

Introduction to microbiology and common micro-organism

MICROBIOLOGY-

The study of unicellular or cell-cluster microorganisms is termed as microbiology.

The term microbiology was introduced by Louis Pasteur (French chemist) who demonstrated that fermentation was caused by the growth of yeasts.

The word Microbiology was derived from Greek word.

Mikros-Small

Bios-Life

Logia-Study

Microbiology is the specific area, concerned with the study of microbes that are too small and can not be seen without magnification

Branch of Microbiology-

Microbiology is the Largest most complex branch of biological science it deals with many diverse biological disciplines.

Branch Name	Study
Bacteriology	To study of bacteria.
Mycology	To the study of fungi microscopic eukaryotic form.
Virology	To study of virus

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Protozoology	To study of Protozoans
Microbial Ecology	To the study of interrelationships between microbes environments
Epidemiology Public Health	To study of control and spread of diseases in communities

Scope of Microbiology-

Production of Antibiotics-

- Micro-organism are directly used in pharmaceutical industry for the production of antibiotics by isolating antibiotic producing micro-organism from nature.

Diagnosis of disease and treatment-

- Eg :- Widal test, Elisa test etc.

Sterilization-

- This process involves killing of microbes by different means to make the pharmaceutical product free from microorganism.

Testing of Pharmaceuticals –

- Endotoxin testing
- Microbiological assays of antibiotics
- Antimicrobial preservation efficacy testing

Plant growth promotion-

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Rhizobium, *Azotobacter*, *Pseudomonas* as species of microbes are present in soil to participate in soil fertility, herbicidal resistance, insect resistance enhancement of quality of plant products.

Common micro-organism Of Microbiology

Microbiology includes a larger and diverse group of microscopic organisms that exist as a single cell of bacteria, archaea, fungi algae, protozoa and helminths the viruses.

1. Moulds:

- *Mucor*, *Rhizopus*, *Botrytis*, *Aspergillus*, *Penicillium* etc is moulds deteriorate the food.
- The manufacturing of certain food and other related Substance some specific species of mould are used mould ripened cheese, production of oriental foods (Soy, Sauce, miso, etc.)

2. Yeast:

- They are mostly non-filamentous & reproduce by fission or budding.
- They maybe both harmful as well useful for food in food industry.
- **Example:-** Yeast is used in food industry are *Saccharomyces*, *Schizosaccharomyces*, *Candida*, *Kluyveromyces* etc.

3. Bacteria:

Bacteria can also be harmful & beneficial for food and food industry.

Example :-

- a. **Bacillus Coagulan:-** A proteolytic species used for curdling of milk.
- b. **Bacillus Purimilus:-** Recommended test organism in sterility testing.
- c. **Microbacterium lacticum:-** Used in production of Vitamines.

4. Amylases:-

These are used in the preparation of starch hydrolysates used in various product formations.

Example:- Beer, Vinegar etc.

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Epidemiology

Introduction:

It is the branch of medical sciences that investigates all the factors that determine the presence or absence of diseases and disorders.

Epidemiology literally meaning the study of what is upon the people is derived from greek word.

Epi- upon, among

demos - people, district

logos - study

Application of Epidemiology:

- To evaluate health services
- To diagnose the health of the community.
- To identify the syndrome.
- To search for cause of disease.
- Planning and Evaluation
- Elucidate mechanism of disease transmission
- To find causation of the disease.
- Determine the mode of transmission.

Epidemic:

- It is define as the large number of people or animals suffering from the same disease at the same time.

Pendemic:-

- It Is define as the growth rate skyrockets and each day grow more than the day prior.

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- The virus has nothing to do with virology, population immunity or disease severity.
- It means a virus covers a wide area, affecting several countries and populations.

Endemic:-

- A disease outbreak is endemic when it is consistently present but limited a particular region.
- The disease spread and rates predictable

Eg: malaria

Modes of transmission

An infectious agent may be transmitted from its natural reservoir to a susceptible host in different ways. There are different classifications for modes of transmission. Here is one classification:

Direct

Direct contact

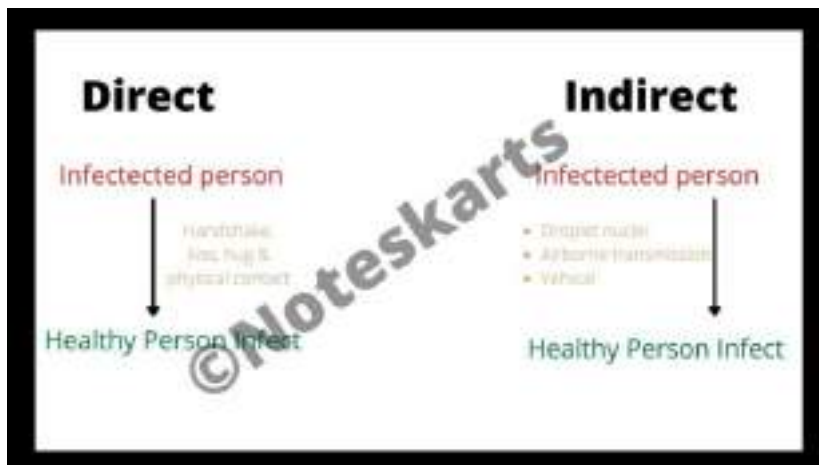
- Droplet spread

Indirect

- Airborne
- Vehicleborne
- Vectorborne (mechanical or biologic)

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Isolation separates sick people with a contagious disease from people who are not sick.

Quarantine separates and restricts the movement of people who were exposed to a contagious disease to see if they become sick.

Incubation period:

The time elapsed between exposure to a pathogen's organism, a chemical, or radiation and when symptoms and signs are first apparent.

The period of time between harmful bacteria or viruses entering a person's and animal body or entering a plant and the effects of a disease.

Contact tracing

- People in close contact with someone who is infected with a virus, such as the Ebola virus, are at higher risk of becoming infected themselves, and of potentially further infecting others.
- Closely watching these contacts after exposure to an infected person will help the contacts to get care and treatment, and will prevent further transmission of the virus. This monitoring process is called contact tracing.

Respiratory infections

Rubella

Causative agent: It is the causative agent of the disease known as general measles.

Symptoms / Clinical Presentation:-

- Headache
- Stuffy or runny nose
- Inflamed, red eye

Epidemiology:-

Every 6 to 9 year and pandemic every 10 to 30 year.

The last worldwide pandemic occurred from 1962 to 1964.

Mumps:-

Causative agent:

It is a viral illness caused by a paramyxovirus.

Clinical presentation:

- Fever, Headache, Muscle aches, tiredness, loss of appetite.
- Symptoms typically appear 16 to 18 days after infection.

Epidemiology:

There are between 100 and 1000 cases per 100000 people each year.

Avian influenza/ Bird flu

Causative agent: It caused by a type of influenza virus.

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Symptoms/ Clinical Presentation:

- Cough, fever, sore throat, muscle aches, shortness of breath.

Epidemiology:

The avian virus has spread from Asia to Europe and Africa and has become endemic in popularity populations in same countries.

H1N1 flu (Swine flu)

Causative agent: They caused by the flu influenza virus.

Symptoms:

- Fever, Chills, cough, sore throat, watery, red eyes, fatigue, diarrhoea, nausea and vomiting.
- Flu symptoms develop about one to three days after you're exposed to the virus.

Epidemiology:

In US the number of clinical illnesses was estimated at 59 million. 265000 hospitalizations and 12000 deaths.

SARS: (Severe Acute Respiratory Syndrome)

Causative agent: SARS are caused by COVID 19.

Symptoms:

Aches, chills, diarrhoea, dry cough, low oxygen levels

Epidemiology:

- SARS originated in southern china in November 2020 and was brought to Hong Kong in February 2003.

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- The disease spread rapidly world wide but mostly to asian countries.
- The epidemic in june the global cumulative total was 8422 cases with 916 deaths case fatality rate of 11% all age of people affected.

MERS: (Middle East Respiratory Syndrome)

They ***caused coronavirus***. First identified in Saudi Arabia in 2012.

These viruses are zoonotic. Zoonotic means the commonly infect animals are can transfer to humans.

Symptoms:

Symptoms are same as SARS & COVID 19.

Epidemiology:

A total of 2562 confirmed MERS cases with 150 case clusters were reported with a case fatality rate of 32.7%

Meningococcal Meningitis:

Causative agent:

It caused by a specific bacterium known as Neisseria meningitidis.

Symptoms:

- Fever and chills.
- Fatigue (feeling tired)
- Vomiting.
- Cold hands and feet.
- Severe aches or pain in the muscles, joints, chest, or abdomen (belly)
- Rapid breathing.
- Diarrhea.
- In the later stages, a dark purple rash.

Epidemiology:

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In 2019, there were about 375 total cases of meningococcal disease reported (incidence rate of 0.11 cases per 100,000 persons). Anyone can get meningococcal disease, but rates of disease are highest in children younger than 1 year old, with a second peak in adolescence.

Acute Respiratory Infections:

Causative agent: There are several different causes of acute respiratory infection.

1. Causes of upper respiratory infection:

- 1) acute pharyngitis
- 2) acute ear infection
- 3) common cold

2. Causes of lower respiratory infection:

- 1) bronchitis
- 2) pneumonia
- 3) bronchiolitis

Symptoms/ Clinical Presentation:

- Congestion, either in the nasal sinuses or lungs
- Runny nose
- Cough
- Sore throat
- Body aches
- Fatigue

Epidemiology:

Acute respiratory infections cause four and a half million deaths among children every year, the overwhelming majority occurring in developing countries.

Ebola

Causative agent:

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It is caused by an infection with a group of viruses within the genus Ebolavirus: Cuevavirus, Marburgvirus, and Ebolavirus.

Symptoms/ Clinical Presentation:

- Fever.
- Aches and pains, such as severe headache and muscle and joint pain.
- Weakness and fatigue.
- Sore throat.
- Loss of appetite.
- Gastrointestinal symptoms including abdominal pain, diarrhea, and vomiting

Epidemiology:

Ebola virus can spread to people when they have contact with an infected animal's blood, body fluids, or tissues. Ebola virus then spreads from person to person through direct contact with blood or body fluids of a person who is sick with or has died from Ebola virus disease.

Intestinal infections

Amebiasis

Causative agent

Amebiasis is a disease caused by the parasite **Entamoeba histolytica**.

Symptoms/ Clinical Presentation:

Loose feces (poop), stomach pain, and stomach cramping

Epidemiology:

Only about 10% to 20% of people who are infected become sick, and most infected people do not become seriously ill.

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Worm Infestations

Causative agent

The causes of worm infections include:

- Coming in contact with an infected surface such as soil containing eggs or germs at a playground or touching pets infected with worms
- Consuming infected food or water
- Improper hygiene
- Inadequate hand washing

Symptoms/ Clinical Presentation:

- Abdominal pain.
- Diarrhea, nausea, or vomiting.
- Gas and bloating.
- Fatigue.
- Unexplained weight loss.
- Abdominal pain or tenderness.

Epidemiology:

Overall prevalence of intestinal worm infection was found to be 49.38%. Ascaris was the most common parasite (46.88%), followed by Taenia (2.1%) and Hymenolepis nana (0.21%). Cure rate was found to be 66% for Ascaris and 100% in other cases.

Food poisoning

Causative agent

It also called foodborne illness, is illness caused by eating contaminated food.

Infectious organisms —

including bacteria, viruses and parasites or their toxins are the most common causes of food poisoning.

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Symptoms/ Clinical Presentation:

- Nausea
- Vomiting
- Watery or bloody diarrhea
- Abdominal pain and cramps
- Fever

Epidemiology:

The US Centers for Disease Control and Prevention (CDC) estimates 1 in 6 Americans (48 million people) are affected by foodborne illness annually. The estimates suggest 128,000 people are hospitalized and 3,000 die.

Arthropod-borne infections

Dengue

Causative agent

The virus responsible for causing dengue, is called **dengue virus (DENV)**. It is a viral infection transmitted to humans through the bite of infected mosquitoes.

Symptoms/ Clinical Presentation:

Clinical findings include nausea, vomiting, rash, aches and pains, a positive tourniquet test, leukopenia, and the following warning signs: abdominal pain or tenderness, persistent vomiting, clinical fluid accumulation, mucosal bleeding, lethargy, restlessness, and liver enlargement.

Epidemiology:

2010, the incidence of dengue has increased to about 15 per million people annually in different states. Every year more than 100 000 infections and 200–400 deaths occur throughout India.

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Malaria

Causative agent

Malaria is caused by a single-celled parasite of the **genus plasmodium**.

Symptoms/ Clinical Presentation:

- Fever.
- Chills.
- General feeling of discomfort.
- Headache.
- Nausea and vomiting.
- Diarrhea.
- Abdominal pain.
- Muscle or joint pain.

Epidemiology:

- In 2020, there were an estimated 241 million cases of malaria worldwide.
- Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. It is preventable and curable.
- The estimated number of malaria deaths stood at 627 000 in 2020.

Filariasis

Causative agent

The causative agents of lymphatic filariasis (LF) include the mosquito-borne filarial nematodes *Wuchereria bancrofti*, *Brugia malayi*, *B. timori*.

Symptoms/ Clinical Presentation:

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- A dry, paroxysmal nocturnal cough; wheezing; dyspnea; anorexia; malaise; and weight loss.

Epidemiology:

Human lymphatic filariasis is caused mainly by *Wuchereria bancrofti*, *Brugia malayi* and *Brugia timori*. Of the estimated 90.2 million people infected, more than 90% have bancroftian and less than 10% brugian filariasis.

Chikungunya

Causative agent

It is caused by the **chikungunya virus (CHIKV)**.

Symptoms/ Clinical Presentation:

- The most common symptoms are **fever and joint pain**. Other symptoms may include headache, muscle pain, joint swelling, or rash.
- Symptoms usually begin 3–7 days after an infected mosquito bites you.

Epidemiology:

- The disease that was silent for nearly 32 years re-emerged in the October 2005 outbreak in India that is still ongoing.
- The first Indian report from Kolkata.
- Chikungunya fever has re-emerged in India after nearly 32 years in October 2005[1,7,38] and the outbreak is ongoing.

Surface infections

Trachoma

Causative agent

It caused by the bacterium **Chlamydia trachomatis**.

Symptoms/ Clinical Presentation:

Pinkeye, heartburn, enanthem, grippe, blinding, struma, ablepsia, pink eye, Bloodstroke, influenza, polio, cataract, cholera, green sickness, trachea, hay fever etc.

Epidemiology:

Trachoma is hyperendemic in many of the poorest and most rural areas of Africa, Central and South America, Asia, Australia and the Middle East. It is responsible for the blindness or visual impairment of about 1.9 million people. It causes about 1.4% of all blindness worldwide.

Tetanus

Causative agent

Tetanus, also called lockjaw, is a serious infection caused by *Clostridium tetani*.

Symptoms/ Clinical Presentation:

- bloody stools
- diarrhea
- fever
- headache

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- sensitivity to touch
- sore throat
- sweating
- rapid heartbeat

Epidemiology:

Tetanus occurs more often in persons who have never been vaccinated against tetanus or who have not had a booster dose in the past 10 years.

Leprosy

Causative agent

It is an infection caused by slow-growing bacteria called **Mycobacterium leprae**.

Symptoms/ Clinical Presentation:

- A stuffy nose
- Nosebleeds
- Growths (nodules) on the skin
- Thick, stiff or dry skin
- Painless ulcers on the soles of feet
- Painless swelling or lumps on the face or earlobes
- Loss of eyebrows or eyelashes

Epidemiology:

Every year around 4,00,000 new cases of leprosy occur in India and India contributes about 80% of the global leprosy case load.