UNIT 4
MICRO-ORGANISM AND DISEASE

1.4. MICRO-ORGANISM

- Micro- organisms are organisms too small to be seen with the naked eye can be seen with the aid of microscope
- **Useful aspect of micro-organism**
  - Decay and recycling of nutrients
  - Used in the making of food, Such as injera, ergo and ayib
  - Produce alcoholic drinks such as beer, wine and tej
  - Important in the new technology called genetic engineering
- **Harmful aspect of micro-organism**
  - Cause disease in plant ,animals and humans
  - Food poisoning bacteria cause spoilage of food. E.g. bacteria and yeast

BACTERIA

- Are members the monera
- Are single - celled and prokaryotic organisms
- Are less complex than eukaryotic cells.
- They lack organelles such as chloroplasts and mitochondria
- Are much smaller than the smallest animal and plant cells
- Reproduction occurs through binary fission
- Bacterial cell have many **similarities to animal and plant cell**. They are made up of **cell wall, cell membrane, cytoplasm** and **genetic material**
- **Some bacteria** have **flagella**(for movement)and **capsule**(for protection)
- Bacteria are classified based on shape into **rod shaped(bacilli), round(cocci), comma(vibro) and spiral**
- Bacteria can also be classified into **gram positive** and **gram negative** based on **gram stain**
- **Gram stain** is a differential stain used to classify bacteria into two
- Different bacteria have different **cell walls** which take up the stain differently

☞ **Stages of gram stain**

1) **Cristal violet/**purple color/; primary stain
2) Iodine solution; as a mordant /to form iodine-- violet complex/
3) Decolorized by **ethanol**
4) **Safranin** /red color/; counter stain or secondary stain

- **Gram positive**
  - Keep the color of primary stain /crystal violet/ not decolorized
  - Retain crystal violet dye and stain blue or purple on Gram's staining
  - Stain **purple**
  - have cell walls composed of thick layers of peptidoglycan
- **Gram negative**
  - Primary stain decolorized by ethanol
  - Accept safranin after decolonization and stain pink or red on Gram's staining.
  - Take the color of secondary stain safranin
  - have cell walls with a thin layer of peptidoglycan.
  - **Stain red/ pink/**

VIRUSES

- Smaller than bacteria
- Usually have regular geometric shape.
- Neither prokaryotic nor eukaryotic cell.
- Viruses are a particle, made up of a **protein coat** and **genetic material**
- The genetic material is either **DNA or RNA**
- They are **obligate parasite**
- Viruses are considered to be living and non-living things.
- **Do not carry out any of the function** of normal living organism **except reproduction**
- Viruses only **reproduce inside living cell**
- Viruses cause some common human disease such as AIDS, Influenza, rabbis

FUNGI

1. **Yeast**
   - Is a single called fungi
   - At anaerobic condition yeast carry out alcoholic fermentation
   - They also used in the process making food such as bread
   - Yeast have heterotrophic mode of nutrition & reproduce **asexually** by **budding**



Fig. food products produced by yeast

2. Moulds

- Made up of filament called hyphae
- A mass of hyphae together forms mycelium
- Reproduce **asexually** by **spore formation**



Fig. mold

Germ theory diseases

- states that germ are the cause of disease
- **The theory of spontaneous generation** states that living things arise from non living things
- **Louis Pasteur** disproves the theory of spontaneous generation.
- **Louis Pasteur** indicates that, infectious disease caused by pathogenic micro-organism. He also introduces **pasteurization** technique.
- **Robert Koch** discovered the first disease causing micro-organism called **bacillus anthracites** which cause **anthrax**

Controlling micro-organism

The major methods of controlling microorganisms include;

- Sterilization
- Pasteurization
- Chemical approach

1) Sterilization

- is the process of complete removal of micro-organism
- some of the methods that are used as sterilization;

A. autoclave sterilization

- Used to sterilize;
  - Equipment's which are not damage by heat
  - **Bacterial spores** which do not die at low temperature
- Killing micro-organisms by boiling them in water at **120^{0}C** under high pressure for **15-45 minutes**.

B. Ultra high temperature (UHT)

- It is a way of **treating food** to kill all the micro-organism found in it.
- It is a techniques of heating the food at a temperature of **135^{0}c to150^{0}cfor 2-6** second
- Used in food processing industries to prevent contamination of food

C. Dry heat sterilization

- Used to sterilize scientific equipment's
- Requires higher temperature high temperature and longer period of time
- Use the temperature of **170^{0}C** for one hour and**160^{0}C** for two hour

2) Pasteurization

- Involves **boiling** or **heating** of milk, bear, other food staff
- It include heating followed by **rapid cooling**
- The temperature used
  - **62.9^{0}C for 30 seconds**
  - **71.6^{0}C for at least 15 seconds**

3) Chemical approach

I. Disinfectants

- **Chemicals that** are used to kill micro-organisms on **inanimate object**
- Disinfectants have the following characteristics
  - Fast acting
  - Effective against all type of micro-organism
  - Disinfect material without damaging or discoloring it
- Dilute bleach and calcium hypochlorite used as disinfectant on drinking water

II. Antiseptics

- **Chemicals (**Disinfectants) that can be applied to a **living tissue** such as skin
- Help to protect the entrance of germs if the skin is cut or damage

III. Antibiotics

- Are chemicals which kill bacteria without damaging human cells.
- Only damage bacteria and do not affect human cells.
- Have no effect on diseases caused by viruses
- **Penicillin** is the first antibiotic produce by Alexandor Flemming

☞ Fungal infection can be often cured by using anti- fungal chemicals.

Culturing (Growing) Microbes

- **Importance of growing micro-organism**
  - To know how to kill them
  - To develop vaccine
  - To identify useful and harmful aspect
- **Precondition** for growing micro-organism;
  - **Isolating** the type of micro-organism to be studied
  - Developing suitable **nutrients medium**
  - Suitable **environmental condition**
- **Nutrient medium**; nutrients required for the growth of micro-organisms
  - It can be solid or liquid
  - **Agar**
    - ✓ As **solid nutrient** medium which is extracted from red algae
    - ✓ Micro-organism are cultured in a **petridish**
  - **Broth**
    - ✓ A liquid nutrient medium
    - ✓ Micro-organism are cultured in **test tube**
- **Culture media;** is a collection of nutrients and microbial cells grow on medium
- **Inoculation;** a technique of transferring microbes into a nutrient medium
  - **Inoculating loop / needle**/; an instrument that is used to transfer micro-organism
  - Culture microbes should transfer in a **zigzag streaks** because to avoid competition

Immune system

- **Immune system** the system in the body which protects against disease causing micro-organisms and foreign proteins (antigen)
- **Immunity** the ability of the body to resist disease

Type of immunity

i. **Innate immunity**
- Natural ability of the body to fight disease producing micro-organism
- Immunity present at the time of birth against certain diseases
- Nonspecific antibodies against disease germs
- Inborn and is due to the presence of naturally occurring antibodies since birth
- It obtain without the stimulation any foreign bodies

ii. **Acquired immunity**
- Immunity developing during the life time of individual after birth
- Acquired immunity either active or passive

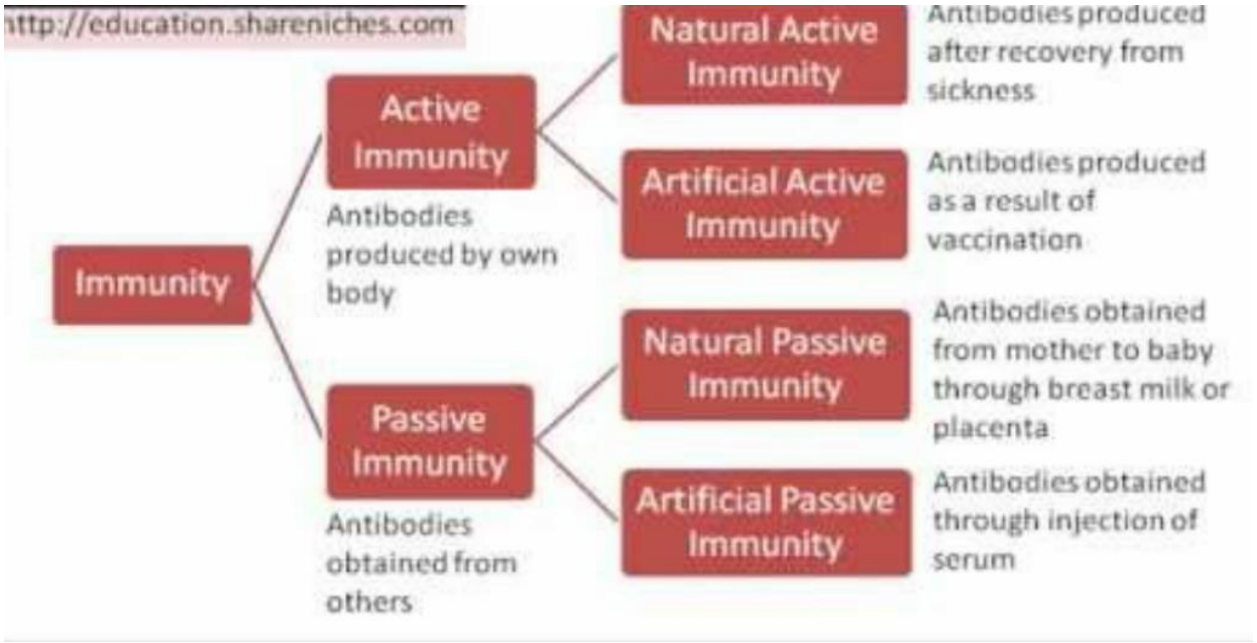
☞ **Active immunity**

1. **Natural active immunity**
   - Immunity resulting from having had a disease previously
   - The infection stimulates the body to form its own specific antibodies against germs
2. **Artificial active immunity**
   - Immunity acquire artificially by receiving **vaccine**

- **Vaccination /Immunization/**the use of dead or weakened pathogens to produce immunity to dangerous disease
  - **Vaccine** stimulated the body to form its own antibodies without having a disease
  - A child receive vaccines for **polio, tetanus, tuberculosis, hepatitis, measles, mumps, diphetria**

☞ **Passive immunity**

1) **Natural passive immunity**
   - Immunity passed **from mother to child**
   - Antibodies from the mother pass into fetus across placenta
   - Many antibodies are passed to the baby through breast milk
2) **Artificial passive immunity**
   - Introducing artificially **antibodies** into the body give immediate immunity



Difference between innate and acquired or adaptive immunity

No	Characteristics	Innate Immunity	Adaptive immunity
1.	Presence	Innate immunity is something already present in the body.	Adaptive immunity is created in response to exposure to a foreign substance.
2.	Specificity	Non-Specific	Specific
3.	Response	Fights any foreign invader	Fight only specific infection
4.	Response	Rapid	Slow (1-2 weeks)
5.	Presence	Present at birth	Develops during a person's lifetime and can be short-lived.