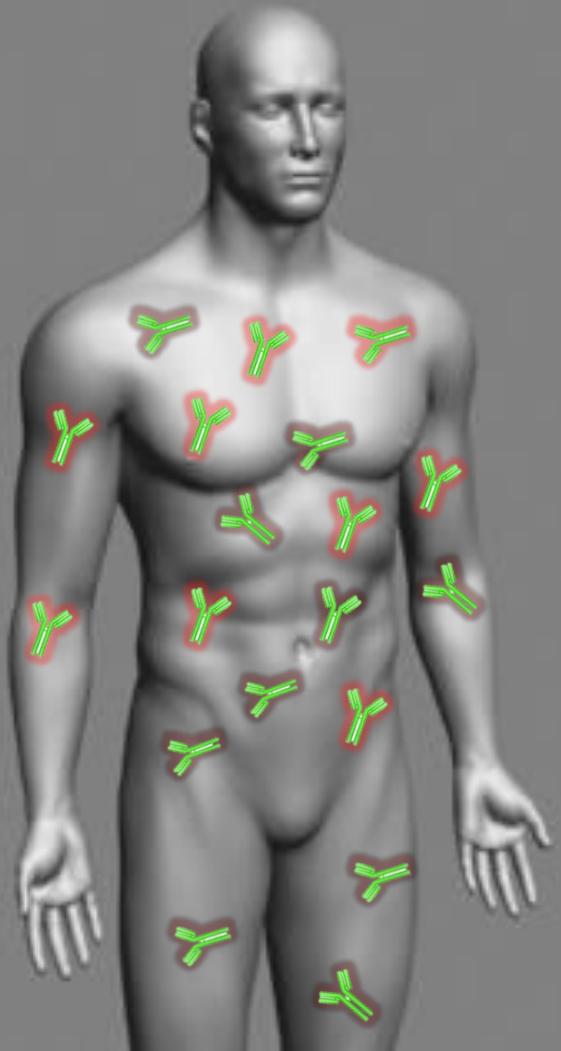
If **Dead** or **Weakened Microbes** are introduced in a healthy body, the body fights and kills them by producing suitable antibodies.



# VACCINE

If **dead** or **weakened** microbes are **Introduced In A Healthy Body**,  
the **Body Fights and Kills Them By Producing Suitable Antibodies.**





The **Antibodies** Remain In The Body  
and we are **Protected** from the  
disease-causing microbes.

This is **How A Vaccine Works.**

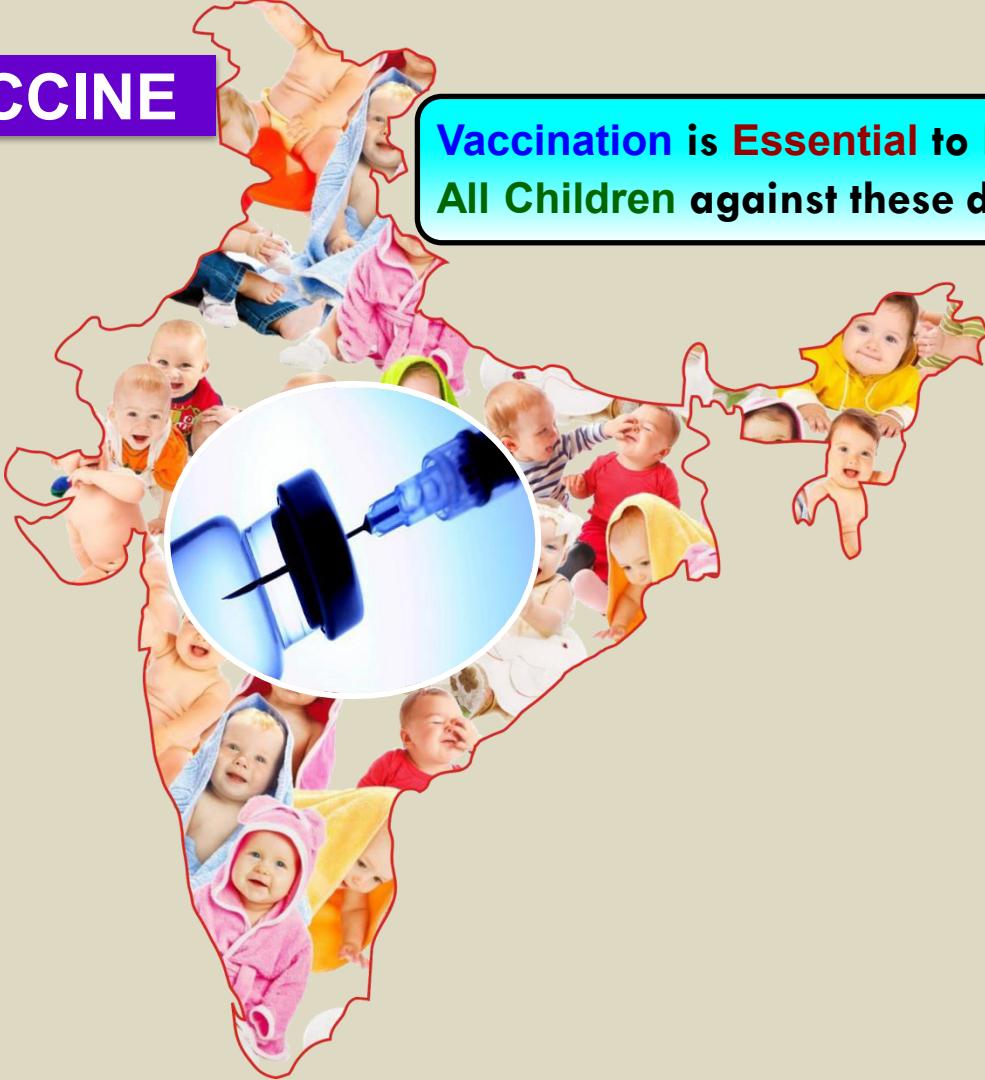
# VACCINE



Vaccination prevents several diseases, including *Cholera*, *Tuberculosis*, *Smallpox* and *Hepatitis*.

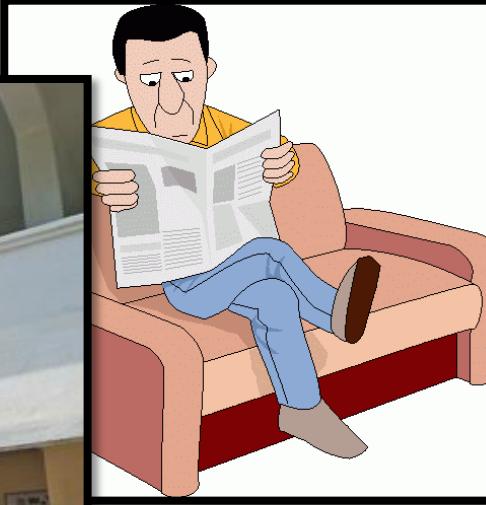
# VACCINE

Vaccination is Essential to Protect  
All Children against these diseases.



# VACCINE

Necessary Vaccines are Available in the Nearby Hospitals.



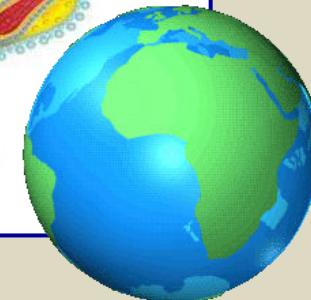
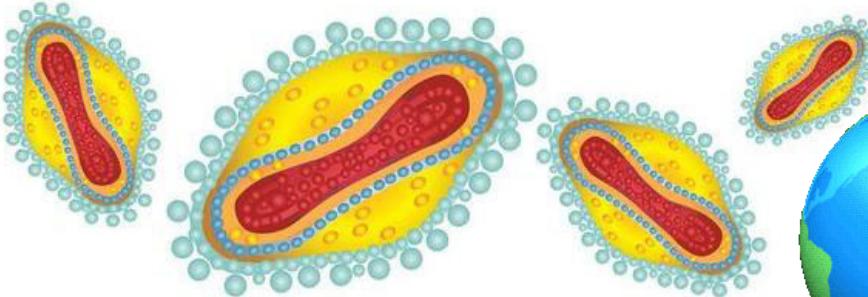
on T.V.  
children  
ramme.

# VACCINE

Polio Drops given to children are actually A Vaccine.

A Worldwide Campaign Against Smallpox has finally led its

**smallpox ERADICATED**



# VACCINE



and other animals

# VACCINE

Edward Jenner discovered the Vaccine For Small-pox in 1798.



# Module 6

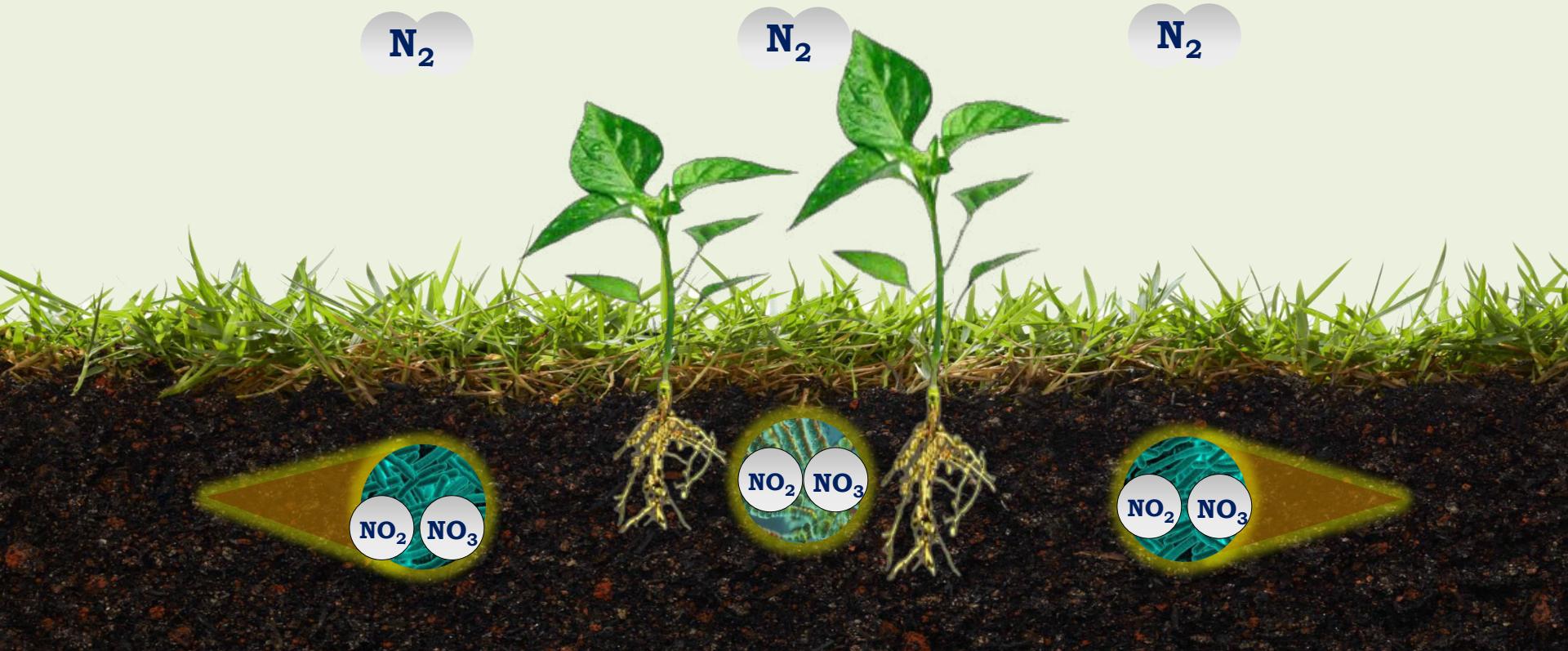


# **Microorganisms : Friend And Foe**

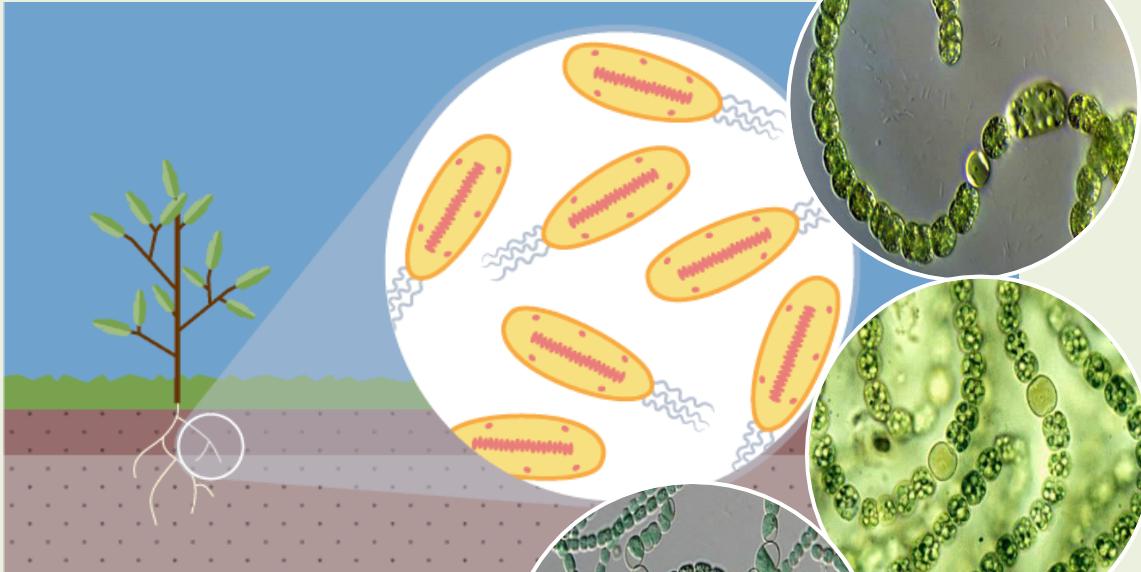
- Increasing Soil Fertility
- Cleaning The Environment

# INCREASING SOIL FERTILITY

Certain Bacteria and Blue Green Algae are able to Fix Nitrogen From The Atmosphere to enrich soil with nitrogen and increase its fertility.



# INCREASING SOIL FERTILITY



These microbes are commonly called 'Biological Nitrogen Fixers'.



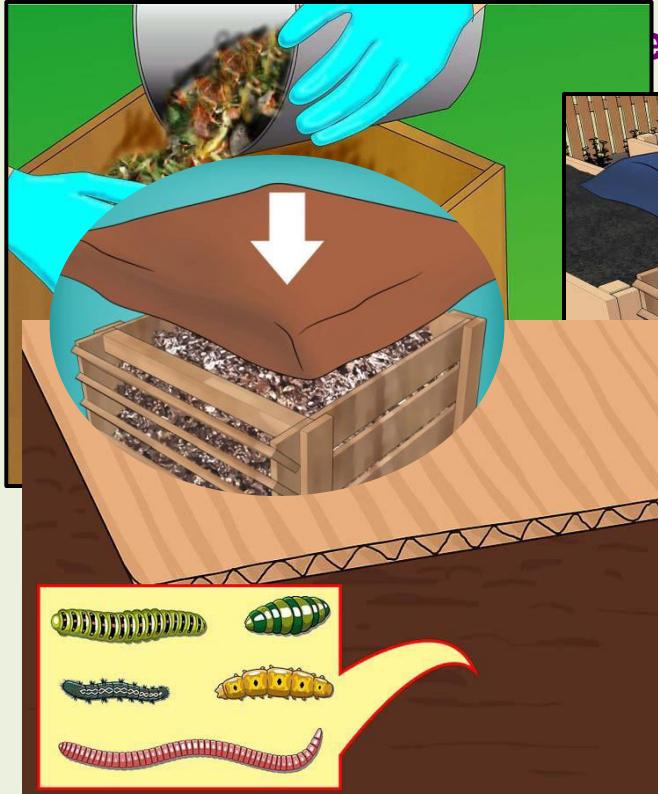
# CLEANING THE ENVIRONMENT



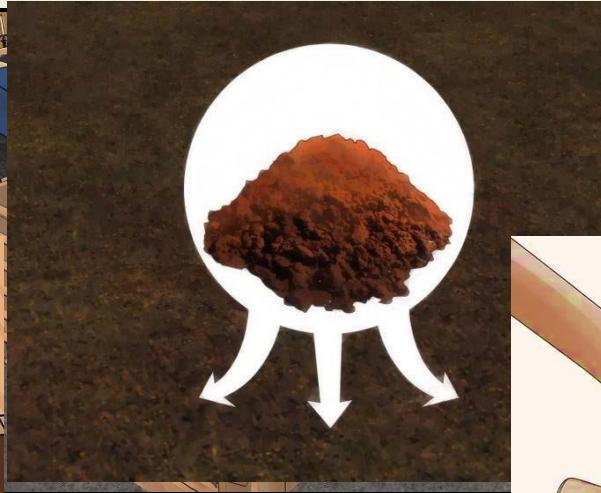
are collected from nearby houses and gardens.

# CLEANING THE ENVIRONMENT

They are **Put In A Pit** meant for waste disposal.



It is **decomposed** and gets converted to a **Manure**.





**Large amount of dead organic waste.** This is because the Microorganisms Decompose Dead Organic Waste of plants and animals found.

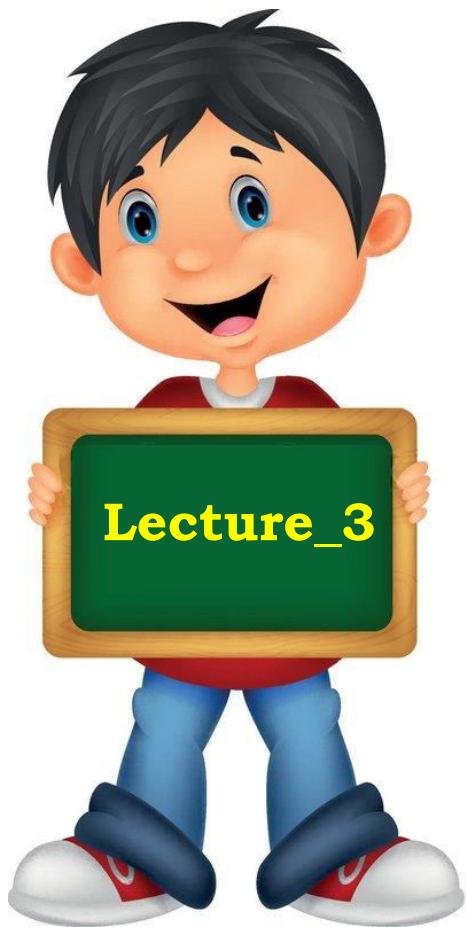
# CLEANING THE ENVIRONMENT

These substances are Again Used By  
Other Plants and Animals.





Thus, microorganisms can be used to  
**Degradethe Harmful And Smelly Substances**  
and thereby Clean Up The Environment.



# Module 7



# **Microorganisms : Friend And Foe**

- Harmful Microorganisms
- Disease - Causing Microorganisms  
In Humans

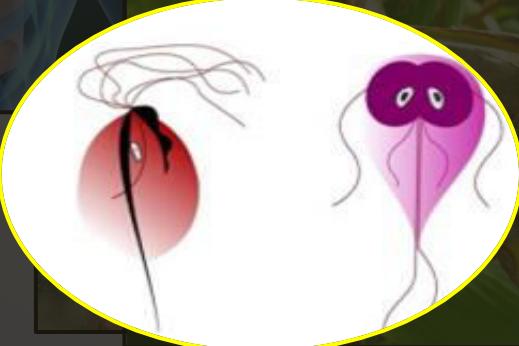
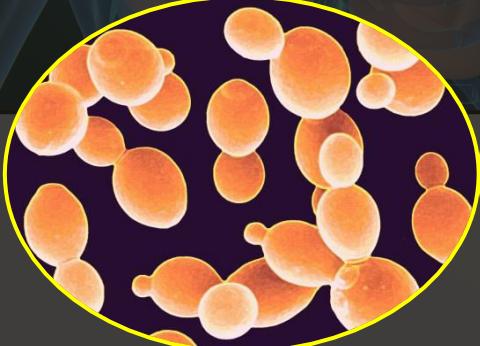
# HARMFUL MICROORGANISMS

Microorganisms are Harmful In Many Ways.

Human Beings, Plants and Animals.



are called  
**PATHOGENS.**



# HARMFUL MICROORGANISMS

Some microorganisms spoil Food, Clothing and Leather.



# DISEASE - CAUSING MICROORGANISMS IN HUMANS

*The Air We Breathe*

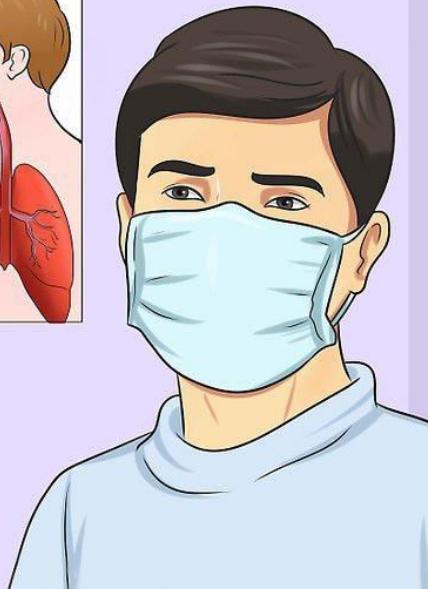
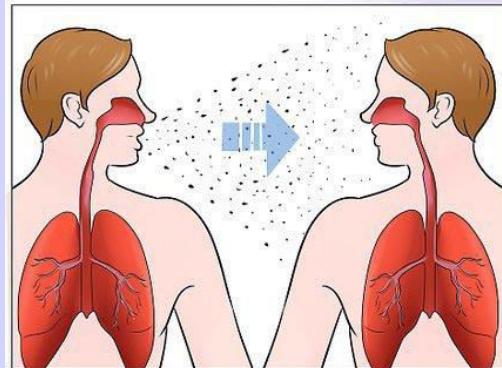
*The Water We Drink*

*The Food We Eat*

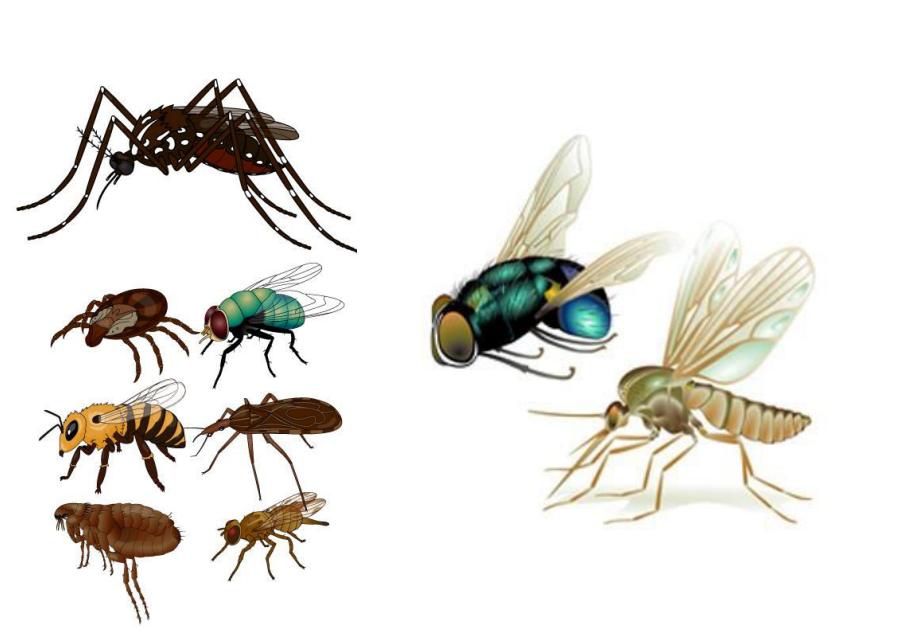


# DISEASE - CAUSING MICROORGANISMS IN HUMANS

**Direct *Contact With An Infected Person***



**Carried Through *An Animal***

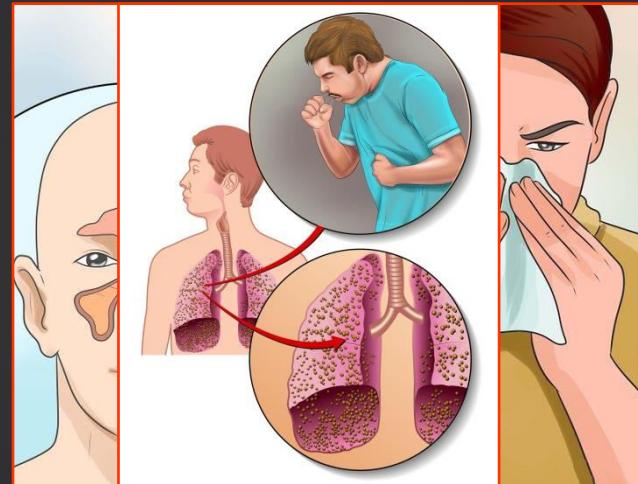


# DISEASE - CAUSING MICROORGANISMS IN HUMANS

EXAMPLES OF SUCH DISEASES INCLUDE



CHICKENPOX

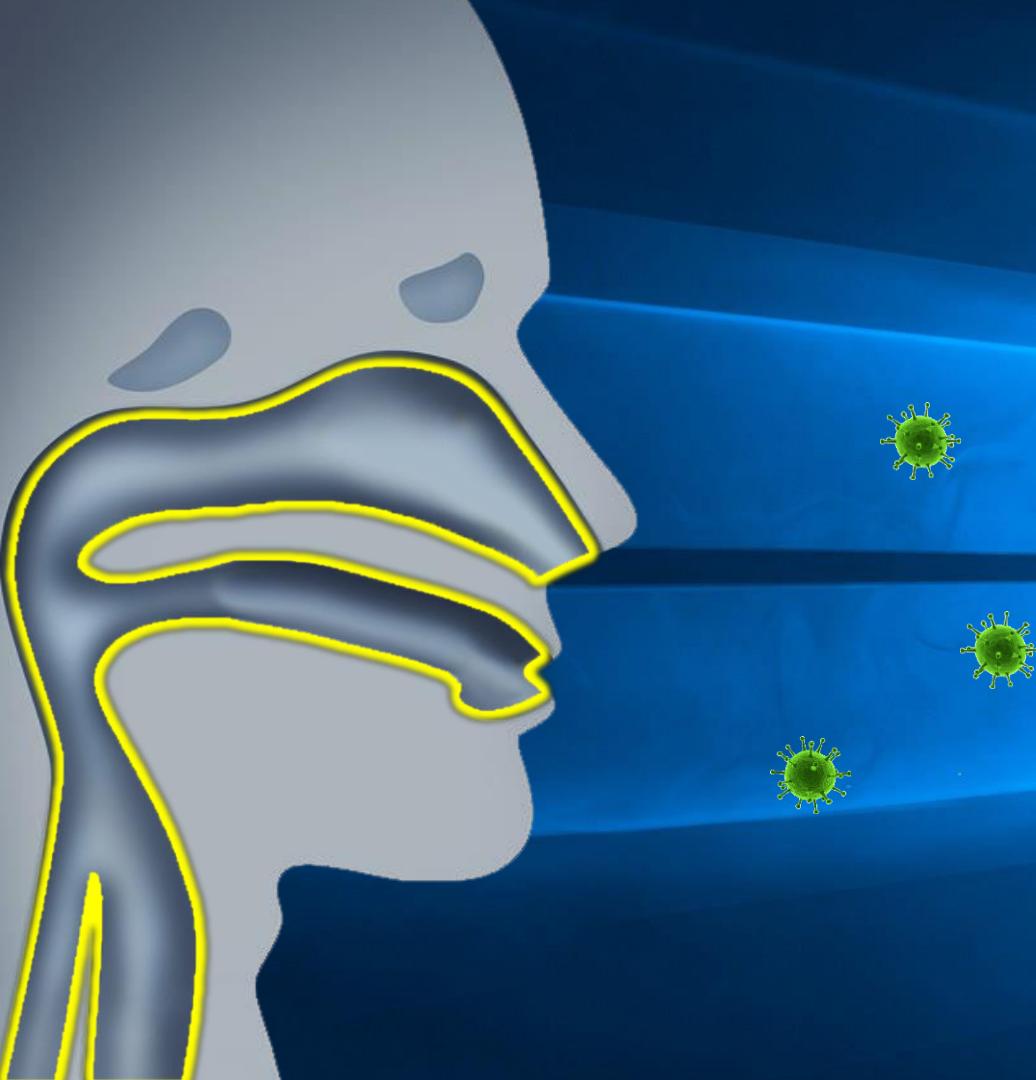


TUBERCULOSIS

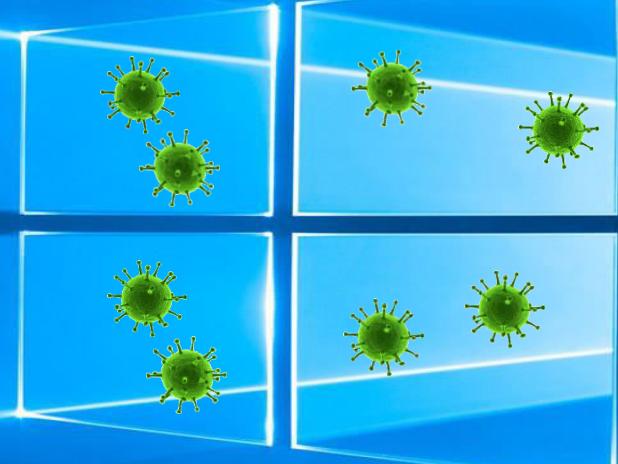
# DISEASE - CAUSING MICROORGANISMS IN HUMANS

When a person suffering from Common Cold Sneezes, Fine Droplets Of Moisture carrying thousands of Viruses Are Spread In The Air.





The virus may enter the body of a healthy person while breathing.



There are Some Insects and Animals which act as, IN HUMANS



Housefly is one such carrier.



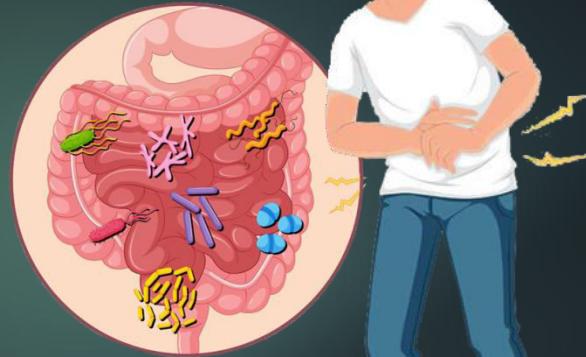
Carriers of Disease-causing Microbes

The flies sit on the garbage and animal excreta.

When these flies sit on uncovered food they May Transfer The Pathogens.



**Whoever Eats The Contaminated Food is likely to Get Sick.**



**So, it is advisable to always keep food covered.**



*As covered food reduces the risk of food poisoning.*



**Another example of a carrier is**



**The female Anopheles Mosquito**



**It carries the parasite of malaria.**

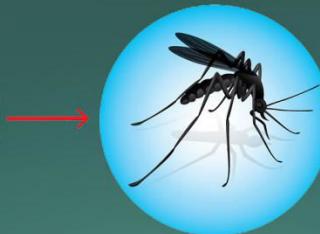
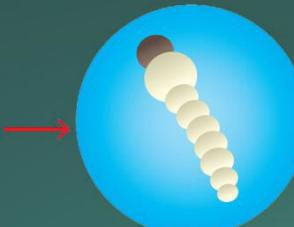
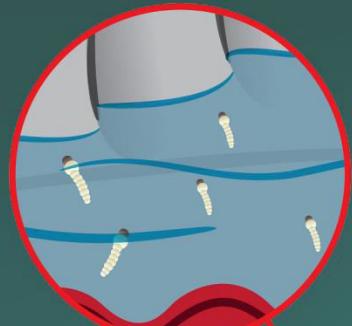
**Another example of a carrier is**



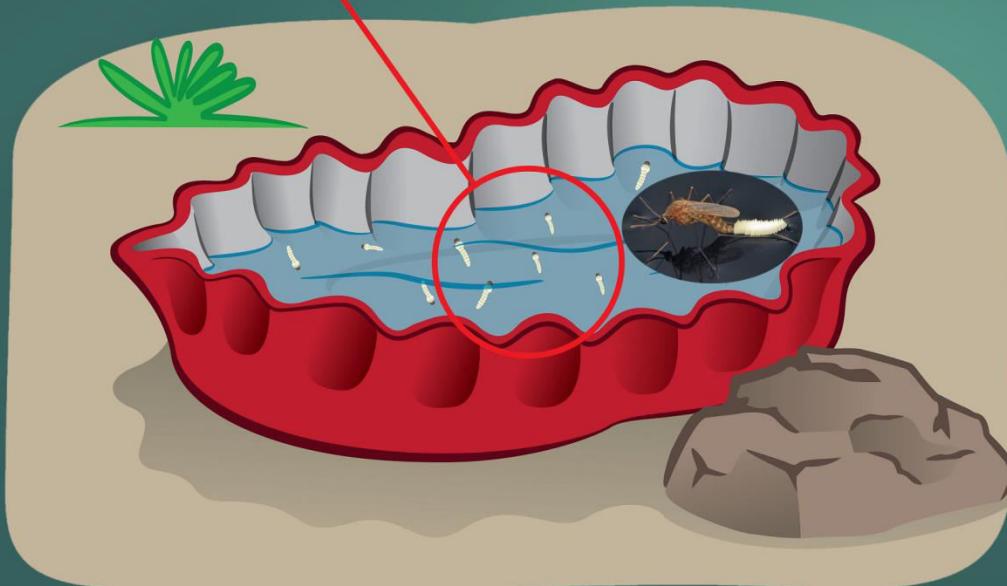
**It carries the  
dengue virus.**



**The female Aedes Mosquito**



All mosquitoes breed in water.



By Keeping The Surroundings Clean And Dry  
We Can Help In Cooling Down; Flame Retardant.



# Module 8



# **Microorganisms : Friend And Foe**

- **Common Human Diseases Caused  
By Microorganisms**

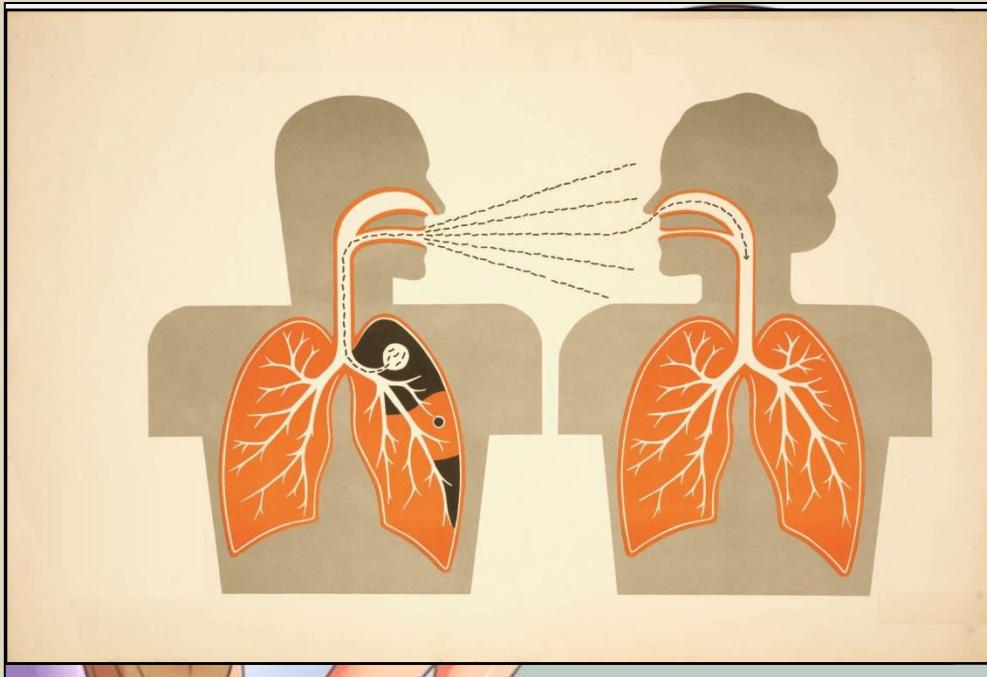
## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	
---------------	-------------------------	----------------------	--

Tuberculosis

Bacteria

Air



# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
---------------	-------------------------	----------------------	-------------------------------

Tuberculosis



Measles



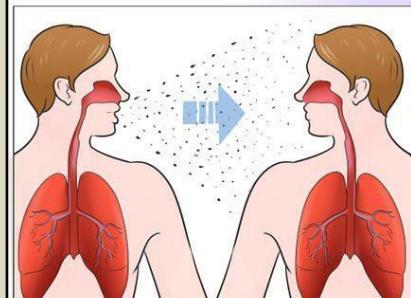
# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
---------------	-------------------------	----------------------	-------------------------------

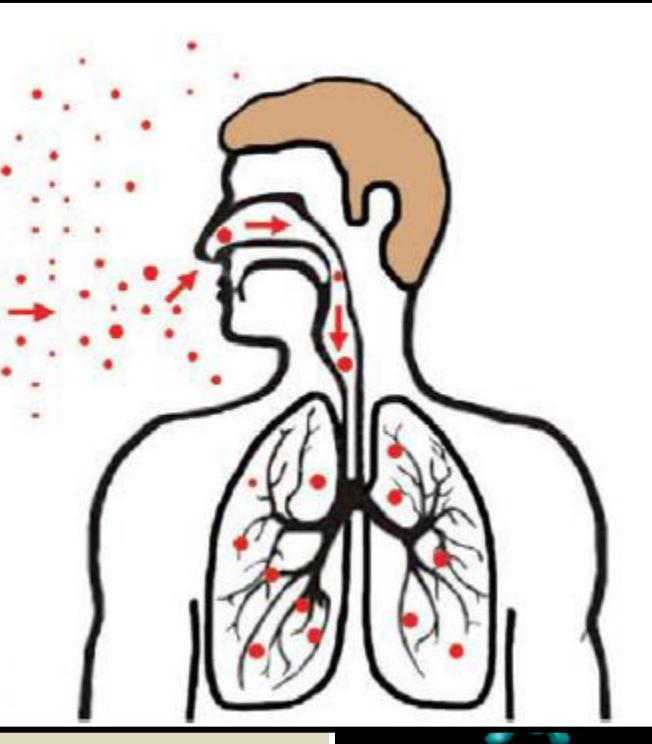
Tuberculosis

Measles

Chicken Pox

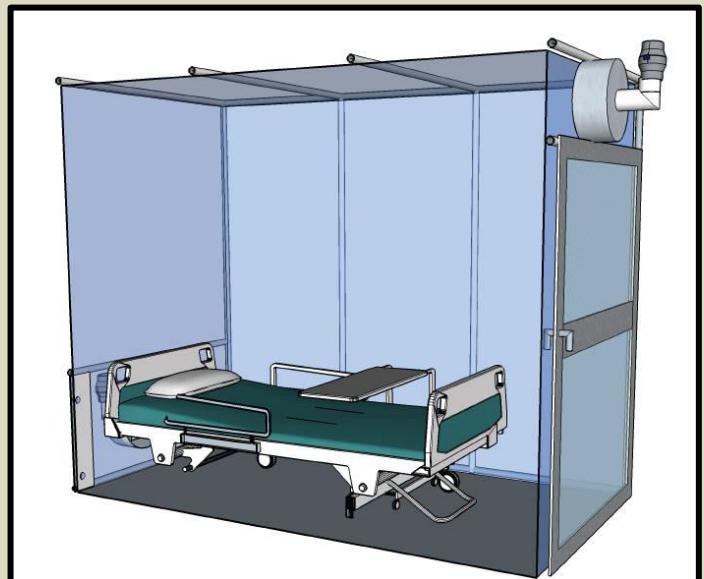


## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
			

## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	



## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
---------------	-------------------------	----------------------	-------------------------------

Tuberculosis

Bacteria

Air

Measles

Virus

Air



Keep the patient in complete isolation. Keep the person belongings of the patient always from those of the others.

## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	Keep the patient in complete isolation. Keep the person belongings of the patient always from those of the others.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	



## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	Keep the patient in complete isolation. Keep the person belongings of the patient always from those of the others. Vaccination to be give a suitable age.



# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis			
Measles			
Chicken Pox			
Polio			
Cholera			

The illustrations show:

- A person with a green shirt holding a red bowl, with a close-up inset showing red, rod-shaped bacteria on their skin.
- A person bending over to drink from a body of water, with a circular inset showing the bacterium *Vibrio cholerae*.
- A person eating a sandwich, with a small inset showing a close-up of the sandwich.

# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis			
Measles			
Chicken Pox			
Polio			
Cholera			
Typhoid			



# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
---------------	-------------------------	----------------------	-------------------------------

Tuberculosis

Measles

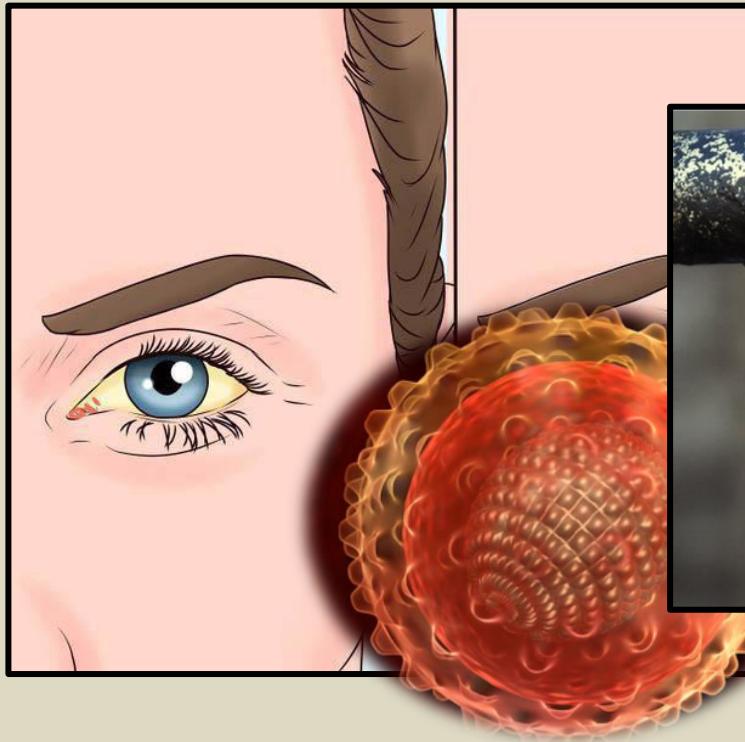
Chicken Pox

Polio

Cholera

Typhoid

Hepatitis A



# Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis			
Measles			
Chicken Pox			
Polio			
Cholera			
Typhoid			
Hepatitis A			
Malaria			

The image is a composite of three panels. The left panel shows a person in a blue shirt coughing. The middle panel is a close-up of red blood cells, one of which contains a small, dark, rod-shaped microorganism. The right panel shows a woman wearing a purple hat and a white shirt, with a mosquito resting on her arm. A circular inset over the mosquito shows a detailed view of its body.

## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	Maintain personal hygiene and good sanitary habits.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	
Cholera	Bacteria	Water/Food	



## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Tuberculosis	Bacteria	Air	Maintain personal hygiene and good sanitary habits. Consume properly cook food.
Measles	Virus	Air	
Chicken Pox	Virus	Air/Contact	
Polio	Virus	Air/Water	
Cholera	Bacteria	Water/Food	
Typhoid	Bacteria	Water	



## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
---------------	-------------------------	----------------------	-------------------------------

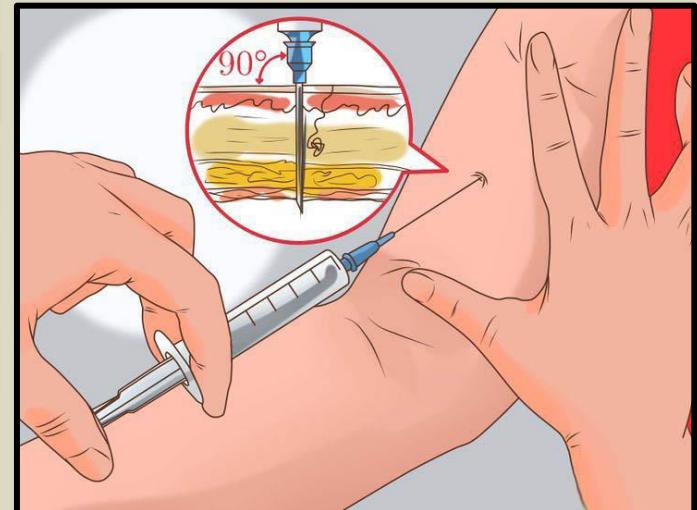


Hepatitis A

Virus

Water

Maintain personal hygiene and good sanitary habits. Consume properly cook food. Drink boiled drinking water. Vaccination.



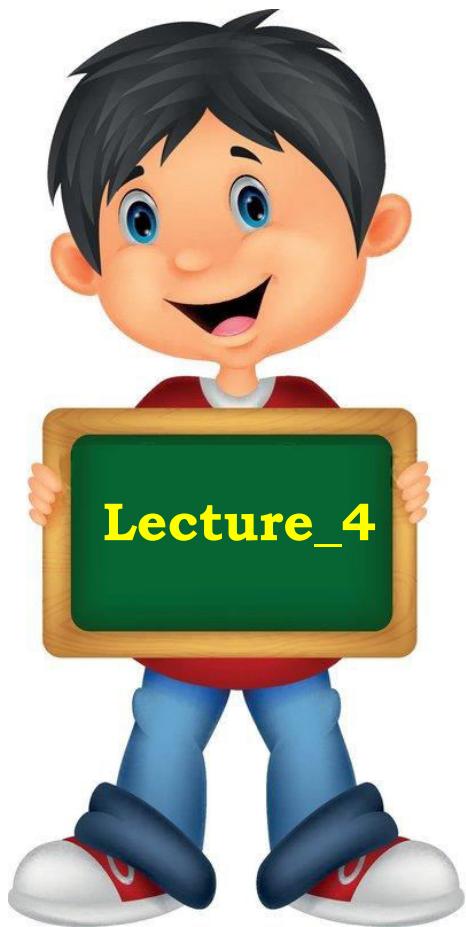
## Some Common Human Diseases Caused by Microorganisms

Human Disease	Causative Microorganism	Mode of Transmission	Preventive Measures (General)
Malaria	Protozoa		<p>Maintain personal hygiene and good sanitary habits. Consume properly cook food. Drink boiled drinking water. Vaccination.</p> <p>Use mosquito net and repellents. Spray insecticides and control breeding mosquitoes by not allowing water to collect in the surroundings.</p>

Malaria

Protozoa

Mosquito



# Module 9



# **Microorganisms : Friend And Foe**

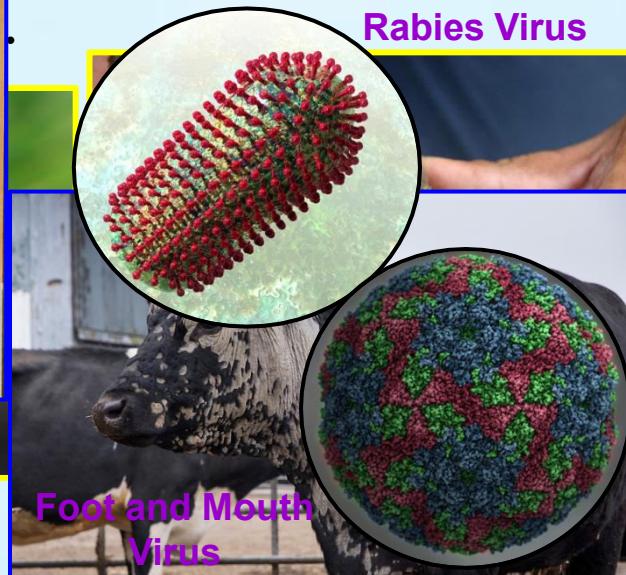
- **Disease - Causing Microorganisms  
In Animals**
- **Disease - Causing Microorganisms  
In Plants**

# Some Common Animal Diseases Caused by Microorganisms

Microorganisms also cause **DISEASES IN ANIMALS.**



Disease that affects animals like Dog, Cow, Horse, Cattle, etc.

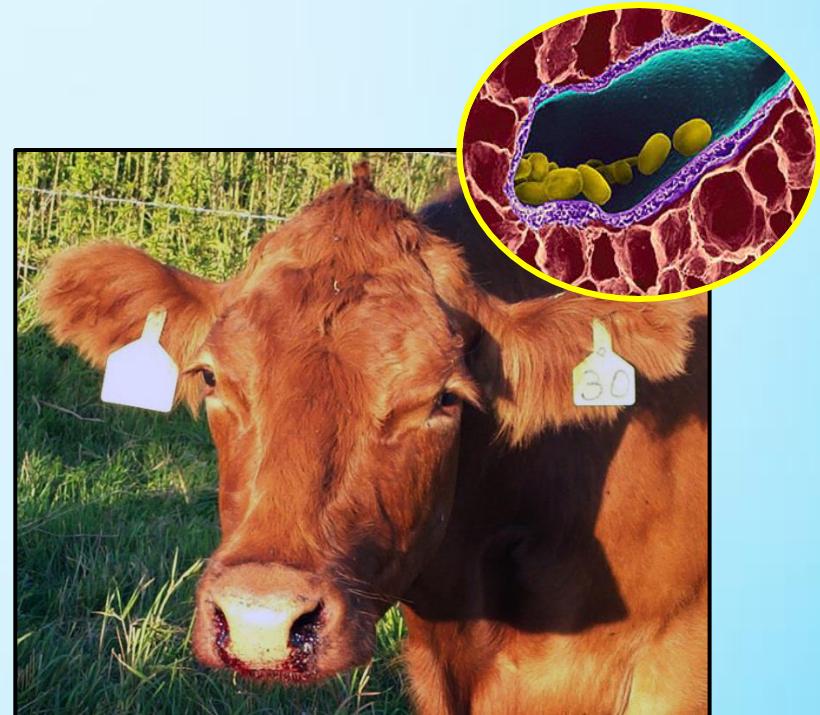
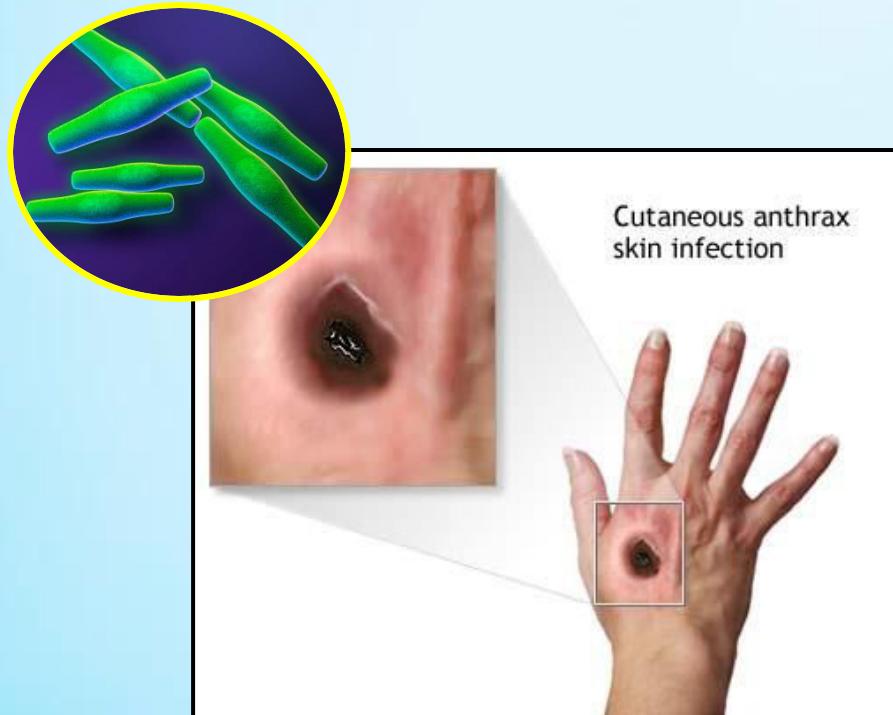


**RABIES** and **FOOT** and **Mouth** disease of cattle are examples of animal diseases caused by **Viruses**.

## Some Common Animal Diseases Caused by Microorganisms

Microorganisms also cause **DISEASES IN ANIMALS.**

Whereas, is a dangerous **Human** and **Cattle Disease** caused by a **Bacterium**.



# DISEASE CAUSING MICROORGANISMS IN PLANTS



Several microorganisms cause  
diseases in plants like  
*wheat, rice, potato*

# DISEASE CAUSING MICROORGANISMS IN PLANTS



Several microorganisms cause  
diseases in plants like  
*sugarcane, orange, apple*

## Some Common Plant Diseases Caused by Microorganisms

Plant Diseases	Micro organism	Mode of Transmission
----------------	----------------	----------------------

Citrus canker



Air

## Some Common Plant Diseases Caused by Microorganisms

Plant Diseases	Micro organism	Mode of Transmission
----------------	----------------	----------------------



# Some Common Plant Diseases Caused by Microorganisms

Plant Diseases	Micro organism	Mode of Transmission
Citrus canker		
Rust of wheat		
Yellow vein mosaic of bindi (Okra)	 A close-up photograph showing a green caterpillar feeding on a light-colored, fleshy plant stem, likely okra. The caterpillar has a segmented body and prolegs.	 A photograph of a large green Okra leaf showing distinct white, mottled spots and patches, characteristic of yellow vein mosaic virus infection. The leaf is set against a background of soil and other foliage.

# Module 10

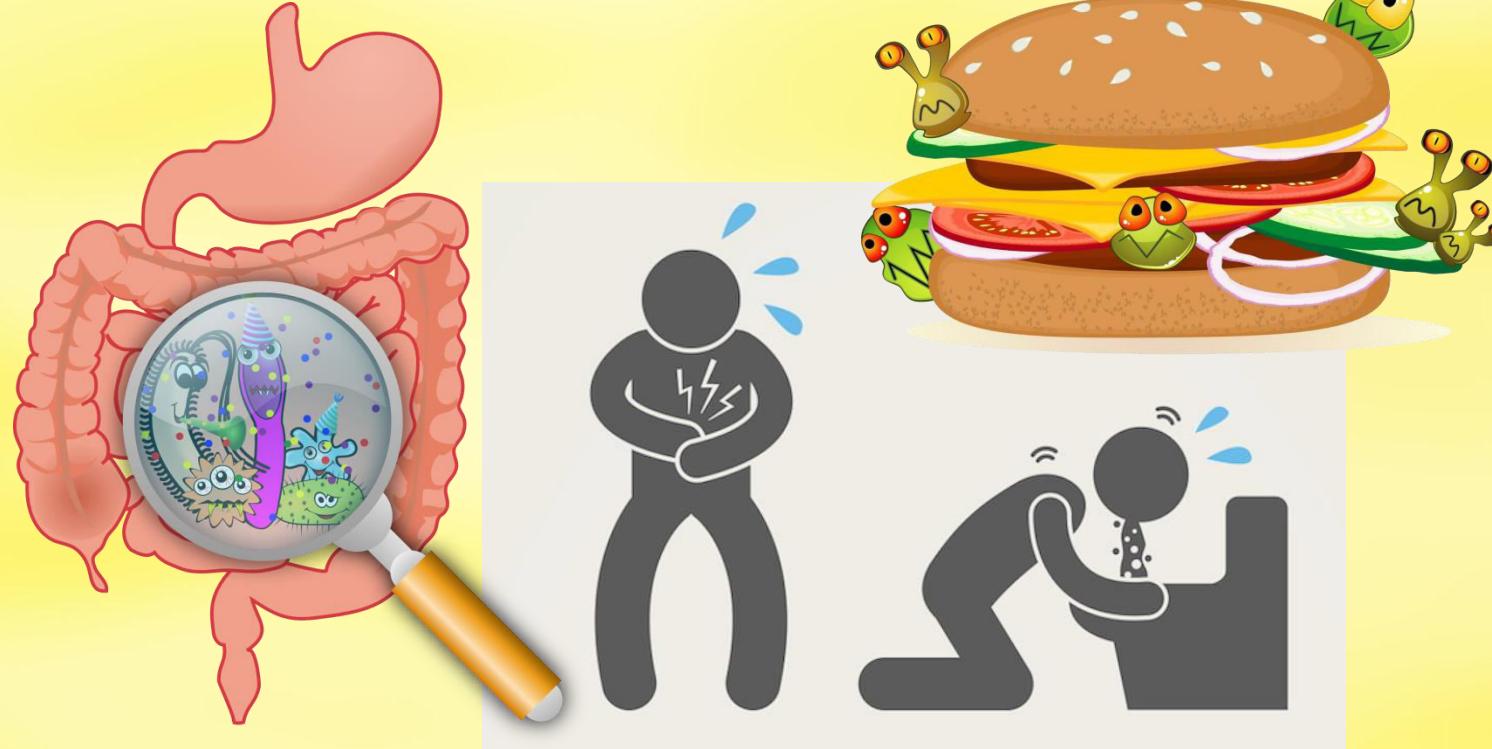


# **Microorganisms : Friend And Foe**

- **Food Poisoning**

# FOOD POISONING

Food Poisoning, as the name suggests, is **The Disease** that results from **Consumption Of Contaminated Food**.



# FOOD POISONING

SYMPTOMS of FOOD POISONING are

VOMITING

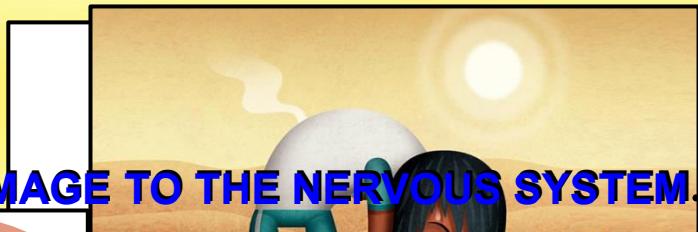
NAUSEA



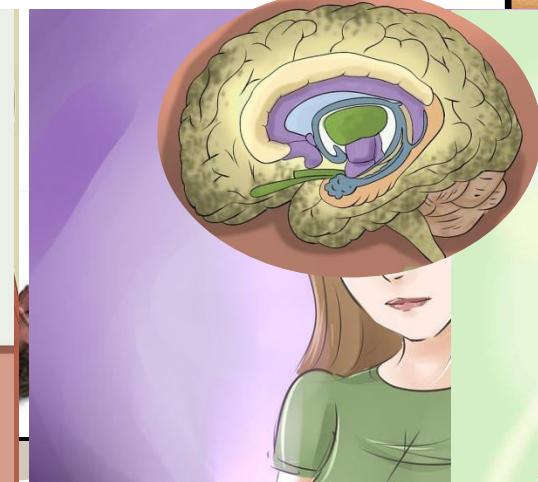
It may also cause WEAKNESS, FATIGUE and DAMAGE TO THE NERVOUS SYSTEM.

DEHYDRATION

DIARRHOEA



SEVERE PAIN IN THE ABDOMINAL REGION



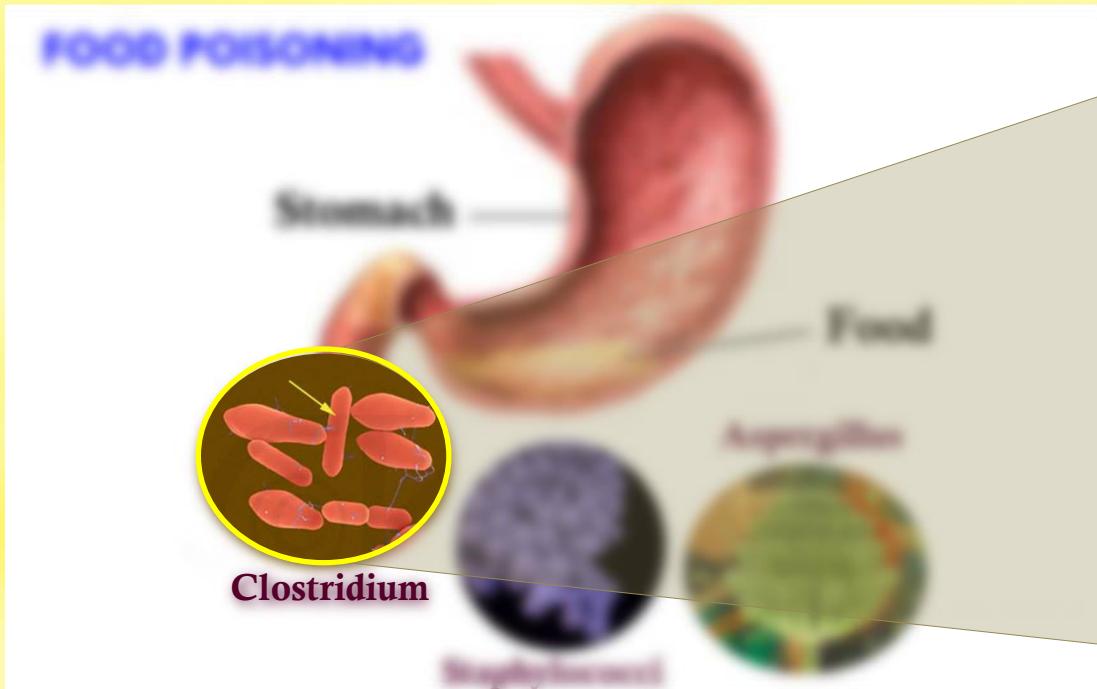
# FOOD POISONING

These symptoms arise due to **The Presence Of Bacteria Or Other Microbes In Food** Or Due To **The Ingestion Of Toxins Contained In Food**(including those produced by bacteria).



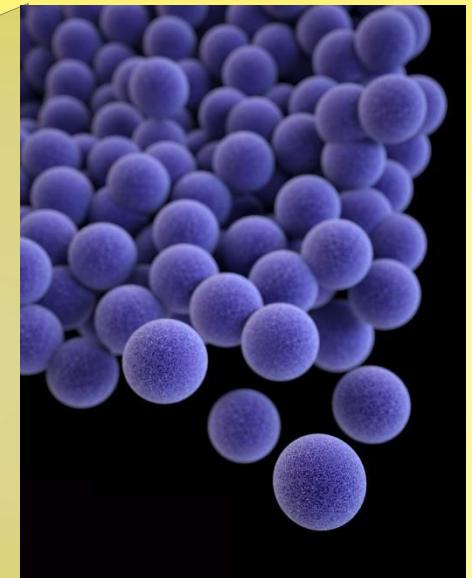
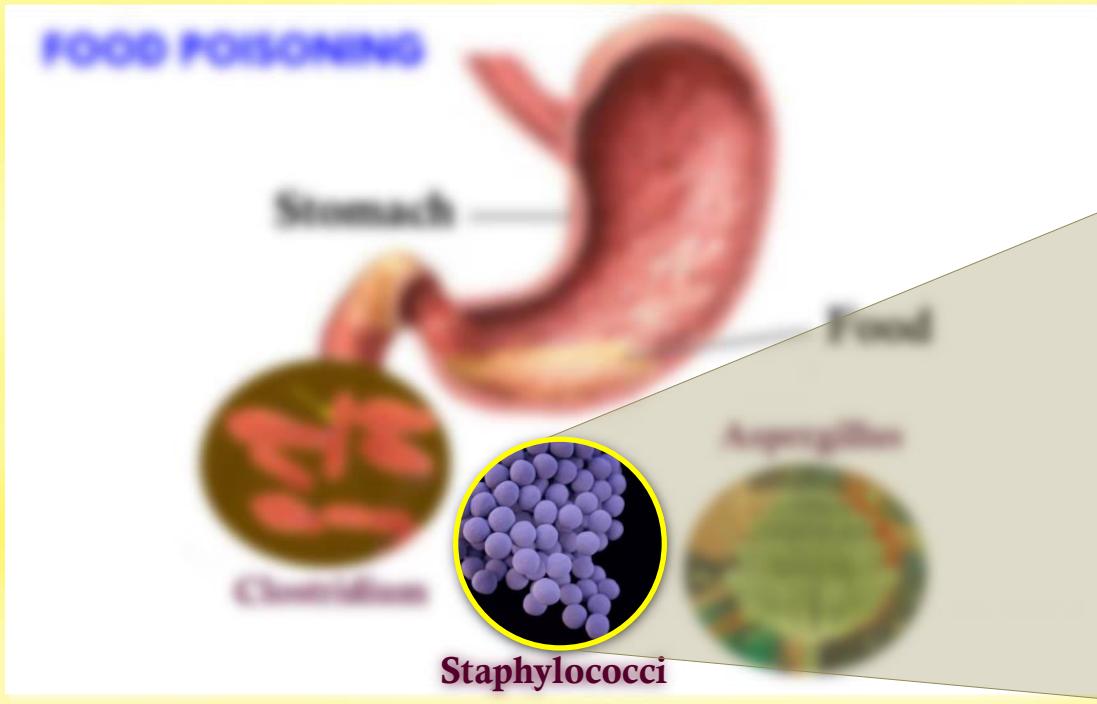
# FOOD POISONING

Some bacteria like Clostridium and Staphylococci and Fungi like Aspergillus cause food poisoning.



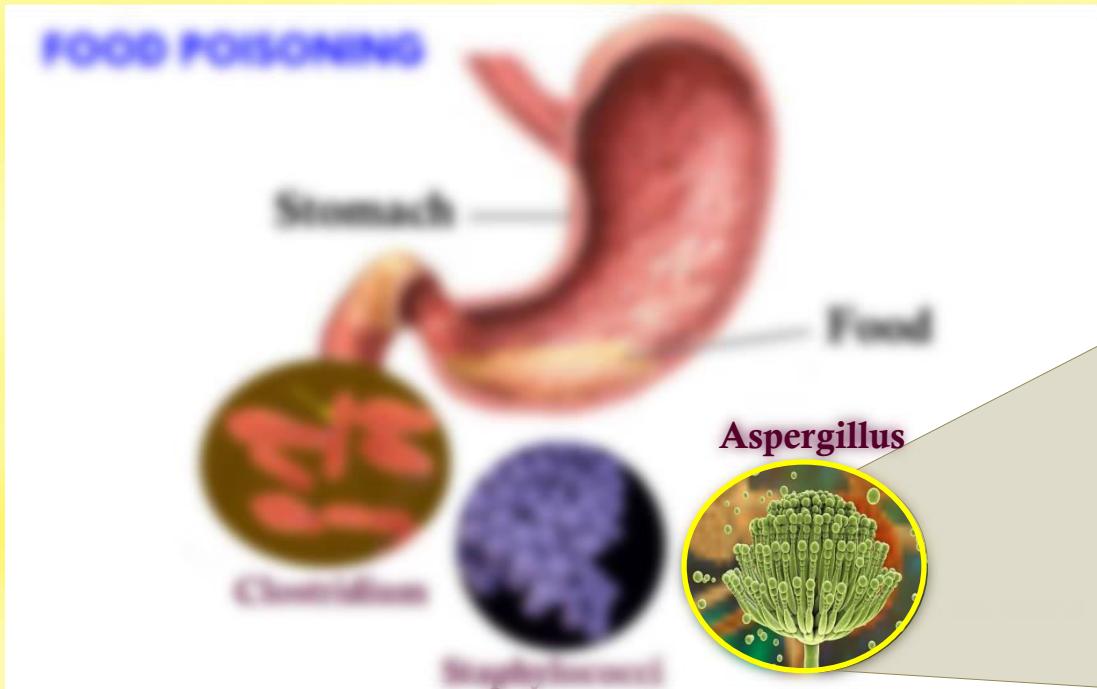
# FOOD POISONING

Some bacteria like Clostridium and **Staphylococci** and Fungi like Aspergillus cause food poisoning.



# FOOD POISONING

Some bacteria like Clostridium and Staphylococci and Fungi like *Aspergillus* cause food poisoning.



# FOOD POISONING

Food must be **Properly Prepared** and properly stored to prevent food poisoning.



# FOOD POISONING

Food must be Properly Prepared and **Properly Stored** to prevent food poisoning.



# FOOD POISONING

Food poisoning can occur when food is left **Unrefrigerated For Long Periods Of Time.**

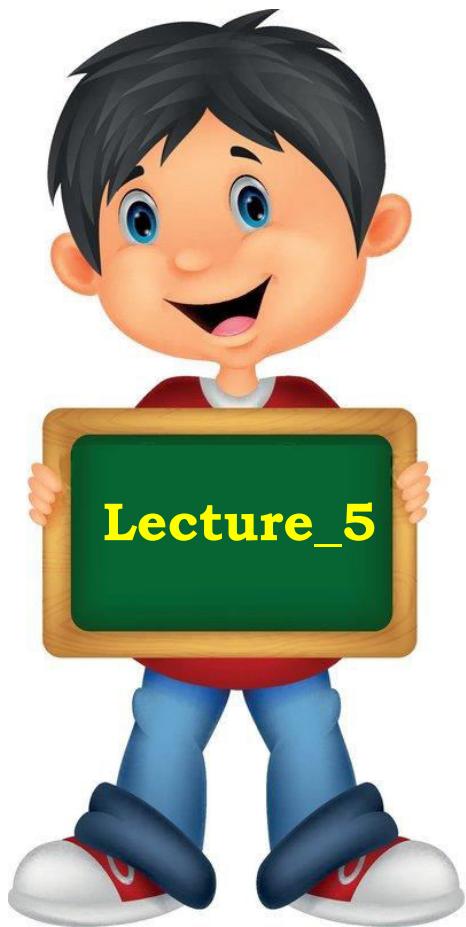


# FOOD POISONING

**Food poisoning can occur when food is left Unrefrigerated For Long Periods Of Time.**  
**Sometimes, Mishandling also causes Food Poisoning.**



**To prevent Contamination Of Food.**



# Module 11



# **Microorganisms : Friend And Foe**

- Food Preservation
- Chemical Method
- Preservation By Common Salt,  
Sugar, Oil And Vinegar



**Bad Smell**

**Microorganisms Spoil Our Food.  
Spoiled food Emits Bad Smell and  
has a Bad Taste and Changed Colour.**



**Changed Colour**



**Bad Taste**



**Spoiling of food is a  
Chemical Reaction.**

# CHEMICAL METHOD

**Salts and Edible Oils are the common chemicals generally used to check the growth of microorganisms.**



To Pickles to prevent the Attack Of Microbes.



## CHEMICAL METHOD

Sodium Benzoate and Sodium Metabisulphite are common preservatives.

To Check For Spoilage, Add A Little Of These Preservatives To A Sample And Squashes To Check Their Spoilage.



# PRESERVATION BY COMMON SALT

Common salt has been used to preserve Meat and Fish for ages.



Dry Salt To Check The Growth Of Bacteria.



## PRESERVATION BY COMMON SALT

Salting is also used to preserve Amla, Raw Mangoes, Tamarind, etc.



# PRESERVATION BY SUGAR

Jams, Jellies and Squashes are preserved by sugar.



**Sugar Reduces The Moisture Content  
Which Inhibits The Growth Of Bacteria  
which spoil food.**



## PRESERVATION BY OIL AND VINEGAR

**Use of Oil And Vinegar Prevents Spoilage Of Pickles because Bacteria Cannot Live In Such An Environment.**

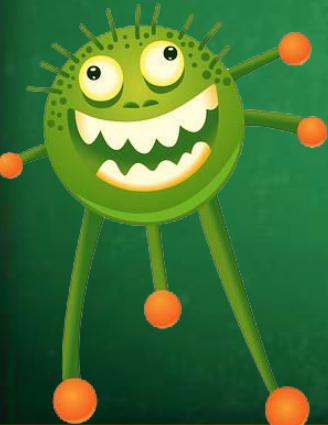


# PRESERVATION BY OIL AND VINEGAR

Vegetables, Fruits, Fish, and Meat are often preserved by this method.



# Module 12



# **Microorganisms : Friend And Foe**

- **Food Preservation**
- **Heat And Cold Treatments**
- **Storage And Packing**

## HEAT AND COLD TREATMENTS

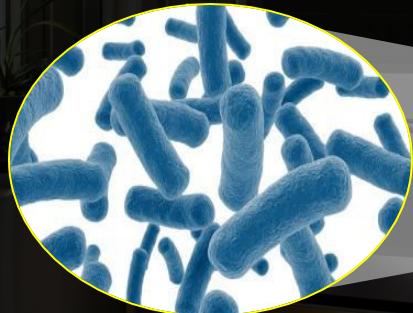
Boiling Kills Many  
Microorganisms.



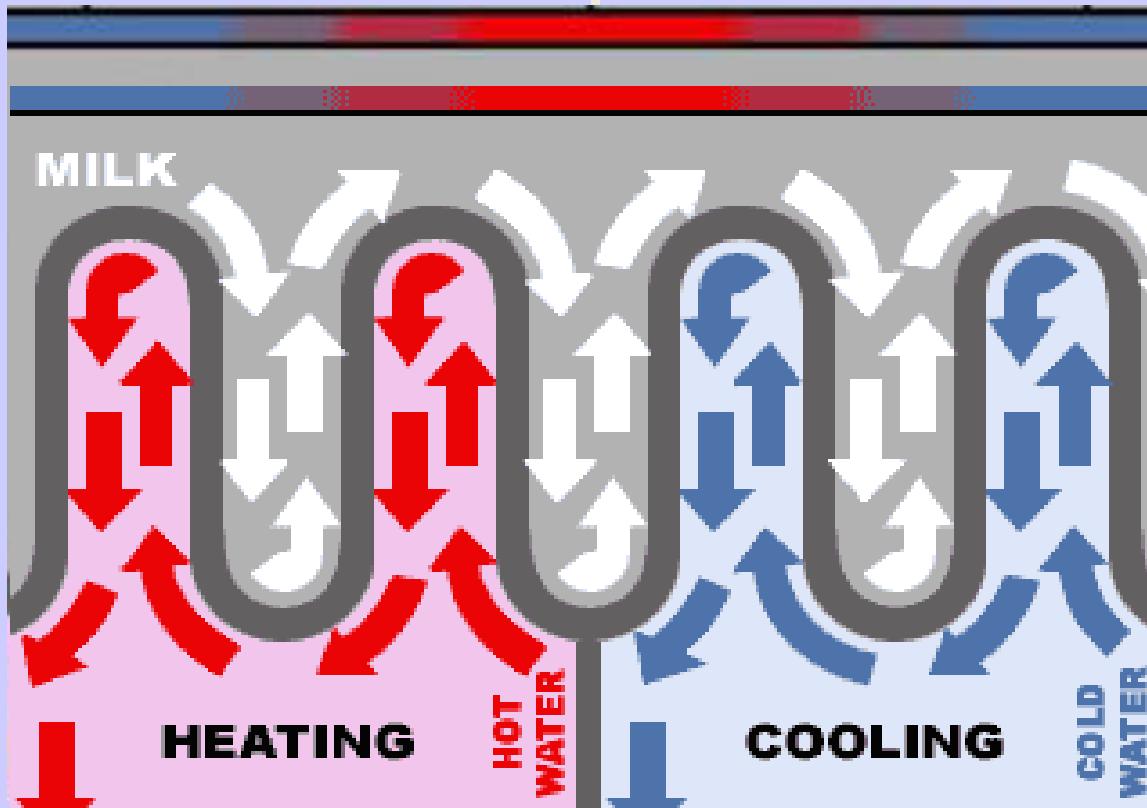
## HEAT AND COLD TREATMENTS

We keep our food in the refrigerator.

Low temperature inhibits the growth of microbes.



The milk is heated to about 70°C for 15 to 30 seconds and then suddenly chilled and stored.



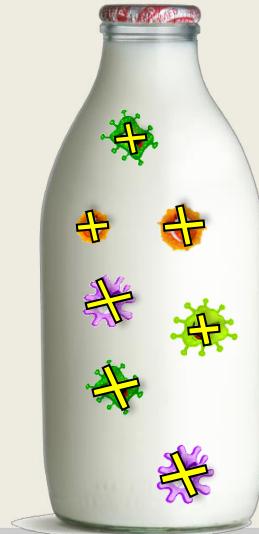
# HEAT AND COLD TREATMENTS

By doing so, it prevents the **Growth Of Microbes.**

*Unpasteurised*



*Pasteurised*



This process was discovered by Louis Pasteur.



## HEAT AND COLD TREATMENTS

**Pasteurised milk can be consumed Without Boiling As It Is Free From Harmful Microbes.**

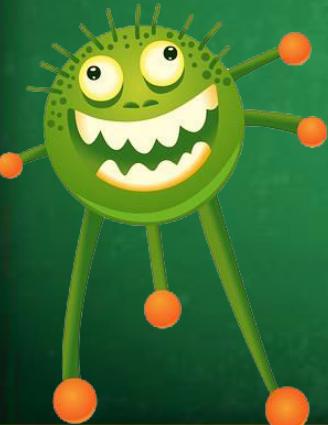


## STORAGE AND PACKING

These days Dry Fruits and Vegetables are sold in Sealed Air Packets to prevent the attack microbes.



# Module 13



# **Microorganisms : Friend And Foe**

- **Nitrogen Fixation**
- **Nitrogen Cycle**

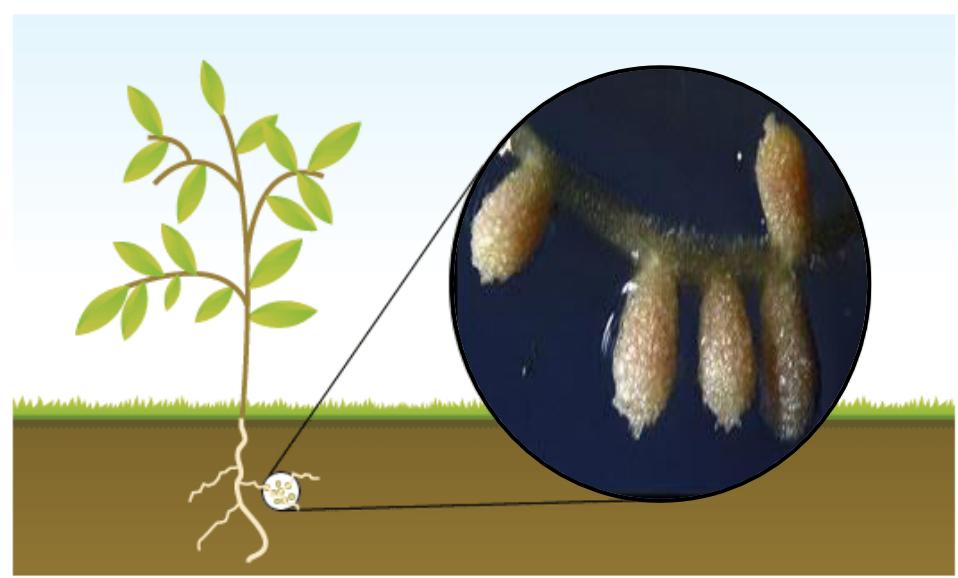
## NITROGEN FIXATION



The bacterium called '**Rhizobium**' is involved in the  
**Fixation Of Nitrogen in Leguminous Plants (Pulses)**

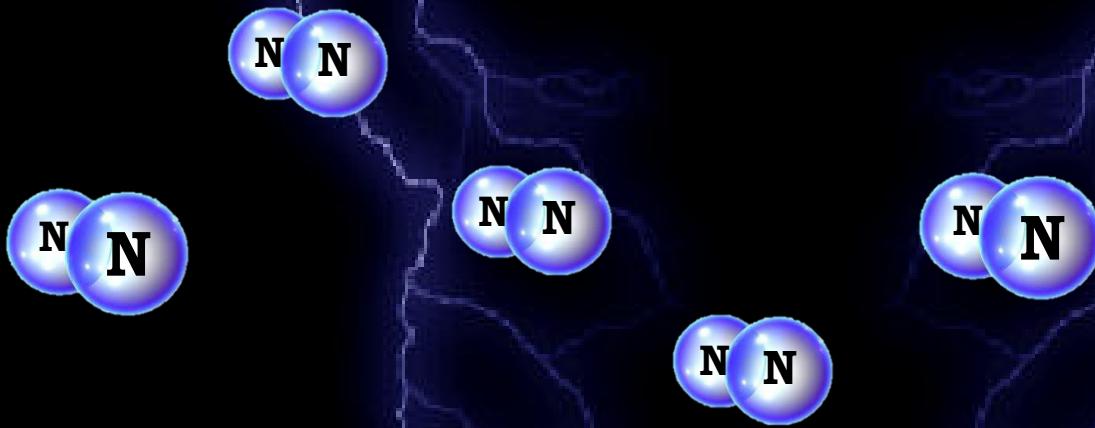
## NITROGEN FIXATION

**Rhizobium** lives in the **Root Nodules** of **Leguminous Plants**, such as **Beans and Peas**, with which it has **Symbiotic Relationship**.

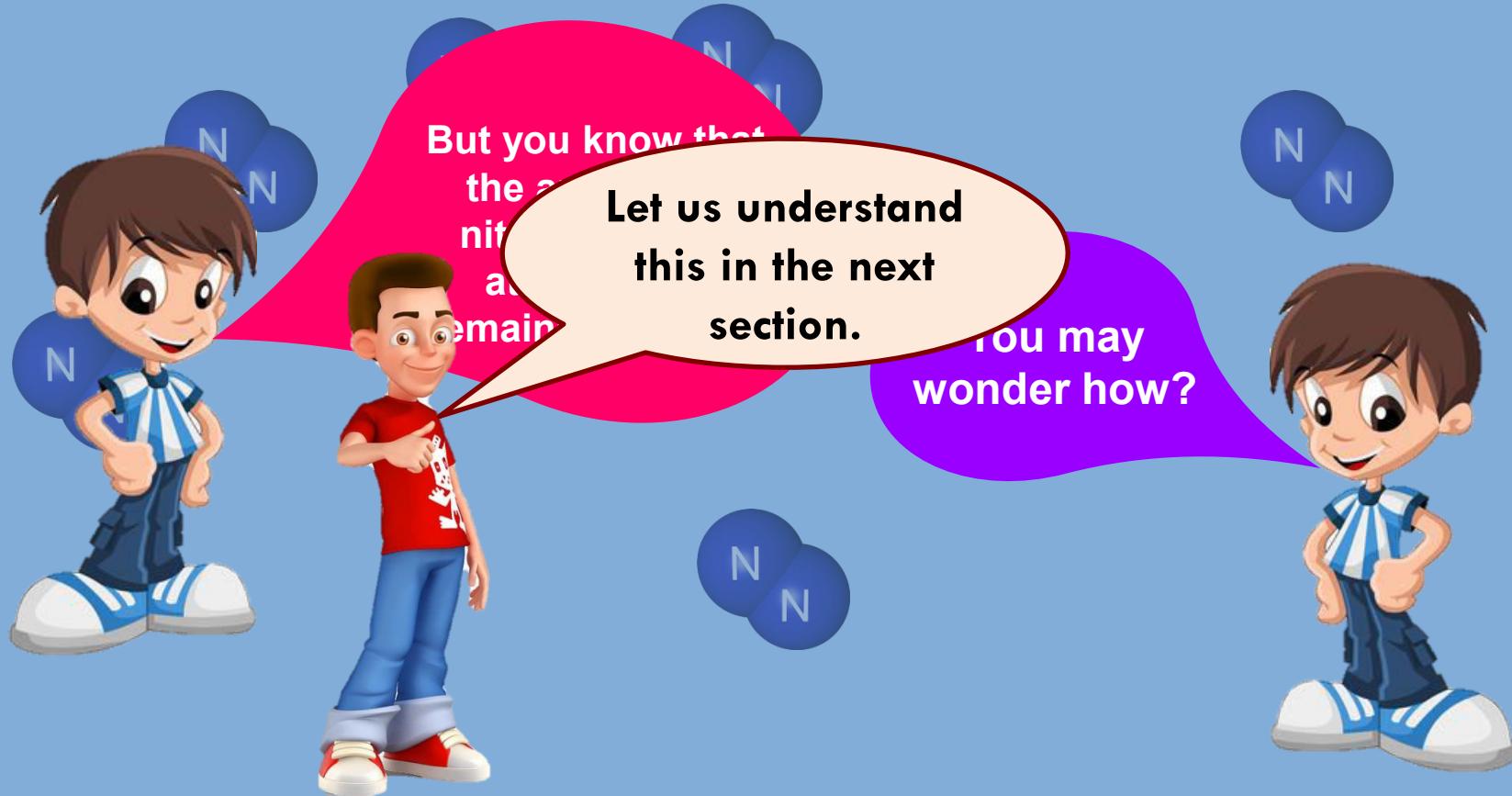


## NITROGEN FIXATION

Sometimes nitrogen gets fixed through the Action Of Lightning.



# NITROGEN FIXATION



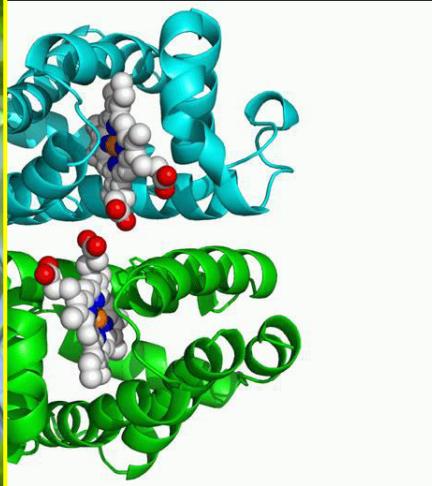
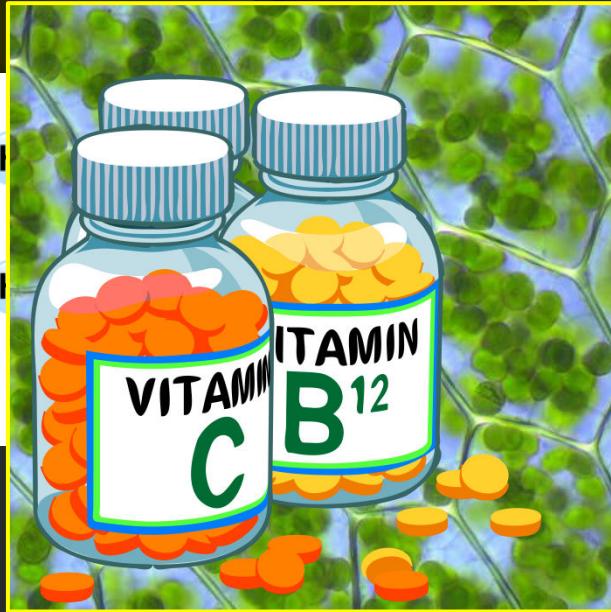
# NITROGEN CYCLE

Our atmosphere has 78% Nitrogen Gas.

Nitrogen

entails % Nitrogen of all living organisms as part

Proteins Nucleic Acids (DNA and RNA), Chlorophyll and Some Vitamins.





The Atmospheric Nitrogen Cannot Be Taken Directly by plants and animals.

N<sub>2</sub>

N<sub>2</sub>

N<sub>2</sub>

N<sub>2</sub>

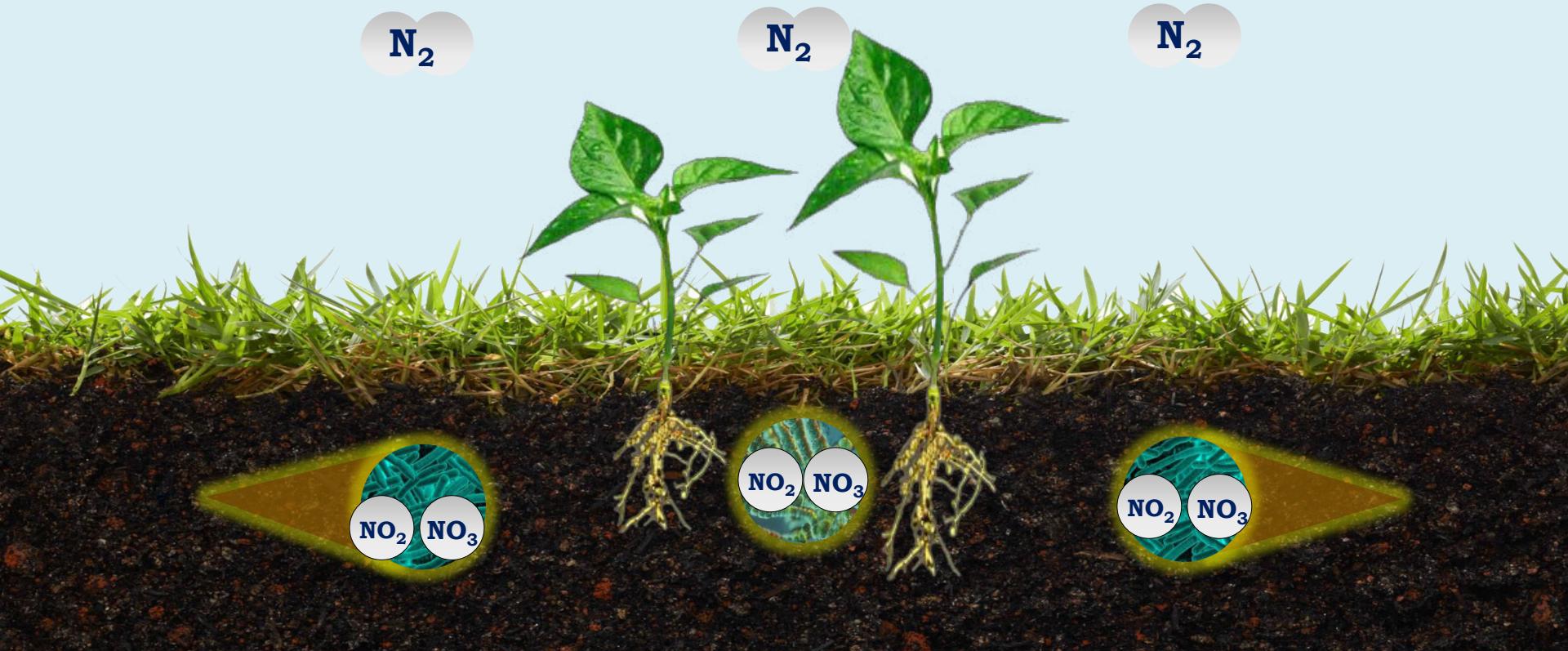
N<sub>2</sub>

N<sub>2</sub>



# NITROGEN CYCLE

Concentrated nitrogen is converted into these Usable pre compounds, so it can be Utilized By The Plants From The Soil Through Their Root System.



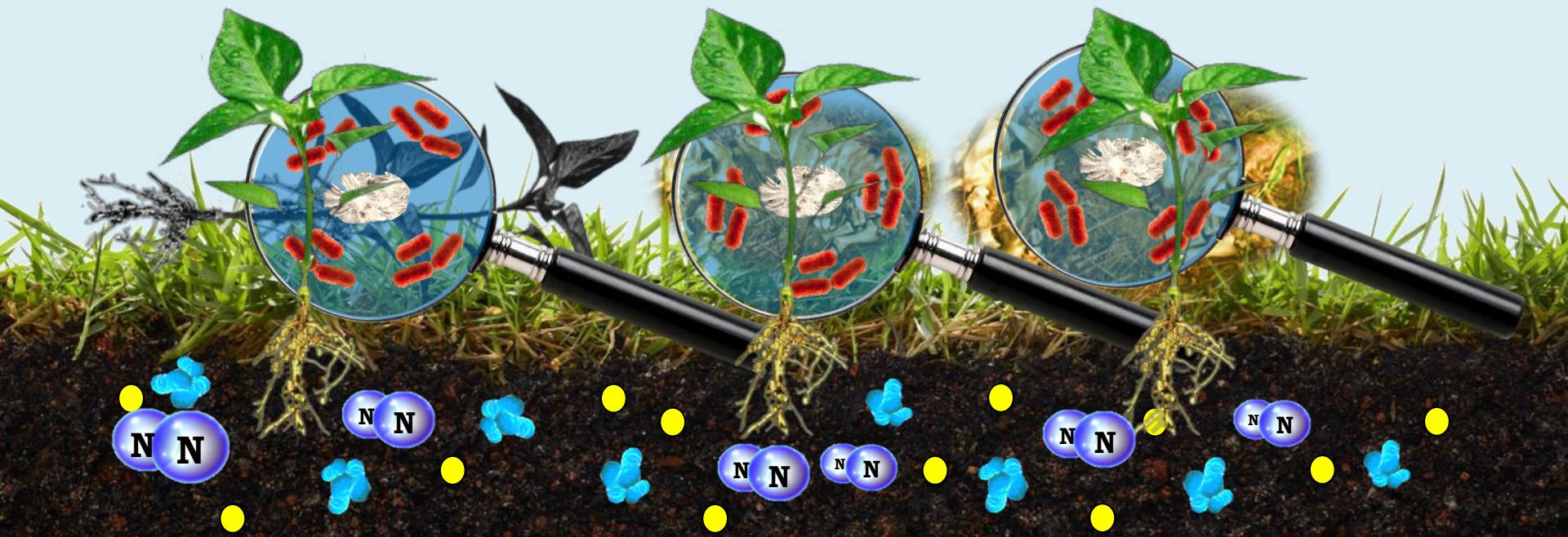
# NITROGEN CYCLE

Animals Feeding On Plants use Nitrogen used together with the synthesis of  
and other nitrogen compounds.



# NITROGEN CYCLE

When Plants Get Nitrogen From Other Places, Bacteria convert some part of them back Again Convert The Soil Nitrogen Gas Into Nitrogen Dioxide In The Atmosphere.



# Thank You