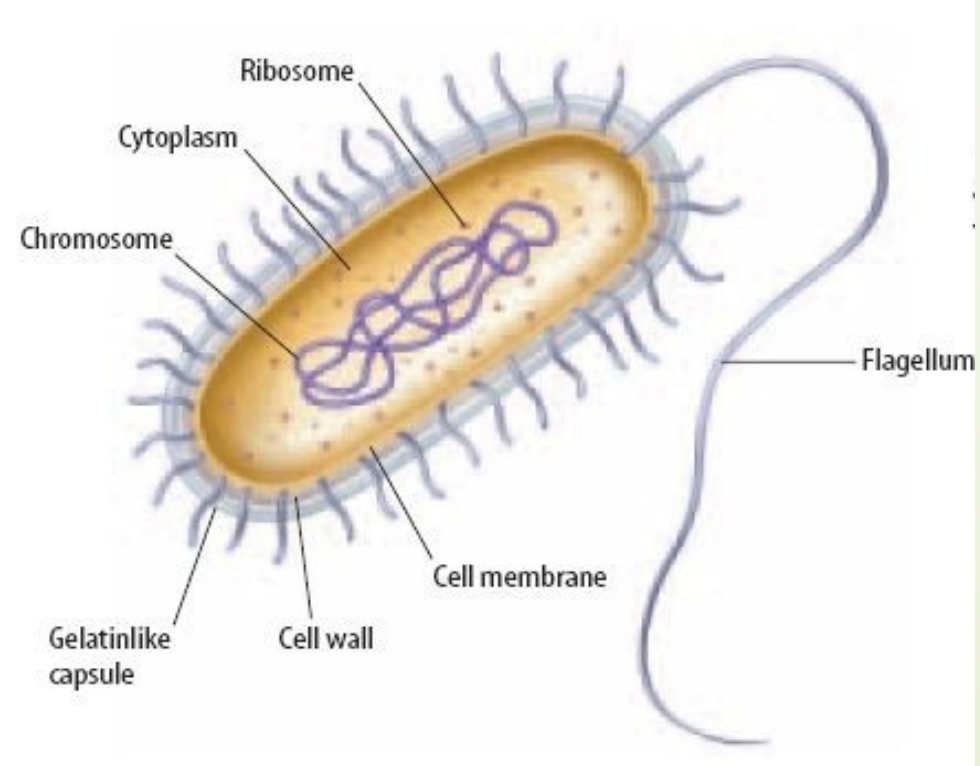
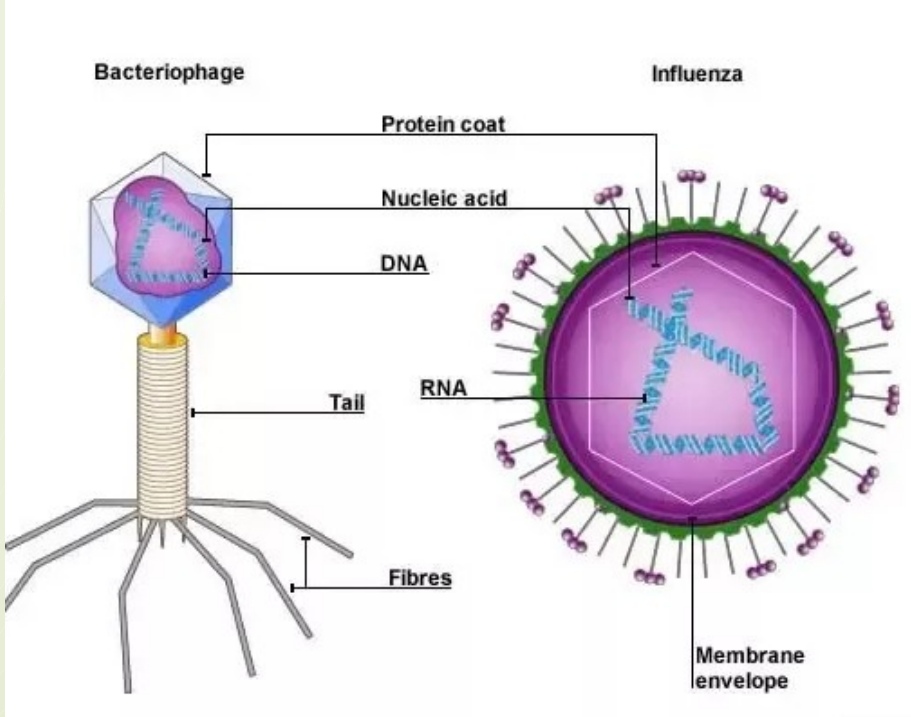
Biological Agents

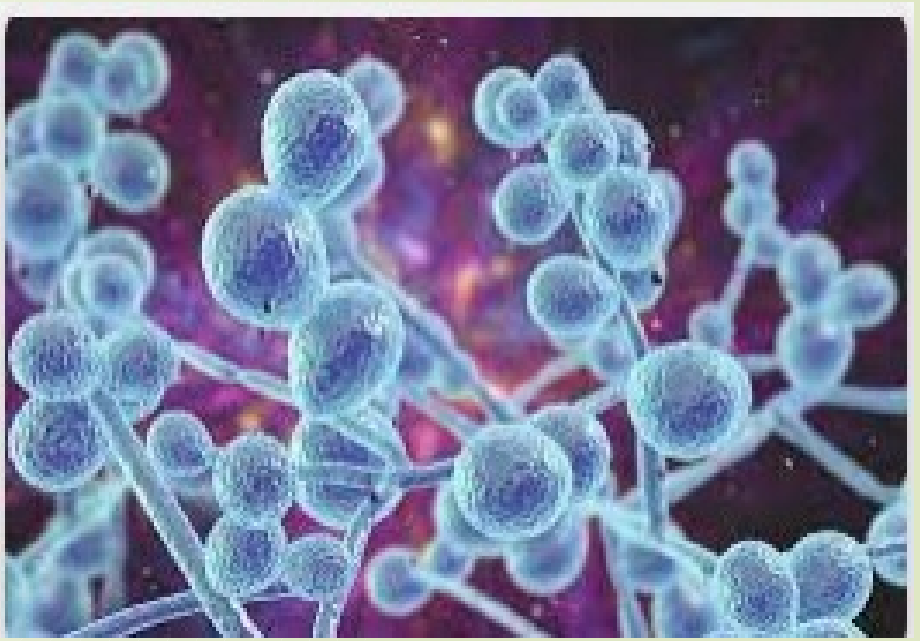
Biological agents

- **Biological agent**: A microorganism, bacteria, virus, fungi, biological toxin, particle or otherwise infectious material, either naturally occurring or genetically modified, which may have the potential to cause infection, allergy, toxicity or otherwise create a hazard to humans, animals, or plants.
- They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions—even death.
- **Bacteria** are single-celled microorganisms with prokaryotic cells, which are single cells that do not have organelles or a true nucleus and are less complex than eukaryotic cells. Many of these bacteria can causes serious human diseases.
- **A virus** is an infective agent that typically consists of a nucleic acid molecule in a protein coat, is too small to be seen by light microscopy, and is able to multiply only within the living cells of a host.

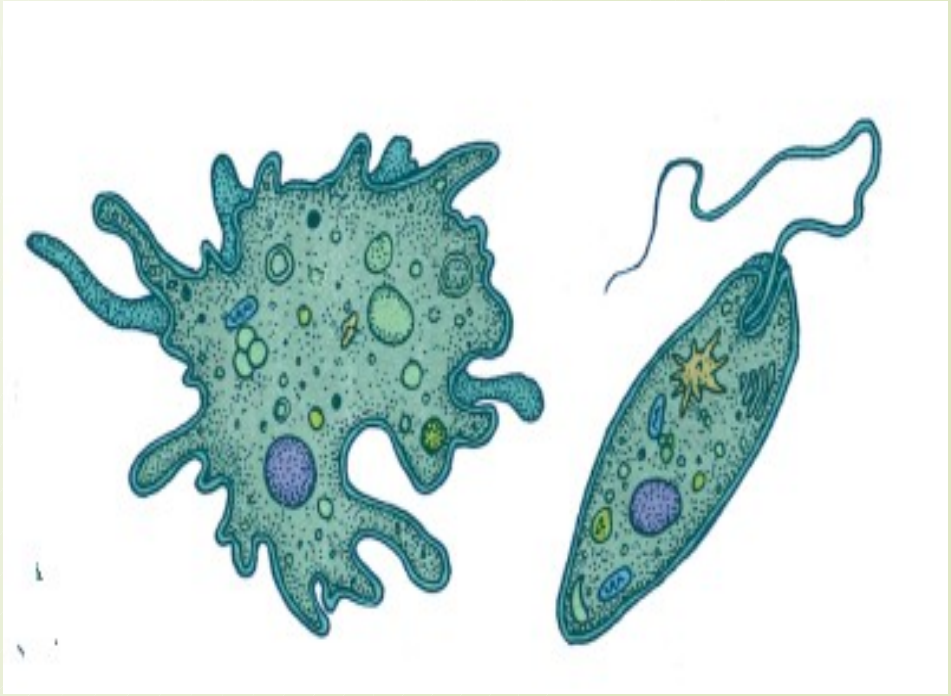

Ribosome
Cytoplasm
Chromosome
Flagellum
Cell membrane
Gelatinlike capsule
Cell wall


Bacteriophage
Influenza
Protein coat
Nucleic acid
DNA
RNA
Tail
Fibres
Membrane envelope

- Toxin: are toxic substances that are produced and released by bacteria to target other bacterial or host cells.
- An allergen is a substance that can cause an normally vigorous immune response that may harms the body.
- Fungi are a group of saprophytic and parasitic spore-producing eukaryotic typically filamentous organisms.
- Prions: is a type of protein that can cause disease in animals and humans by triggering normally healthy proteins in the brain to fold abnormally.



- Protozoa: A parasitic single-celled organism that can divide only within a host organism. For example malaria Entamoeba and plasmodium.
- A host: A multicellular organism that is infected with or is fed upon by a parasitic or pathogenic organism



- **Exposure:** An event during which an individual comes in contact with, or is in close proximity to, biological agents with the potential for infection or harm to occur.
- **Infectious dose:** The amount of biological agent required to cause an infection in the host, measured in number of organisms. Often defined as the ID50, the dose that will cause infection in 50% of those exposed.
- **Transmission**: The transfer of biological agent(s) from objects to living things, or between living things, either directly or indirectly via aerosols, droplets, body fluids, vectors, food/water or other contaminated objects.
- **Laboratory acquired infection:** Any event where an employee is exposed to a biohazardous agent in a laboratory and subsequently develops an infection from the exposure.
- Bacteria account for the largest proportion of infections (43%) in diagnostic laboratories, with over 37 different species reported.
- **Brucella *species***, *Neisseria meningit*ides and *Mycobacteriun tuberculosis* are the most common
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The effects of the Biological Agents

- As they are invisible, it is often difficult to appreciate the risk the present. However, worker in laboratories can be harmed through the followings
- Directly by the effect of the biological agent such as the effect of most viruses which cause lysis of the infected cells.
- The effect of toxins produced by the biological agent such as toxins produced by many bacteria like *Bacillus anthracis* (the causative agent of anthrax).
- Allergic reaction induced by some biological agents such as *Streptococcus pyogenes* and *Pseudomonas aeruginos*a

Route of microbes entry to the body

- **Inhalation (aerosols): Respiratory infection such as influenza and tuberculosis**
- Droplet transmission results from contact with contaminated respiratory secretions. A person with a droplet-spread infection coughs, sneezes or talks, releasing infected secretions that spread through the air to the oral or nasal mucous membrane of a person nearby
- Airborne transmission occurs when microbial particles or dust particles containing pathogens remains suspended in the air for prolonged period, and then spread widely by air currents and inhaled. The tiny particles remain suspended in the air for several hours and may cause infection when a susceptible person inhales them.

- **Ingestion:**
  - Eating and drinking
  - Applying cosmetics
  - Pipetting
- **Absorption through the mucous membranes**
  - Splash to eyes, nose and mouth
  - Hand to face movement

Injection

- Contaminated sharp objects
- Insects (mechanical and biological vectors)

Host factors Affecting Risks

- Deficiencies in host defenses
- Skin- eczema, chronic dermatitis, psoriasis
- Immune system deficiencies - asplenia
- Poorly controlled Type 1 diabetes, pregnancy, asthma, cancer, connective tissue disease.
- Very young and older ages are usually more susceptible to disease.
- Malnutrition can increase the severity of infection

The complex interaction between host, agents and environment