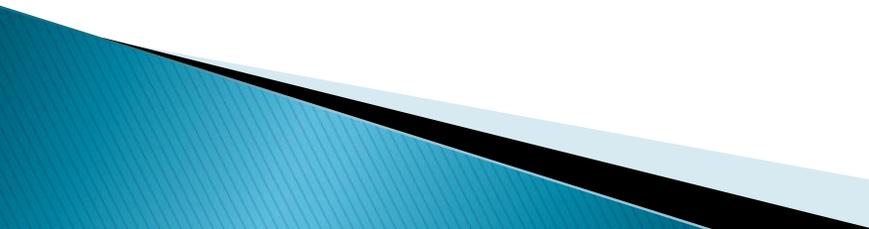


# Applications of Microbiology-Food, Industrial and Environment

## **Objectives:**

1. To know the application of microorganisms for the benefits of mankind.
2. To know the various Sources and Factors affecting spoilage of food.

# Food Microbiology

- Study of microorganisms which have both beneficial and deleterious effects on the quality and safety of foods.
  - General biology of the microorganisms that are found in foods including: their growth characteristics, identification, and pathogenesis.
  - Food poisoning, Food spoilage, and Food legislation. Pathogens in product, or harmful microorganisms.
- 

# Factors affecting Microbial Growth in Food:

Two Parameters:

**Intrinsic:** Part of the food product itself such as pH, moisture content (water activity), Oxidation-reduction potential, nutrient content, antimicrobial constituents and biological structures of food.

**Extrinsic.** Properties of the environment (processing and storage) that exist outside of the food product and, may affect both the foods and their microorganism eg: storage temperature of food, relative humidity, presence/concentration of gases and presence/activities of other microorganisms.

# Sources of Microorganisms in Food

- Soil
  - Water
  - Air
  - Food Handlers
  - Utensils
  - Vegetables (plant) and vegetable products
  - Globalization of food supply and Terrorist attacks.
- 

# Food borne Illness

A disease or illness caused by the consumption of contaminated foods or beverages.

- Food borne diseases are primarily of two types:
- Food-borne infections: This is caused due to ingestion of microbes, followed by growth, tissue invasion, and/or release of toxins.
- Food Intoxications. Caused as a result of ingestion of toxins in foods in which microbes have grown. Most of these diseases are infectious, caused by a variety of bacteria, viruses, and parasites.
- Food Toxiinfection: Caused by harmful toxins or chemicals that have contaminated the food, for example, poisonous mushrooms or heavy metal contamination.

# Food Spoilage

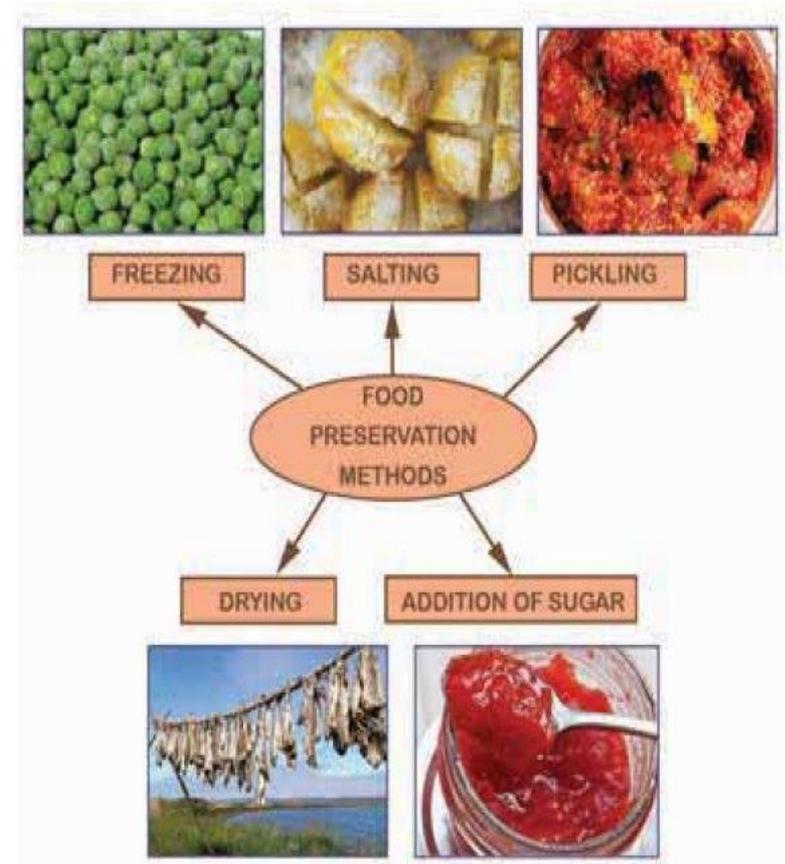
- Changes in texture, appearance and organoleptic qualities of the food, making it unsuitable for human consumption.
- Spoilage is often the result of a succession. One organism creates an environment conducive to the growth of another.

## Common microbial food spoilage is:

- Putrefaction- Protein + Proteolytic microorganism's — amino acids + amines + ammonia +H<sub>2</sub>S.
- Fermentation- Carbohydrates + Fermenting microorganism's —acids + alcohols +gases
- Rancidity- Fatty foods + Lipolytic microorganism's — Fatty acids +Glycerol

# Food Preservation

- Process of treating and handling food to stop or greatly slow down spoilage (loss of quality, edibility or nutritive value) caused or accelerated by microorganisms.
- Preservation usually prevents the growth of bacteria, fungi, and other microorganisms, as well as retarding the oxidation of fats which cause rancidity.
- Processes to inhibit natural ageing and discoloration that can occur during food preparation such as the enzymatic browning reaction in apples after they are cut.



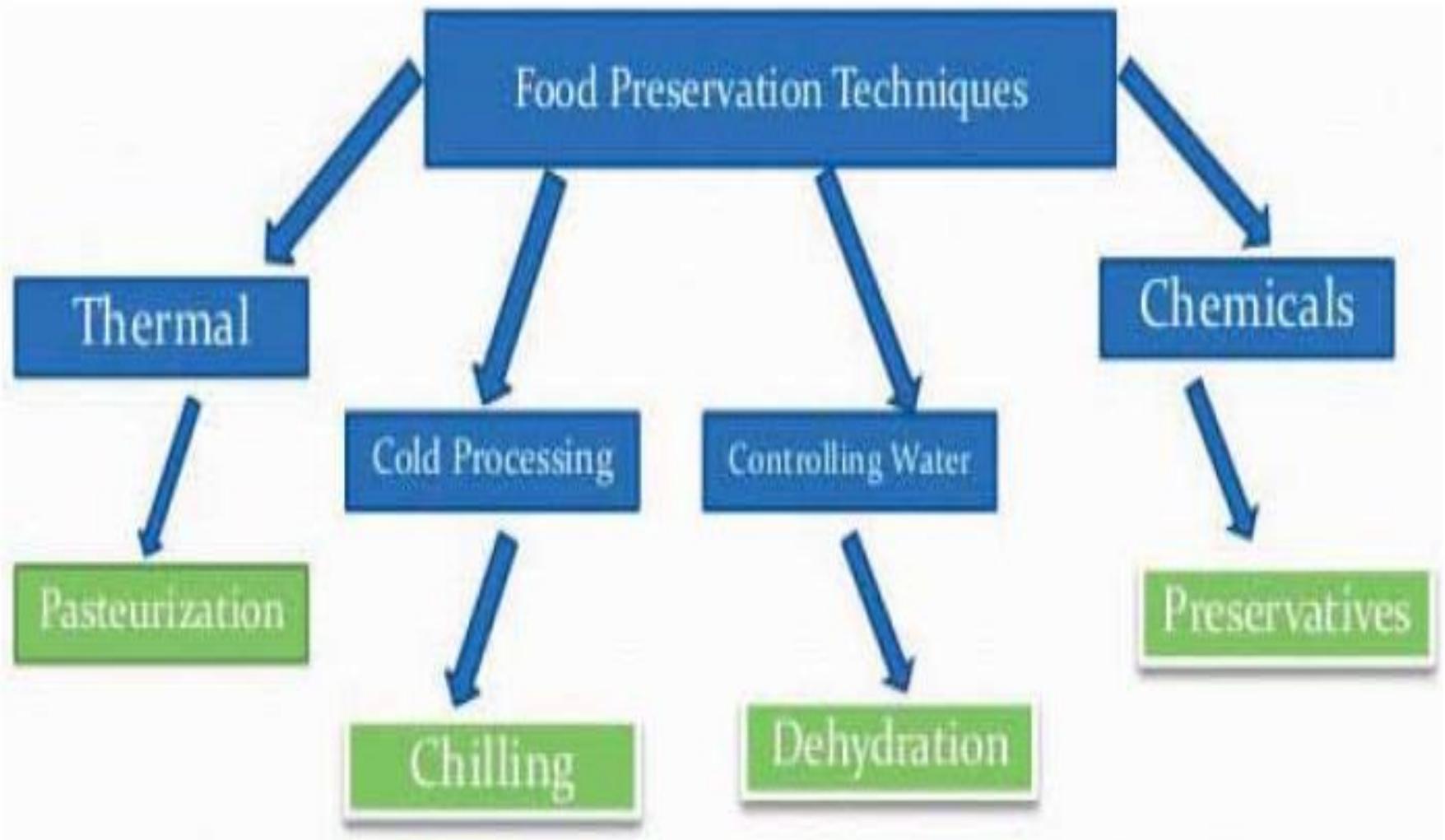
▲ Fig. 2 Methods of food preservation

# Fermented Foods

- Most common method of food preservation is fermentation process. These are the foods that have been subjected to the action of micro-organisms or enzymes, in order to bring about a desirable change.
- Microbial fermentation can increase nutritional quality and digestibility of food while producing desirable textures and flavors(organoleptic properties).
- Fermentation, like spoilage, is dependent on microbial succession. The physical and chemical nature of the food determines fermentation organisms and inhibits unwanted microbes.
- Microbes involved are lactobacilli (lactic acid bacteria), acetic acid bacteria, yeasts and occasionally mycelial fungi.
- Early procedures used ‘backslop’ method. Today “starter cultures (collection of well identified and characterized microorganisms which initiate fermentation) are extensively used in the dairy industry.

## **Some examples of fermented foods are as follows:**

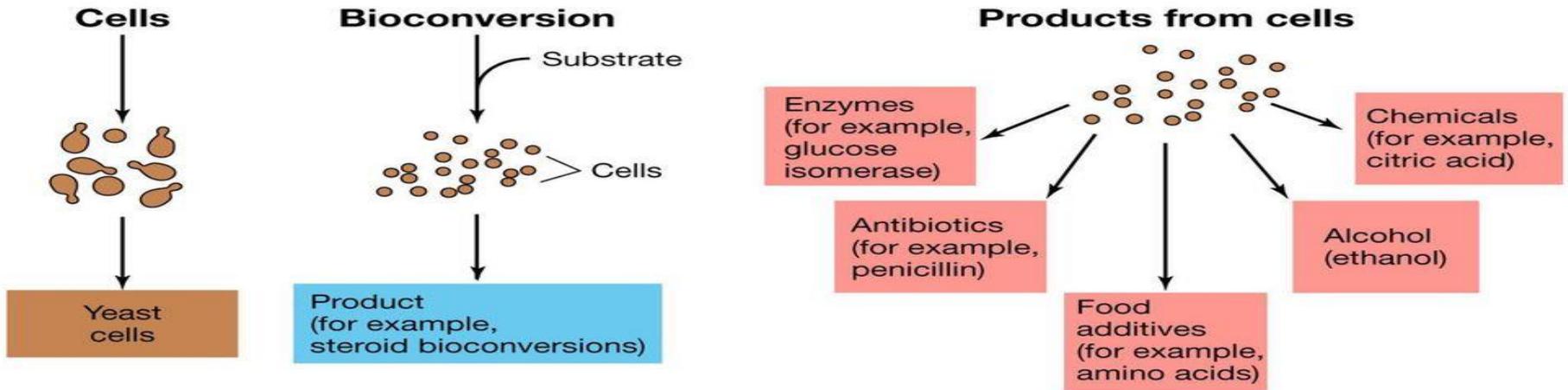
- Dairy Products- Buttermilk, Sour cream, Yoghurt, Cheese
- Meat Products: Sausages, Cured ham, Salami
- Vegetables and Cereal Fermentation Products.  
Wine, Bread, Sourdough, Tofu, Pickles, Silages



▲ Fig. 3 Techniques of food preservation

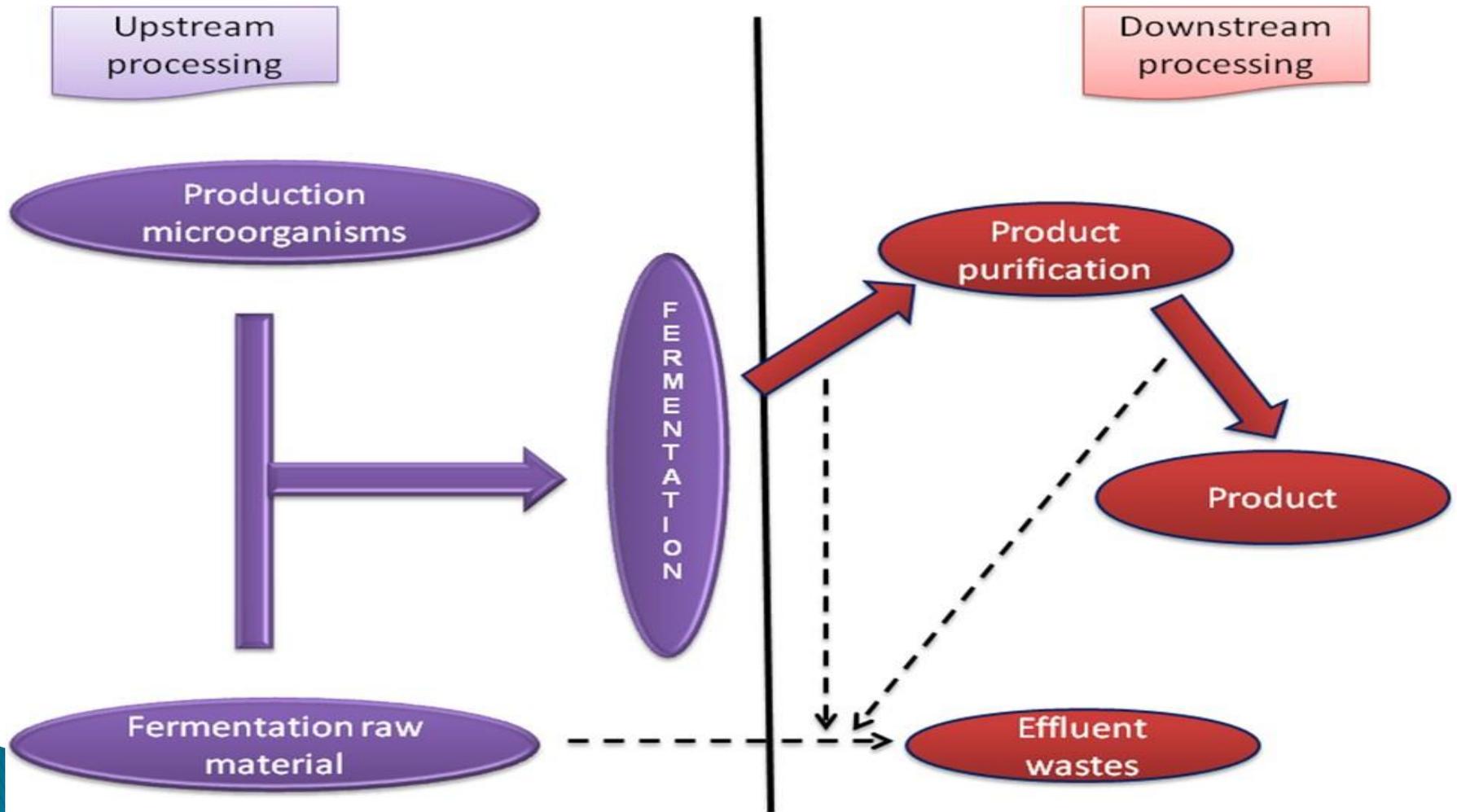
# Industrial Microbiology

Use of microorganisms, usually grown on a large scale, to obtain valuable commercial products by way of significant chemical transformations is called industrial microbiology.



## Products of industrial microbiology

# Fermentation in Industry:



# Environmental Microbiology

Environmental microbiology is the study of the composition and physiology of microbial communities in the environment viz soil, water, air and sediments covering the planet and can also include the animals and plants that inhabit these areas.

Environmental microbiology also includes the study of microorganisms that exist in artificial environments such as bioreactors.



# Soil Microbiology

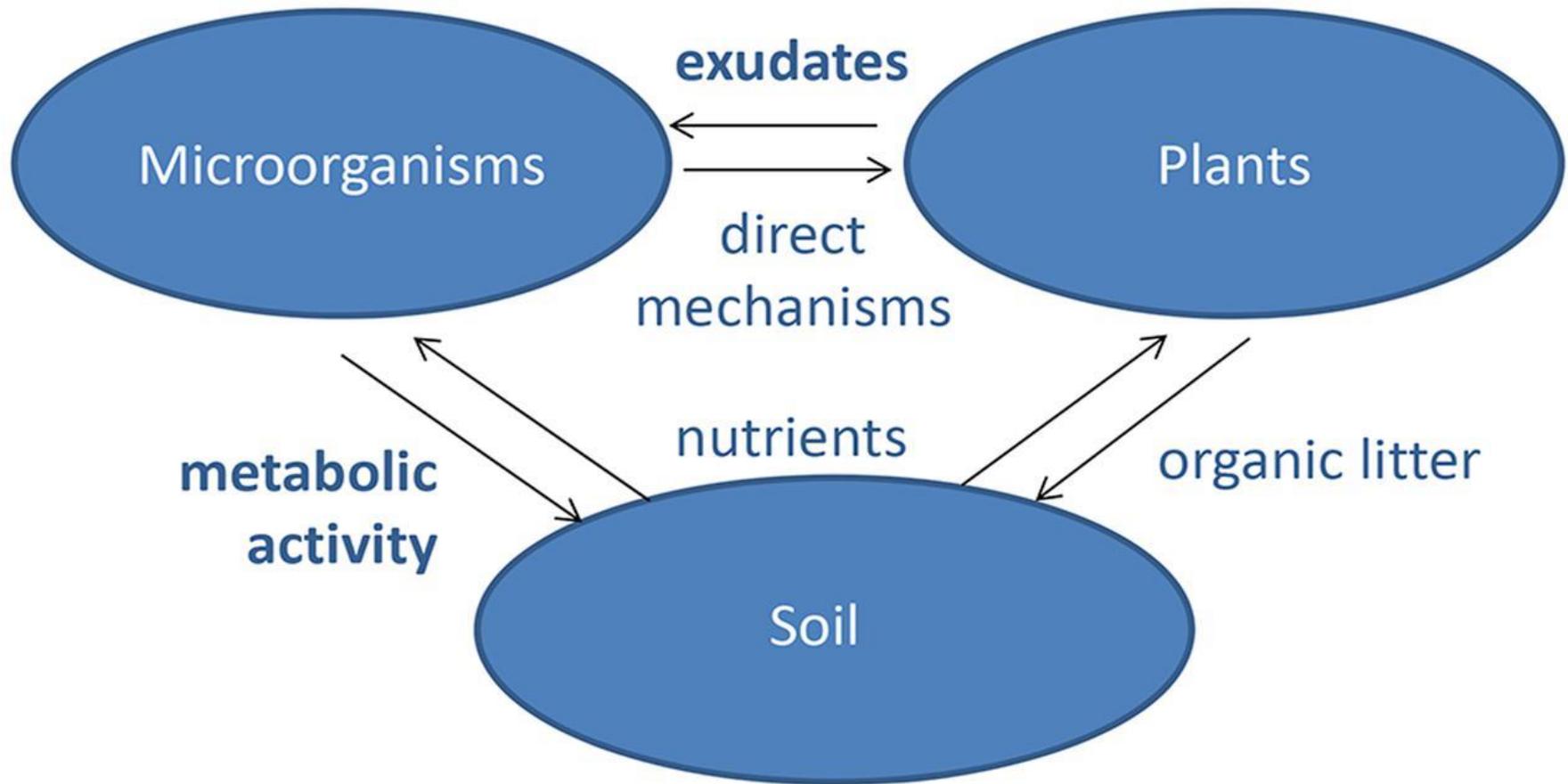
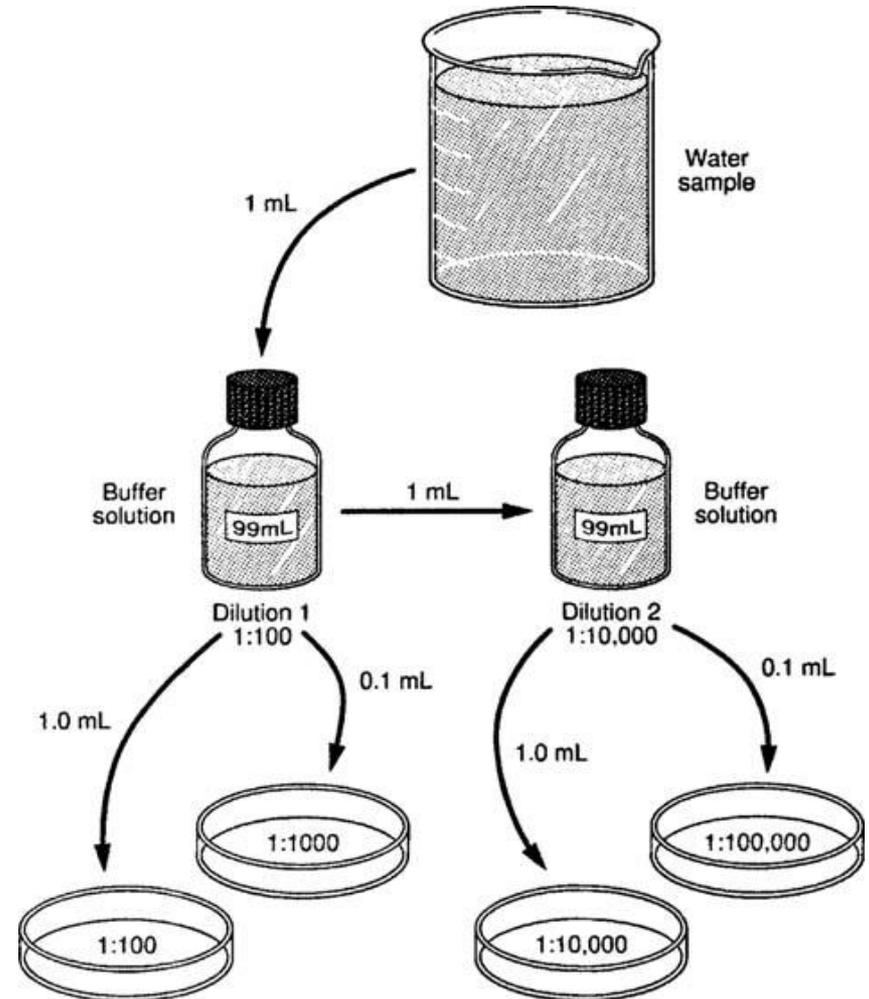


Fig: Interactions among soil microbes and plants

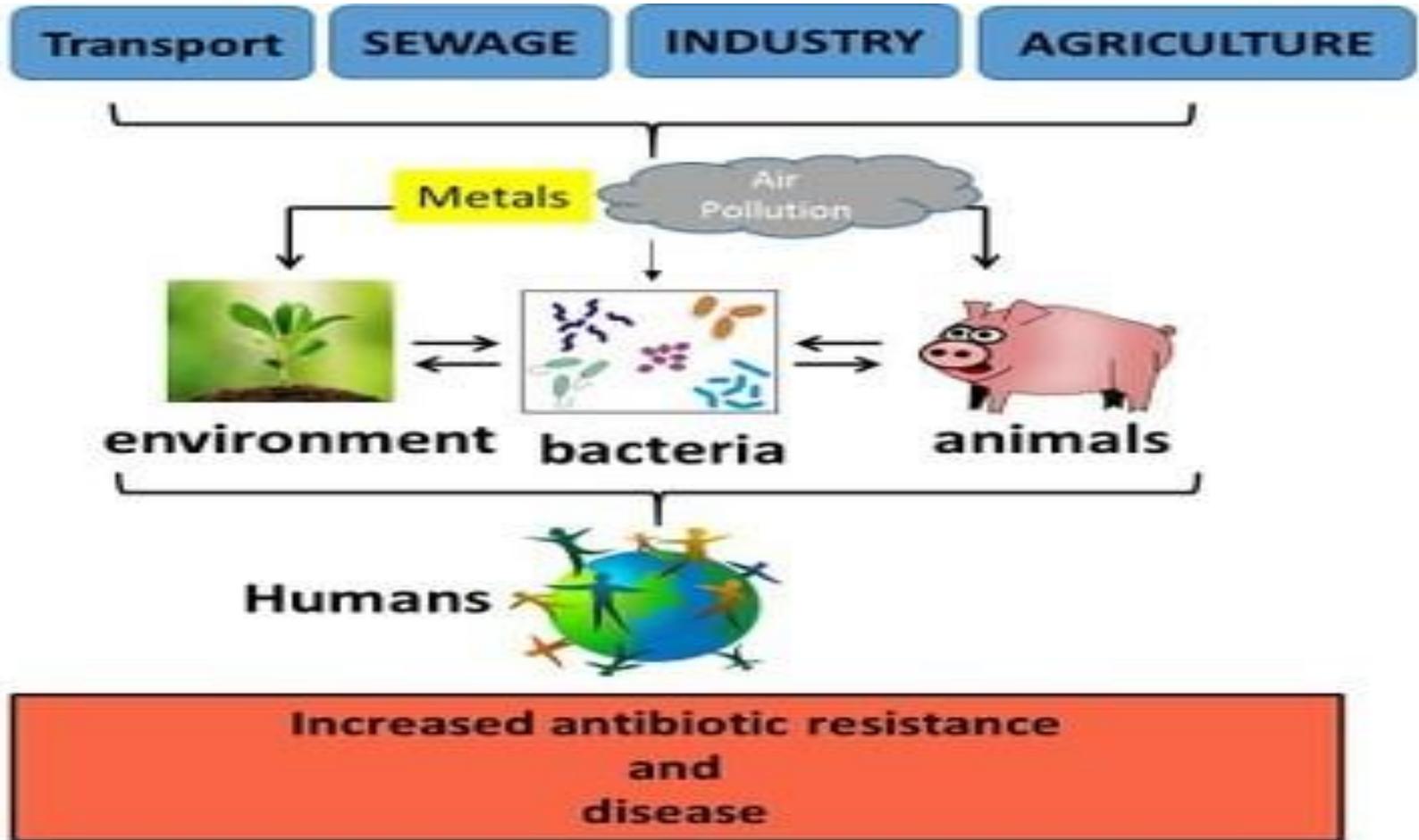
Source: Frontierseen.com

# Water Microbiology

- ▶ Study of microorganisms and their communities in water environment.
- ▶ It also includes aquatic habitat like planktons, benthos, and biofilms etc in lakes rivers, sea, groundwater etc



# Air Microbiology



Pollution of environment leads to more resistant, infectious bacteria that can transfer between the environment, animals and humans

Thanks