What are MICROBES?

Microbes are tiny living things that are found all around us and are too small to be seen by the naked eye. They live in water, soil, and in the air. The human body is home to millions of these microbes too, also called microorganisms. Some microbes make us sick, others are important for our health. The most common types are bacteria, virus and fungi.

BACTERIA

Bacteria are microscopic, single-cell organisms that live almost everywhere. Bacteria live in every climate and location on earth. Some are airborne while others live in water or soil. Bacteria live on and inside plants, animals, and people. The word "bacteria" has a negative perception, but bacteria actually perform many functions for organisms and in the environment. For example, plants need bacteria in the soil in order to grow.

The majority of bacteria are harmless to people and some strains are even beneficial. In the human gastrointestinal tract, good bacteria aid in digestion and produce vitamins. They also help with immunity, making the body less hospitable to bad bacteria and other harmful pathogens. When considering all the strains of bacteria that exist, relatively few are capable of making people sick.

Bacterial infections are one cause of foodborne illness. Nausea, vomiting, diarrhea, fever, chills, and abdominal pain are common symptoms of food poisoning. Raw meat, fish, eggs, poultry, and unpasteurized dairy products may harbor harmful bacteria that can cause illness. Unsanitary food preparation and handling can also encourage bacterial growth. Bacteria that cause food poisoning include:

**Escherichia coli (E. coli)** is a diarrhea illness that may be accompanied by nausea, vomiting, fever, and abdominal cramps.

**Listeria monocytogenes (L. monocytogenes)** causes fever, muscle aches, and diarrhea. Pregnant women, elderly individuals, infants, and those with weakened immune systems are most at risk for acquiring this infection.

**Salmonella** causes fever, diarrhea, and abdominal cramps. Symptoms typically last between 4 and 7 days.

**Vibrio cholerae** causes diarrhea when ingested, but it can also cause severe skin infections when it comes in contact with an open wound.
VIRUS

Unlike bacteria, viruses have no cells of their own. This means that they're not, strictly speaking, living organisms. Instead, they're made up of one or more molecules surrounded by a protein shell. The genetic information found inside this shell is needed for the viruses to reproduce. Many viruses are responsible for diseases. Some are harmless and only trigger a minor cold, while others can cause serious diseases like HIV and Corona virus. Other diseases caused by viruses include influenza ("the flu"), measles or inflammation of the liver (viral hepatitis). Viruses invade healthy cells and start to multiply from these cells. A virus can't reproduce without these host cells. Not all viruses cause symptoms, and in many cases the body successfully fights back against the attackers. This is the case with cold sores, which many people have experienced at some time. They are caused by viruses that are found in certain nerve cells and can lead to the typical blisters in some people if their immune system is weak or run-down. It's relatively difficult to fight viruses with medication. To protect against some viruses, the immune system can be “trained” by a vaccination so that the body is better prepared to fight the virus.

Fungi

Fungi can live in lots of different environments. The best-known fungi include yeast, mold and edible fungi like mushrooms. Just like bacteria, some fungi occur naturally on the skin or in the body. But fungi can also cause diseases. Diseases caused by fungi are called mycoses. Common examples include athlete’s foot or fungal infections of the nails. Fungal infections can sometimes also cause inflammations of the lungs, or of mucous membranes in the mouth or on the reproductive organs, and become life-threatening for people who have a weakened immune system. But humans have also benefited from the helpful qualities of some fungi. We owe the discovery of penicillin to a type of mold that is used to produce this antibiotic.
Yeast  mold  Mushroom
Escherichia coli is a Gram-negative, facultative anaerobic, rod-shaped and is commonly found in the lower intestine of warm-blooded organisms. Some types can cause illness in humans, including diarrhea, abdominal pain, fever, and sometimes vomiting.

Food poisoning caused by E. coli usually through eating contaminated water or food. Symptoms of intestinal infection generally begin between 1 and 10 days after infected with E. coli. Some strains of E. coli, for example O157:H7, can produce Shiga toxin that can cause severe abdominal cramps, bloody diarrhea and vomiting.

Staphylococcus aureus is a Gram-positive, round shaped bacterium, facultative anaerobe, non-motile, do not form spores, and commonly found on the skin or in the nose of even healthy individuals. Staph infections can turn deadly if the bacteria invade deeper into your body, entering your bloodstream, joints, bones, lungs or heart.

Food poisoning symptoms associated with staph infection are nausea, vomiting and diarrhea with incubation period lasts one to six hours, the illness itself lasting from 30 minutes to 3 days. The bacteria is capable of generating toxins that produce food poisoning in the human body.

Bacillus cereus is a Gram-positive, motile, rod-shaped, facultative anaerobic, beta-hemolytic and spore forming bacterium commonly found in soil and food. B. cereus causes two different types of food poisoning: the diarrhoeal type and the emetic type.

The diarrheal type is associated with a wide range of foods, has an 8 to 16 hour incubation time, and is associated with diarrhea and gastrointestinal pain. The emetic type is commonly caused by growing cells in the food. This type leads to nausea and vomiting 1–5 hours after consumption. Emetic toxin can withstand 121 °C for 90 minutes.

Salmonella is a Gram-negative, rod shaped, non-spore-forming, motile and facultative anaerobes. Salmonella infection is a common bacterial disease that affects the intestinal tract known as salmonellosis. These bacteria typically live in animal and human intestines and are shed through faeces.

Humans become infected most frequently through contaminated water or food. Salmonella bacterial infection causes gastrointestinal symptoms, including diarrhea, abdominal pain, nausea, and vomiting. Symptoms develop within 12-72 hours and typically last four to seven days.
**S. aureus** on BPA agar

**E. coli** on EMB agar

**E. coli (3M ECC Petrifilm)**
Blue with gas colonies

**Salmonella** on XLD agar

**B. cereus** on MYP agar

**S. aureus (3M STX Petrifilm)**
Red violet colonies