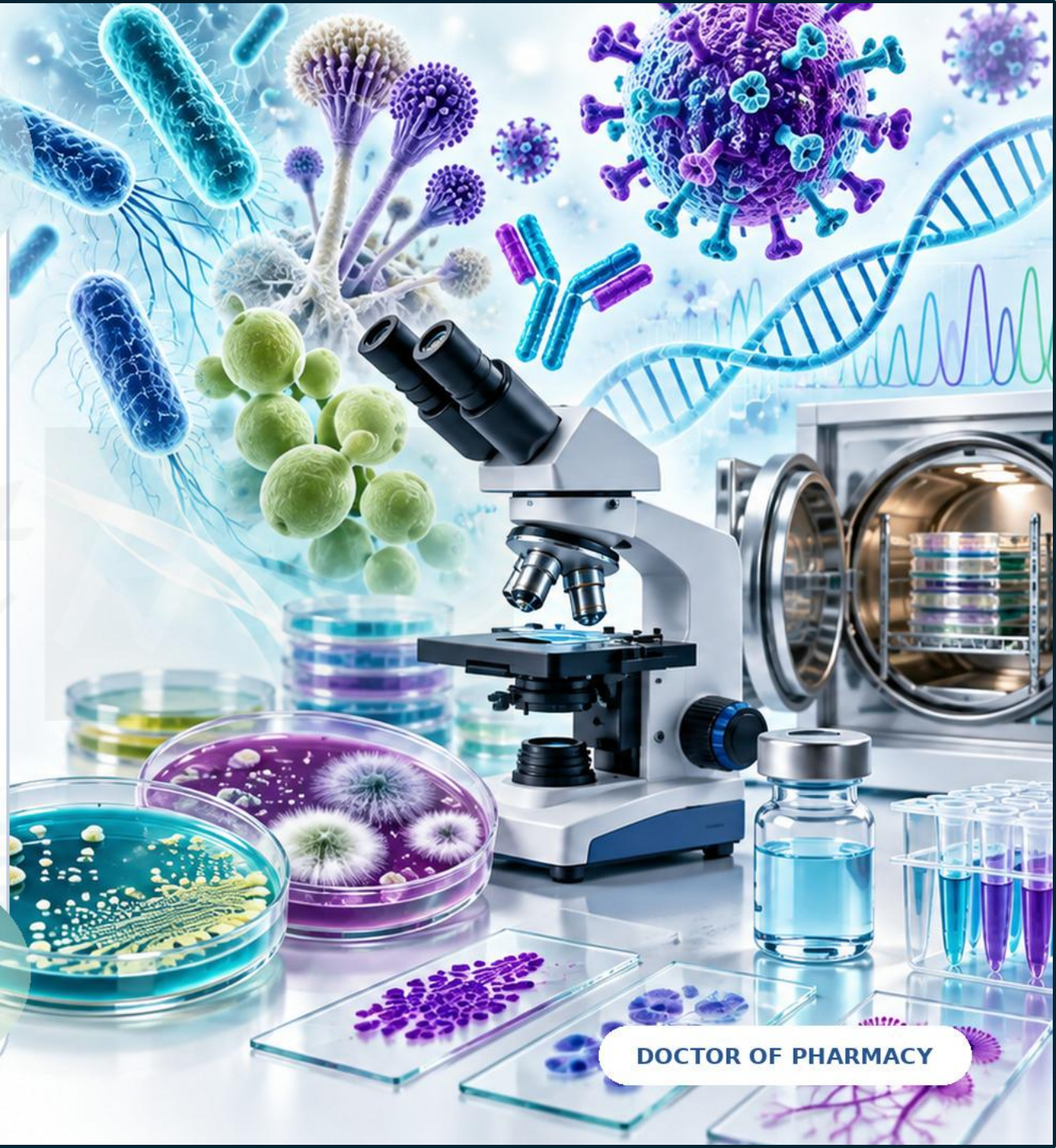
PHARM.D • YEAR 2

Pharmaceutical Microbiology

CHAPTER 2

# Classification of Microbes: Bacteria, Fungi, Viruses, Rickettsiae and Spirochetes



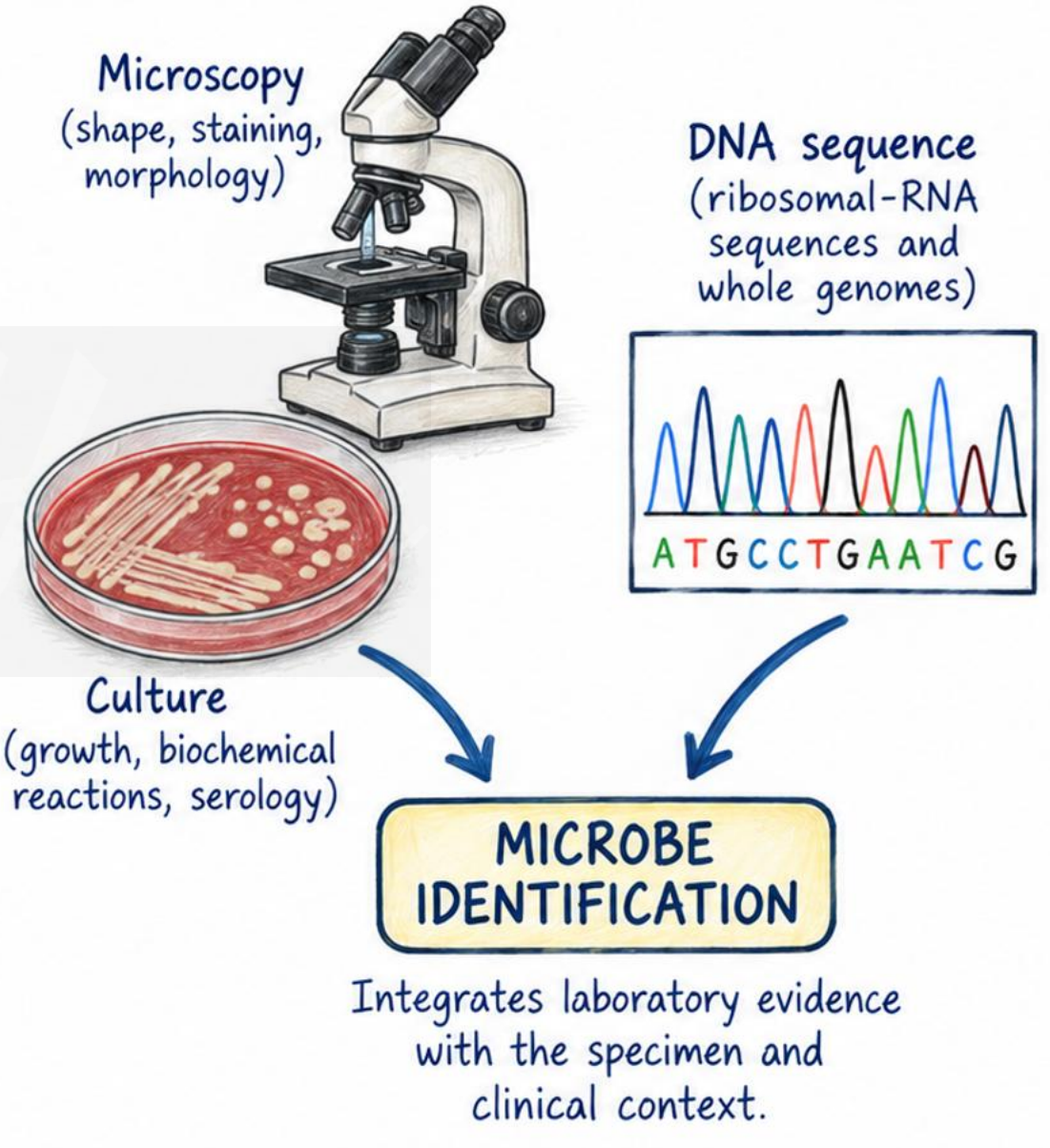
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# How Microbes Are Classified

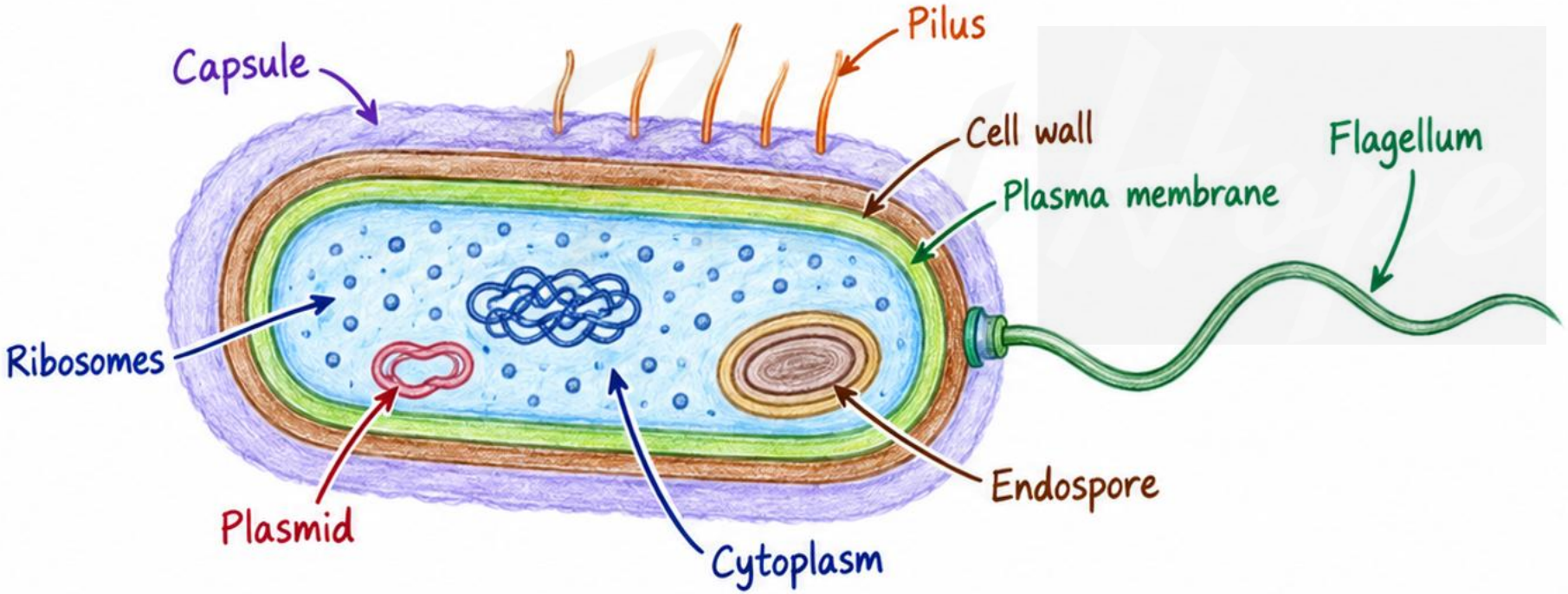
**Classification** organizes microbes by shared characteristics and evolutionary relationships.
**Traditional methods** compare shape, growth, staining, biochemical reactions and serology.
**Molecular methods** compare nucleic acids, including ribosomal-RNA sequences and whole genomes.
A good identification combines appropriate laboratory evidence with the specimen and clinical context.

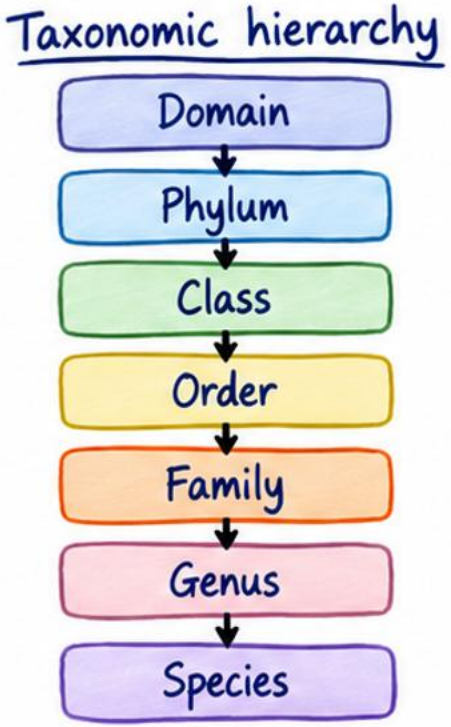
For a patient sample, identification begins with a clinical question. A genetic match alone should be checked against contamination, normal colonization and specimen site.



# Taxonomy and Bacterial Structure

Taxonomy moves from domain to phylum, class, order, family, genus and species. Bacteria are prokaryotic cells with a membrane, cytoplasm, ribosomes and usually a cell wall. Some carry capsules, flagella, pili or plasmids. Endospores are highly resistant resting structures formed by certain genera, notably *Bacillus* and *Clostridium*.




Genus and species names communicate a precise identity. Capsule may help evade host defense; plasmids may carry accessory traits, including some resistance genes.

# Gram Reaction and Growth Needs

## Gram-positive bacteria

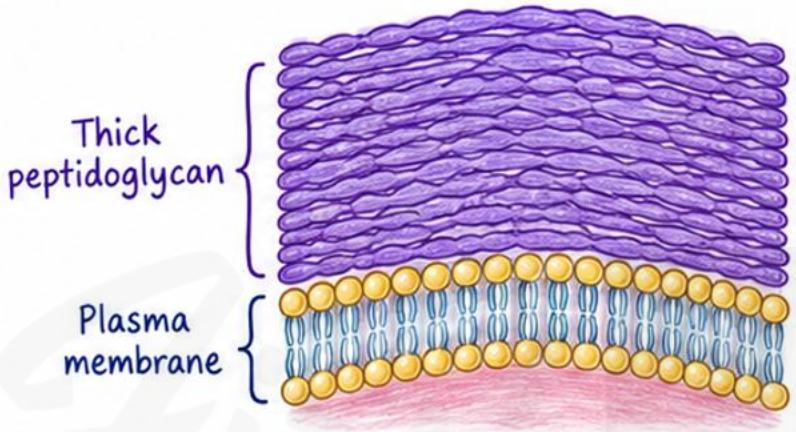
Gram-positive bacteria retain crystal violet because of thick peptidoglycan.

## Gram-negative bacteria

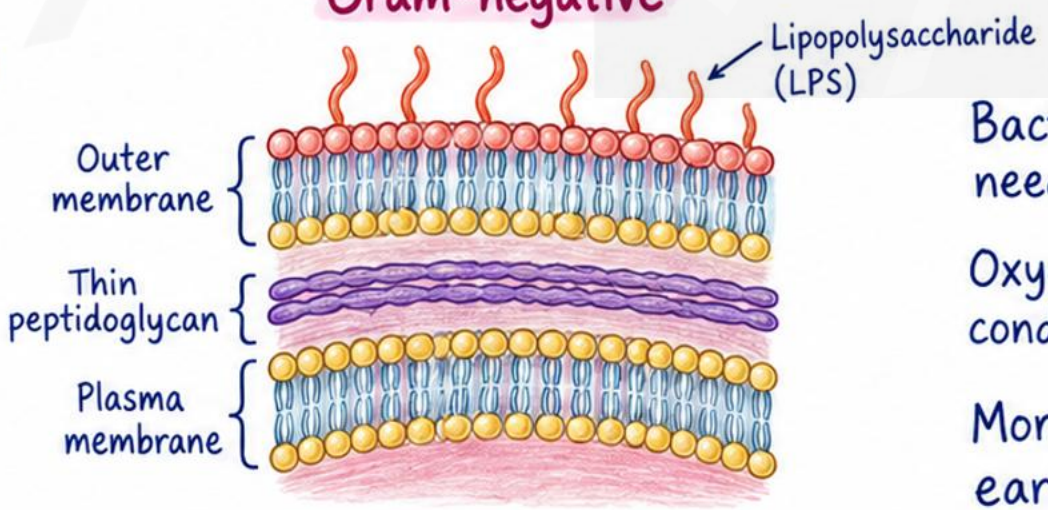
Gram-negative bacteria have thinner peptidoglycan plus an outer membrane and usually stain pink after counterstaining.

The outer membrane of Gram-negative bacteria contains lipopolysaccharide.

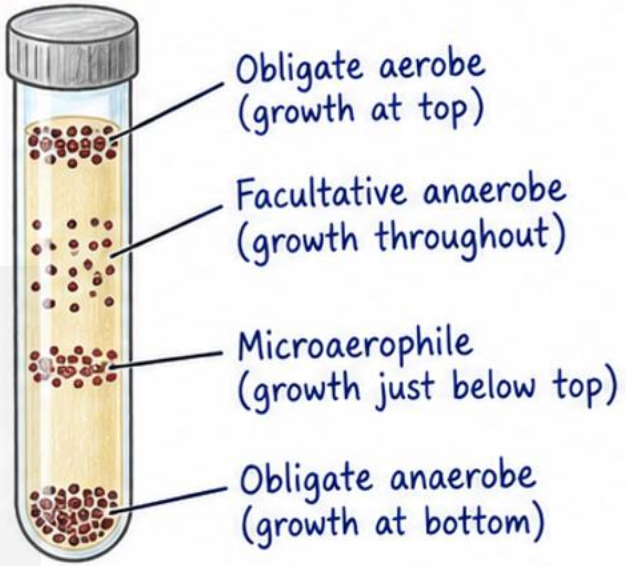
### Gram-positive




### Gram-negative




## Oxygen preference




Bacteria also differ in oxygen needs and preferred temperature.

Oxygen preference describes growth conditions, not a separate taxonomic rank.

Morphology and Gram reaction guide early laboratory decisions, but they do not identify a species by themselves.

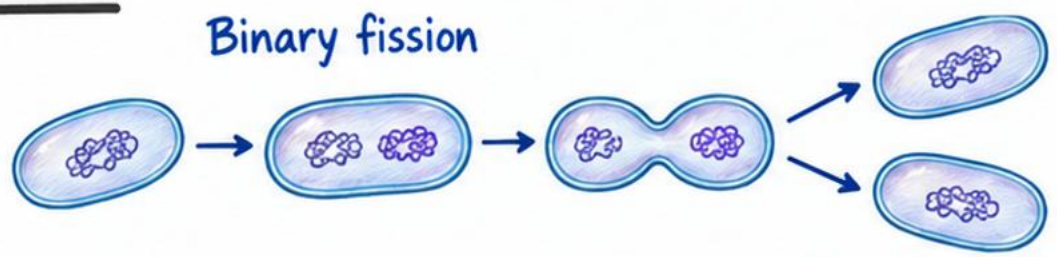
# Bacterial Variation and Uses

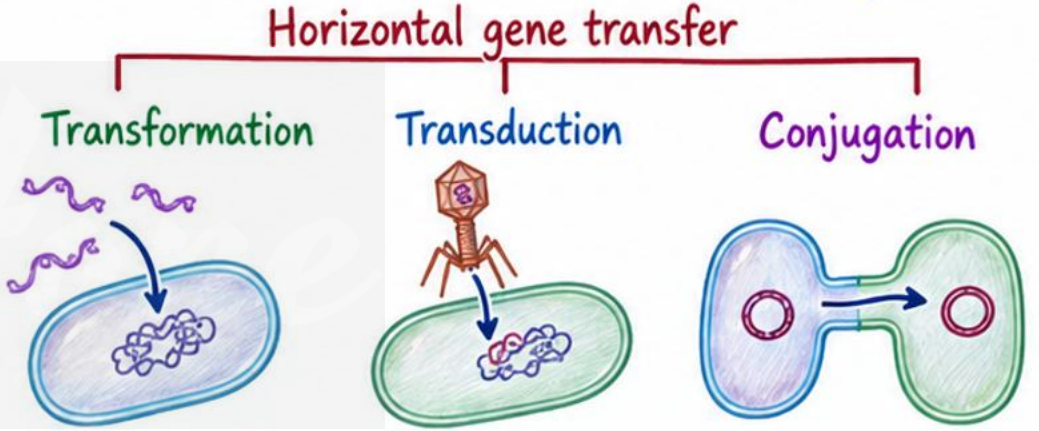
Binary fission produces daughter cells.

Mutation and horizontal gene transfer create variation; transformation, transduction and conjugation are major transfer routes.

Bacteria can be pathogens, normal microbiota or useful production organisms.

Culture, biochemical testing and molecular methods are selected according to the question and specimen.




Horizontal transfer can spread traits between unrelated cells, while mutation changes inherited sequence.

Neither automatically creates a new species or causes disease.






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