

Bacteria Cell Structure

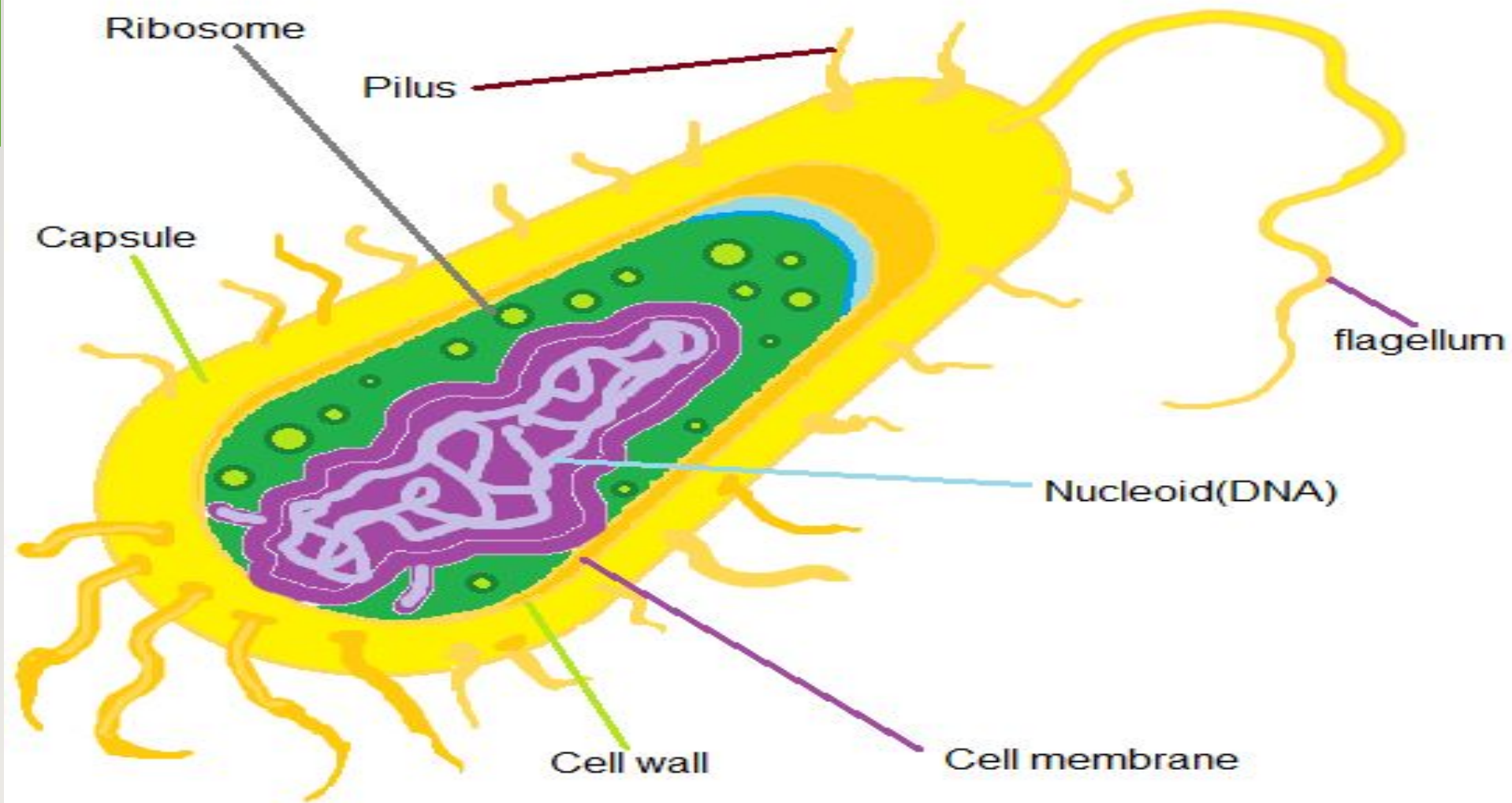
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Bacteria Cell Anatomy



Cell Envelope

- The cell envelope is made up of two to three layers: the interior cytoplasmic **membrane**, **the cell wall**, and -- in some species of bacteria -- an outer **capsule**.

Capsule

- Some species of bacteria have a third protective covering, a capsule made up of polysaccharides (**complex carbohydrates**).
- Capsules play a number of roles, but the most important are to keep the bacterium from **drying** out and to **protect it from phagocytosis** (engulfing) by larger microorganisms.
- The capsule is a major virulence factor in the major **disease-causing** bacteria, such as ***Escherichia coli*** and ***Streptococcus pneumoniae***.
- Non-encapsulated mutants of these organisms are avirulent, i.e. they don't cause disease.

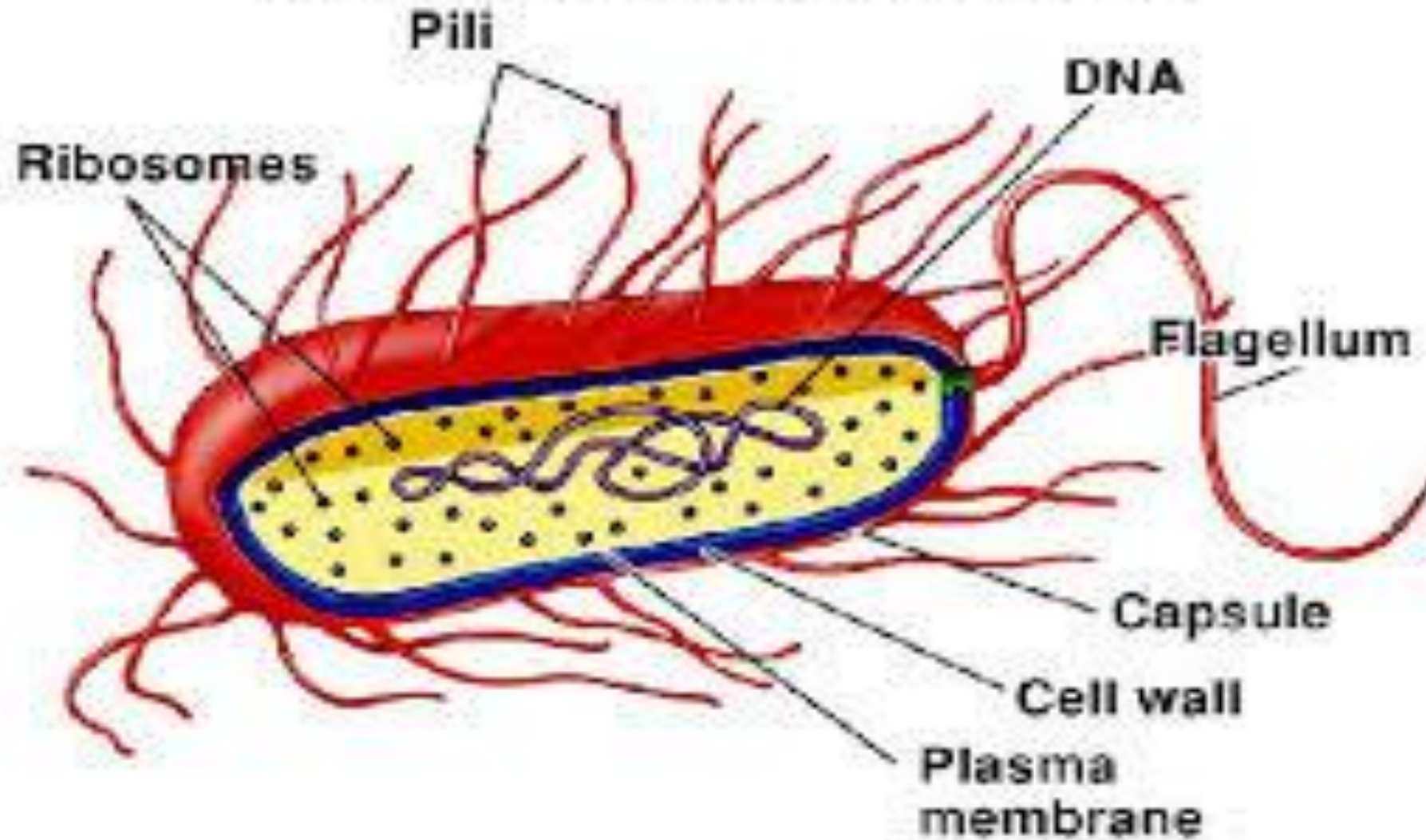
Cell Wall

- Each bacterium is enclosed by a rigid cell wall composed of **peptidoglycan**, a **protein-sugar (polysaccharide)** molecule.
- The wall gives the cell its **shape** and surrounds the cytoplasmic membrane, **protecting** it from the environment. It also helps to anchor appendages like the pili and flagella, which originate in the cytoplasm membrane and **protrude** through the wall to the outside.
- The strength of the wall is responsible for keeping the cell from **bursting** when there are large differences in osmotic pressure between the cytoplasm and the environment.

Cytoplasmic Membrane

- A layer of **phospholipids and proteins**, called the cytoplasmic membrane, encloses the interior of the bacterium, regulating the flow of materials **in and out** of the cell.
- This is a structural trait bacteria share with all other living cells; a barrier that allows them to selectively interact with their environment.
- Membranes are dynamic, constantly adapting to different condition

Bacterial Cell Structure



Flagella

- Flagella (singular, flagellum) are hairlike structures that provide a means of **locomotion** for those bacteria that have them.
- They can be found at either or both ends of a bacterium or all over its surface.
- The flagella beat in a propeller-like motion to help the bacterium **move toward nutrients; away from toxic chemicals**

Pili

- Many species of bacteria have pili (singular, pilus), **small hairlike** projections emerging from the outside cell surface.
- These outgrowths assist the bacteria in **attaching** to other cells and surfaces
- Without pili, many disease-causing bacteria lose their ability to infect because they're unable to attach to host tissue.
- Specialized pili are used for **conjugation**, during which two bacteria exchange fragments of plasmid DNA.

Cytoplasm

- The cytoplasm, of bacterial cells is where the functions for **cell growth, metabolism, and replication** are carried out.
- It is a **gel-like matrix** composed of water, enzymes, nutrients, wastes, and gases and contains cell structures such as **ribosomes, a chromosome, and plasmids**.
- The cell envelope encases the cytoplasm and all its components.
- Unlike the true cells, bacteria **do not have** a membrane enclosed nucleus. The chromosome, a single, continuous strand of DNA, is localized, but not contained, in a region of the cell called the nucleoid. All the other cellular components are scattered throughout the cytoplasm.

Nucleoid

- The nucleoid is a region of cytoplasm where the **chromosomal DNA** is located.
- It is not a membrane bound nucleus, but simply an area of the cytoplasm where the strands of DNA are found.
- Most bacteria have a **single, circular chromosome** that is responsible for **replication**, although a few species do have two or more.
- Smaller circular auxiliary DNA strands, called plasmids, are also found in the cytoplasm.

Cytoplasm/ Plasmid

- One of those components, plasmids, are small, extrachromosomal genetic structures carried by many strains of bacteria.
- Like the chromosome, **plasmids are made of a circular piece of DNA**. Unlike the chromosome, they are **not involved in reproduction**.
- Only the chromosome has the genetic instructions for initiating and carrying out cell division, or binary fission, the primary means of reproduction in bacteria.
- Plasmids **replicate independently** of the chromosome and, while not essential for survival, appear to give bacteria a selective advantage.

Cytoplasm/ Plasmid

- **Plasmids are passed on to other bacteria through two means:**

For most plasmid types, copies in the cytoplasm are passed on to daughter cells during binary fission.

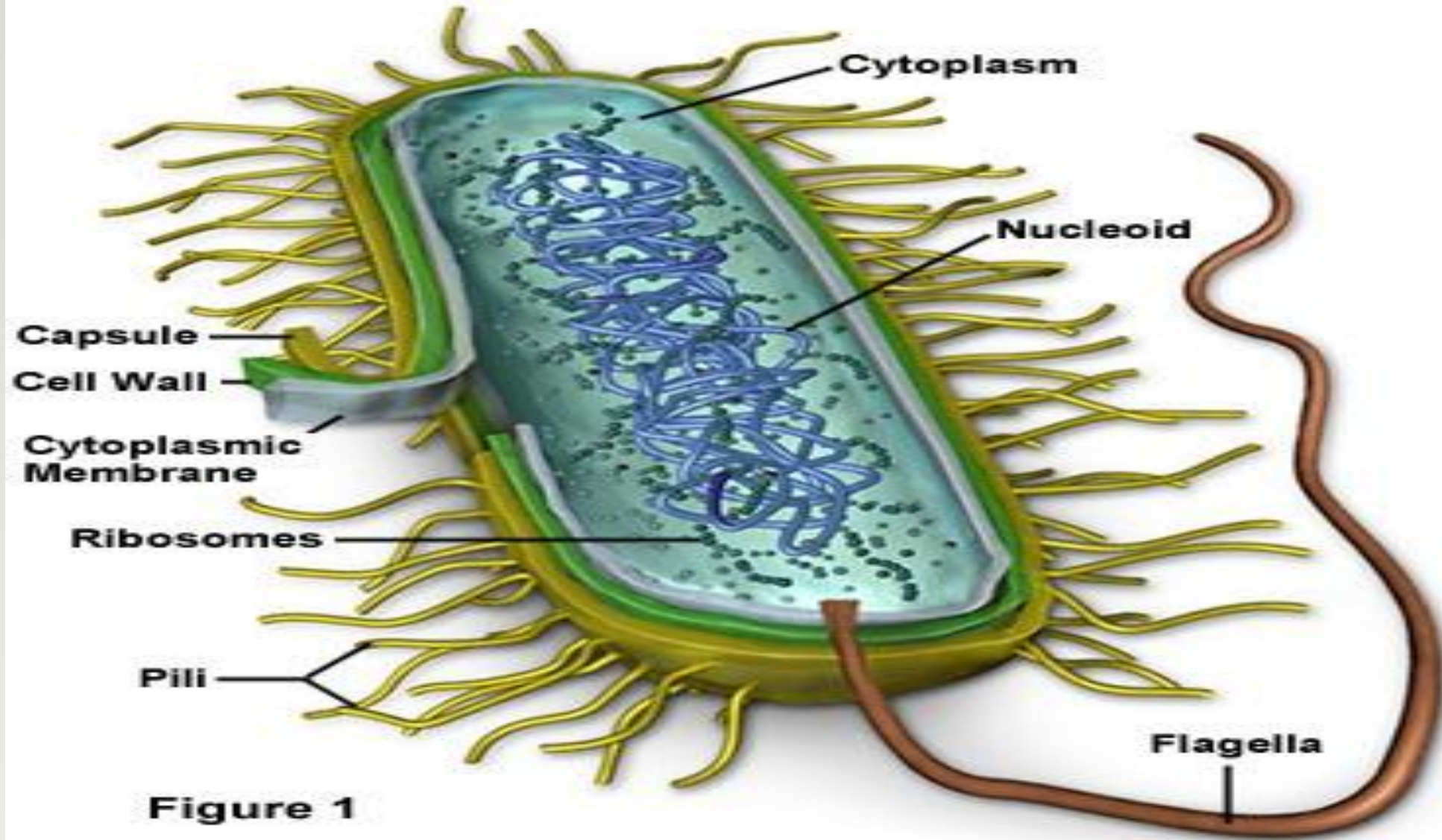
Other types of plasmids, however, form a tubelike structure at the surface called a pilus that passes copies of the plasmid to other bacteria during conjugation, a process by which bacteria exchange genetic information.

- Plasmids have been shown to be instrumental in the transmission of special properties, such as **antibiotic drug resistance**.
- The ability to insert specific genes into plasmids have made them extremely useful tools in the fields of **molecular biology and genetics**, specifically in the area of genetic engineering..

Ribosomes

- Ribosomes are microscopic "**factories**" found in all cells, including bacteria.
- They translate the genetic code from the molecular language of nucleic acid to that of **amino acids—the building blocks of proteins**.
- **Proteins** are the molecules that perform all the functions of cells and living organisms.
- Bacterial ribosomes are never bound to other organelles, but are free-standing structures distributed throughout the cytoplasm.

Prokaryotic Cell Structure



THANK
YOU

