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Topic: BACTERIA

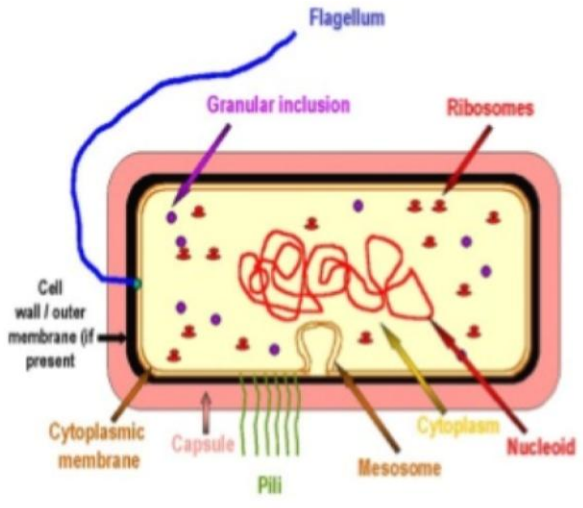
Structure of bacteria

Basic structures

- Cell wall
- Cell membrane
- Cytoplasm
- Nuclear material

Special structures

- Capsule
- Spore
- Flagella
- Pili



Feeding:

Bacteria feed in different ways:

Heterotrophic bacteria or **heterotrophs**: get their energy through consuming organic carbon. Most absorb dead organic material, such as decomposing flesh.

Autotrophic bacteria or **autographs**: make their own food, either through either:

- **Photosynthesis:** using sunlight, water and carbon dioxide, or
- **Chemosynthesis**: using carbon dioxide, water, and chemicals such as ammonia, nitrogen, sulfur, and others

Aerobes or **aerobic bacteria**: can only grow where there is oxygen.

Anaerobes or **anaerobic bacteria**: can only grow where there is no oxygen. In humans, this is mostly in the gastrointestinal tract. They can also cause gas, gangrene, tetanus, botulism, and most dental infections.

Facultative anaerobes or **facultative anaerobic bacteria**: can live either with or without oxygen, but they prefer environments where there is oxygen. They are mostly found in soil, water, vegetation and some normal flora of humans and animals. Examples include *Salmonella*.

Mesophiles or **mesophilic bacteria**: are the bacteria responsible for most human infections. They thrive in moderate temperatures, around 37°C. This is the temperature of the human body.

Examples: Listeria monocytogenes, Pseudomonas maltophilia, Staphylococcus aureus, Streptococcus pyrogenes, Streptococcus pneumoniae, Escherichia coli.

The human intestinal flora, or gut microbiome, contains beneficial mesophilic bacteria, such as dietary Lactobacillus acidophilus.

Thermophiles: can live in high temperatures, up to 75 to 80°C, and **Hyperthermophiles:** can surivive in temperatures up to 113°C.

Reproduction and transformation:

Bacteria may reproduce and change using the following methods:

- **Binary fission**: An asexual form of reproduction, in which a cell continues to grow until a new cell wall grows through the center, forming two cells. These separate, making two cells with the same genetic material.
- **Transfer of genetic material**: Cells acquire new genetic material through processes known as conjugation, transformation, or transduction. These processes can make bacteria stronger and more able to resist threats, such as antibiotic medication.

- **Spores**: When some types of bacteria are low on resources, they can form spores. Spores hold the organism's DNA material and contain the enzymes needed for germination. They are very resistant to environmental stresses. The spores can remain inactive for centuries, until the right conditions occur. Then they can reactivate and become bacteria.
- Spores can survive through periods of environmental stress,including ultraviolet (UV) and gamma radiation, desiccation, starvation, chemical exposure, and extremes of temperature.

Uses:

Human survival:

Many of the bacteria in the body play an important role in human survival. Bacteria in the digestive system break down nutrients, such as complex sugars, into forms the body can use.

Non-hazardous bacteria also help prevent diseases by occupying places that the pathogenic, or disease-causing, bacteria want to attach to. Some bacteria protect us from disease by attacking the pathogens.

Nitrogen fixation: Bacteria take in nitrogen and release it for plant use when they die. Plants need nitrogen in the soil to live, but they cannot do this themselves. To ensure this, many plant seeds have a small container of bacteria that is used when the plant sprouts.

Food technology:

Lactic acid bacteria, such as *Lactobacillus* and *Lactococcus* together with yeast and molds, or fungi, are used to prepare foods such as as cheese, soy sauce, natto (fermented soy beans), vinegar, yogurt, and pickles.

Not only is fermentation useful for preserving foods, but some of these foods may offer health benefits.

For example, some fermented foods contain types of bacteria that are similar to those linked with gastrointestinal health. Some fermentation processes lead to new compounds, such as lactic acid, which that appear to have an anti-inflammatory effect.

Bacteria in industry and research:

Bacteria can` break down organic compounds. This is useful for activities such as waste processing and cleaning up oil spills and toxic waste.

The pharmaceutical and chemical industries use bacteria in the production of certain chemicals.

Bacteria are used in molecular biology, biochemistry and genetic research, because they can grow quickly and are relatively easy to manipulate. Scientists use bacteria to study how genes and enzymes work.

Bacillus thuringiensis (Bt) is a bacterium that can be used in agriculture instead of pesticides. It does not have the undesirable environmental consequences associated with pesticide use.