

The background of the image is a microscopic view of numerous rod-shaped bacteria. The bacteria are primarily pink and purple in color, with some appearing more vibrant than others. They are scattered across the frame, some in sharp focus and others blurred, creating a sense of depth. The overall appearance is that of a dense bacterial culture.

Taxonomy

Area of Taxonomy

- ▶ **Classification** is the categorization of organisms into taxonomic groups. Classification of bacteria requires experimental and observational techniques; this is because biochemical, physiologic, genetic, and morphologic properties.
- ▶ **Nomenclature** refers to the naming of an organism by international rules (established by a recognized group of medical professionals) according to its characteristics.
- ▶ **Identification** refers to the practical use of a classification scheme to: (1) isolate and distinguish desirable organisms from undesirable ones, (2) verify the authenticity or special properties of a culture in a clinical setting, and (3) isolate and identify the causative agent of a disease.

Criteria of classification

▶ Growth on Media:

1. Component of culture media must be include metabolic nutrients like carbon source, amino acids, vitamins and other minerals.

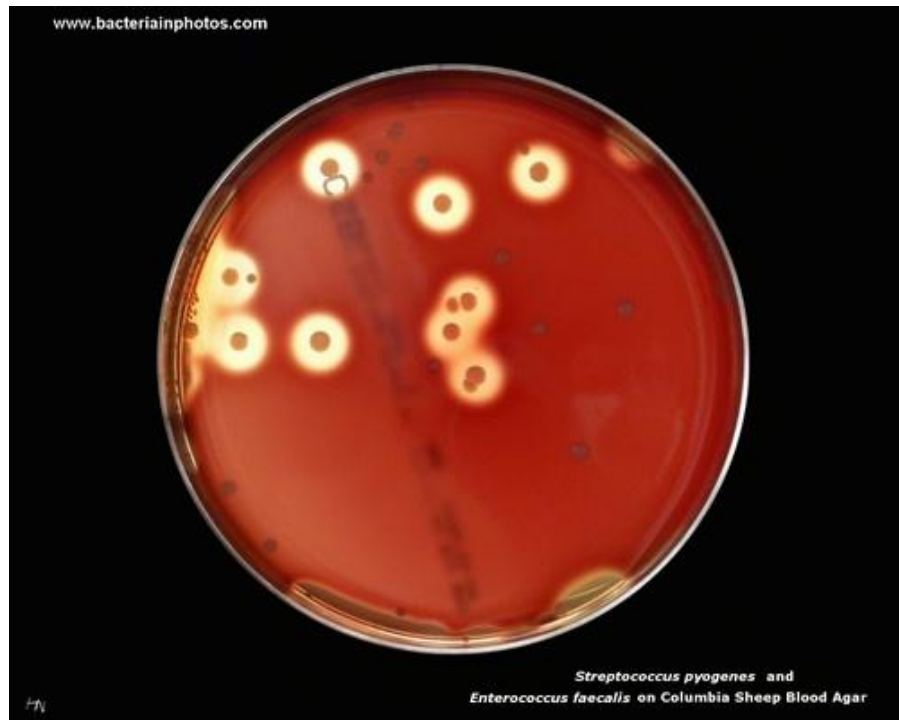


2. Types of media:

- ▶ **Non Selective Media:** Blood agar and chocolate agar are examples of complex, nonselective media, which support the growth of many different bacteria.
- ▶ **Selective Media:** The basis for selective media is the incorporation of an inhibitory agent that specifically selects against the growth of irrelevant bacteria.
 1. Sodium azide—selects for gram-positive bacteria over gram-negative bacteria
 2. Bile salts (eg, sodium deoxycholate)—select for gram-negative enteric bacteria, and inhibit gram-negative mucosal and most gram-positive bacteria
 3. Colistin and nalidixic acid—inhibit the growth of many gram-negative bacteria

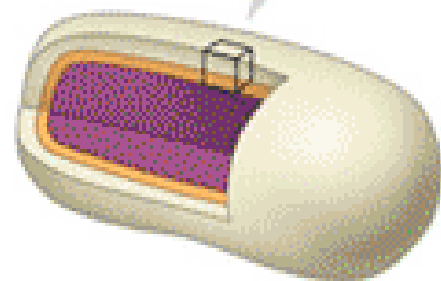
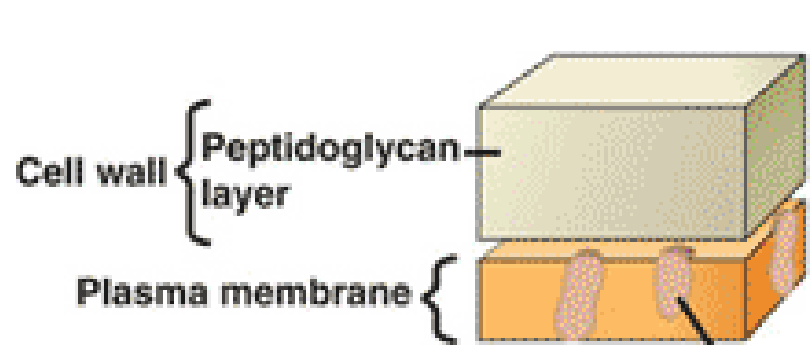
Examples of selective media are MacConkey agar (contains bile) that selects for the Enterobacteriaceae and CNA blood agar (contains colistin and nalidixic acid) that selects for Staphylococci and Streptococci.

- ▶ Differential Media contain some material that consumed by some type of bacteria make it differentiate from others in same family.
1. Hemolysis on blood agar
 2. Lactose fermentation on MacConkey agar.

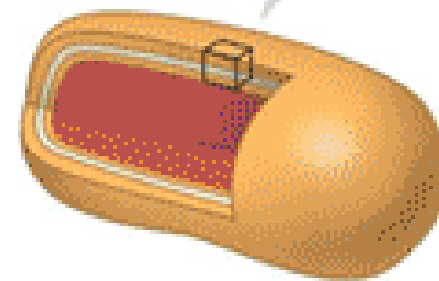
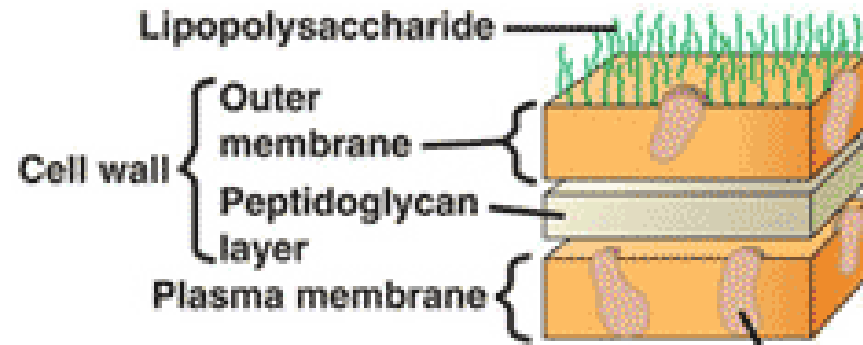
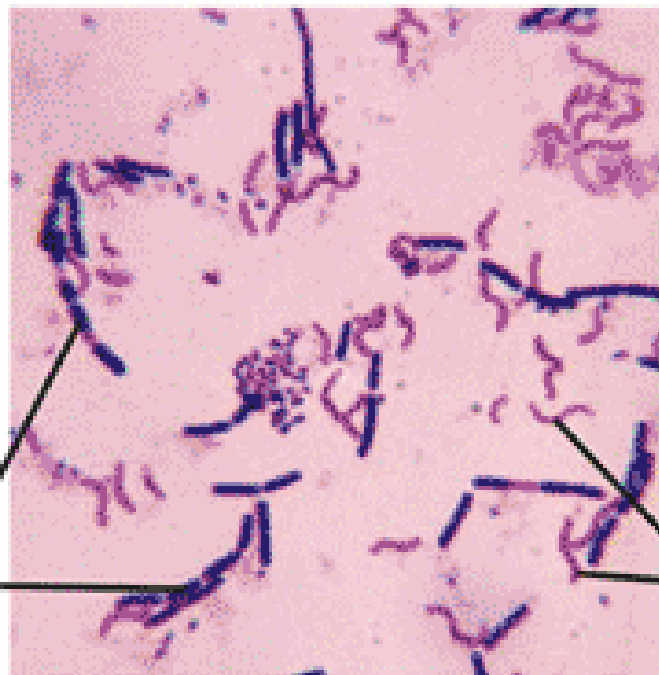


Bacterial Microscopy

- ▶ Depend on visualization of bacterial shape by microscope.
- ▶ The Gram stain, together with visualization by light microscopy, has been among the most informative methods for classifying the eubacteria.
- ▶ This staining technique is generally the first step in broadly dividing bacteria on the basis of fundamental differences in the structure of their cell walls.



(a) Gram-positive



(b) Gram-negative

Biochemical Tests

- ▶ Depend on the ability of some types of bacteria to produce or interact with specific reagent.
- ▶ **oxidase test** can be used to distinguish organisms on the basis of the presence or absence of a respiratory enzyme, cytochrome C, the lack of which differentiates the Enterobacteriaceae from other gram-negative rods.
- ▶ **catalase** activity can be used, for example, to differentiate between the gram-positive cocci.

Immunologic Tests

- ▶ The designation "sero" simply indicates the use of antibodies (polyclonal or monoclonal) that react with specific bacterial cell surface structures such as lipopolysaccharide (LPS), flagella, or capsular antigens. The terms "serotype," "serogroups," and "serovars" are, for all practical purposes, identical—they all utilize the specificity of these antibodies to subdivide strains of a particular bacterial species.

Genetic Instability

- ▶ Developments in molecular biology now make it possible to investigate the relatedness of genes or genomes by comparing sequences among different bacteria.
- ▶ For these cases genetic instability can cause some traits to be highly variable within a biologic group or even within a specific taxonomic group.
- ▶ For example, antibiotic resistance genes or genes encoding enzymes (lactose utilization, etc.) may be carried on **plasmids** or **bacteriophages**, extrachromosomal genetic elements that may be transferred among unrelated bacteria or that may be lost from a subset of bacterial strains identical in all other respects.

Gram Negative Bacteria

- ▶ Have a complex cell envelope consisting of an outer membrane, a periplasmic space containing a thin peptidoglycan layer and a cytoplasmic membrane.
- ▶ The cell shape may be spherical, oval, straight or curved rods, helical, or filamentous.
- ▶ Motility, if present, occurs by means of flagella or by gliding motility.
- ▶ Members of this category may be **phototrophic** or **nonphototrophic** bacteria.
- ▶ Include **aerobic**, **anaerobic**, **facultatively anaerobic**, and **microaerophilic** species

Gram Positive Bacteria

- ▶ The cell envelope of gram-positive organisms consists of a thick cell wall that determines cellular shape and a cytoplasmic membrane.
- ▶ Cells may be spherical, rods, or filaments.
- ▶ Some bacteria in this category produce **spores** (eg, *Bacillus* and *Clostridium spp.*) as resting forms that are highly resistant to disinfection.
- ▶ The gram-positive eubacteria are generally **chemosynthetic heterotrophs**.
- ▶ include aerobic, anaerobic, and facultatively anaerobic species.

Eubacteria Lacking Cell Walls

- ▶ These are microorganisms that lack cell walls.
- ▶ They are enclosed by a unit membrane, the plasma membrane.
- ▶ Six genera have been designated as mycoplasmas on the basis of their habitat; however, only two genera contain animal pathogens.
- ▶ Mycoplasmas are highly pleomorphic organisms and range in size from vesicle-like forms to very small ($0.2\mu\text{m}$), filterable form.
- ▶ Reproduction may be by budding, fragmentation, or binary fission, singly or in combination.
- ▶ A unique characteristic of the Mollicutes is that some genera require cholesterol for growth; unesterified cholesterol is a unique component of the membranes of both sterol-requiring and non-sterol-requiring species if present in the medium.

The Archaeobacteria

- ▶ These organisms are predominantly inhabitants of extreme terrestrial and aquatic environments (high salt, high temperature, anaerobic).
- ▶ The archaeobacteria consist of aerobic, anaerobic, and facultatively anaerobic organisms.
- ▶ **chemolithotrophs, heterotrophs, or facultative heterotrophs.**