SHAPE, SIZE AND ARRANGEMENT OF BACTERIA

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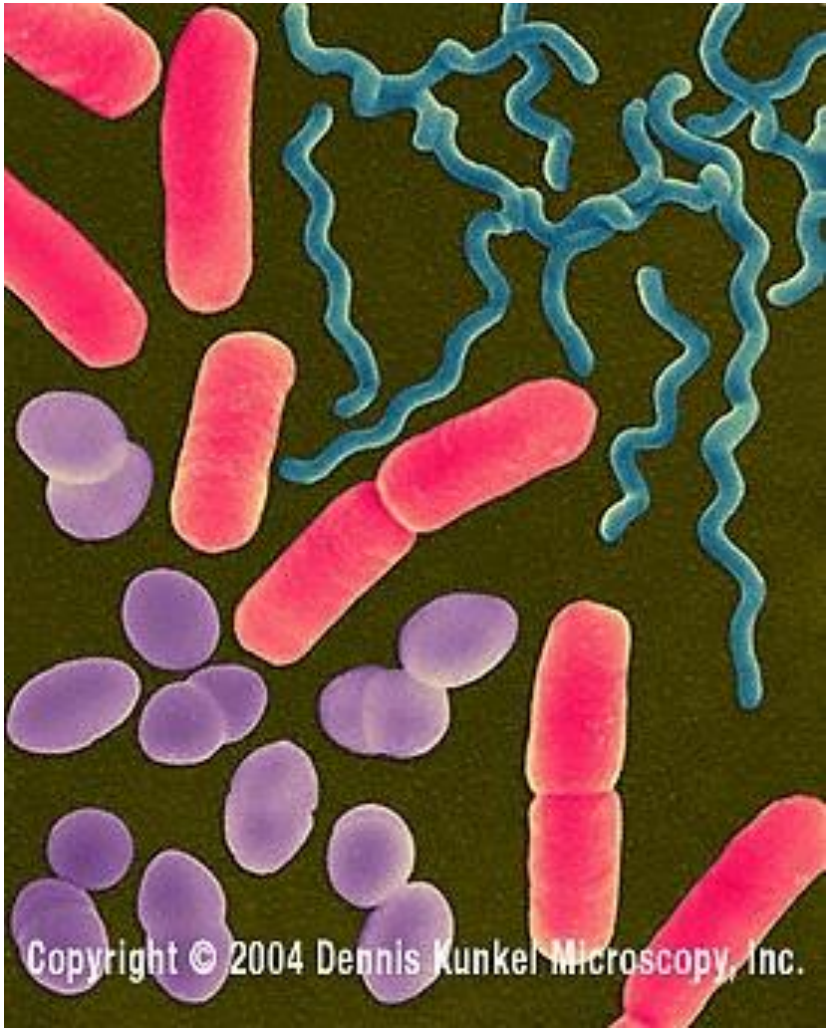
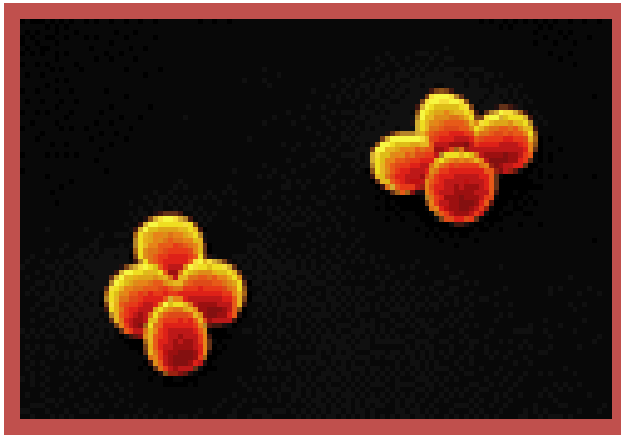
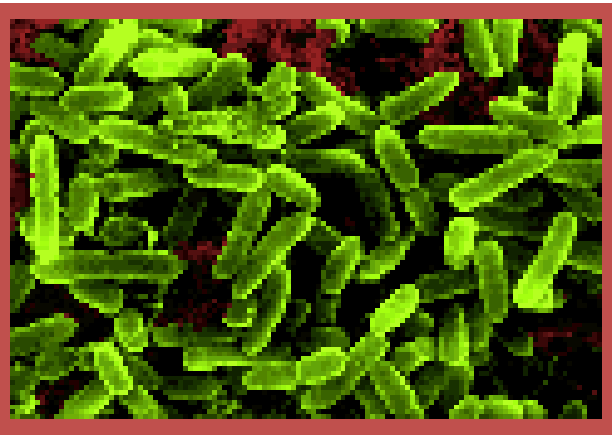
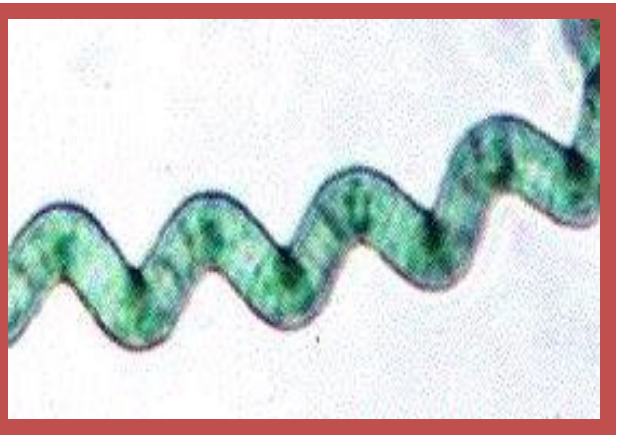
Shapes of Bacteria



Basic shapes

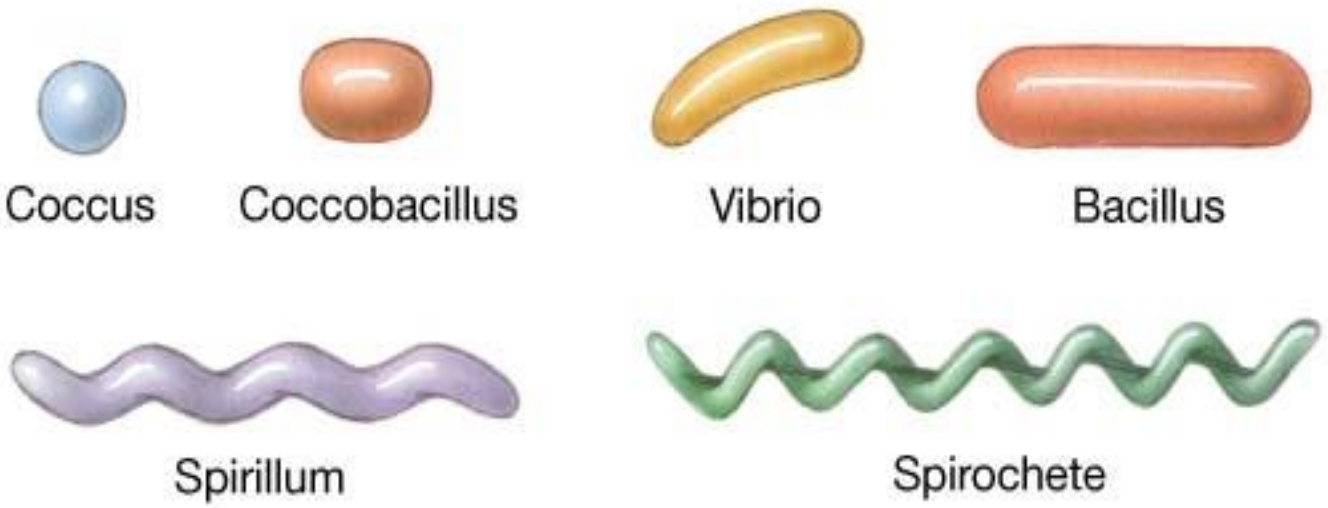
1. Coccus (pl. cocci)– round or spherical
2. Bacillus (pl. bacilli) – rod or cylindrical
3. Spirillum (pl. spirlli) – spiral

SHAPES OF BACTERIA

- ***Cocci*** – Spherical or ovoid cells, e.g*. Staphylococcus* .
- ***Bacilli*** –
  - Straight and cylindrical rods, e.g. *Bacillus* spp.
  - long, thin filamentous form, e.g. *Actinomycetes*
- ***Spirillum*** –
  - comma-shaped (vibrio), e.g. *Vibrio, Campylobacter*
  - spiral-shaped, loosely coiled (spirochete), e.g. *Spirochetes,*
  - elongated, tightly coiled (spirillum), e.g. *Azospirillum* spp)
- ***Pleomorphic*** – variable shape

Other Common Shapes

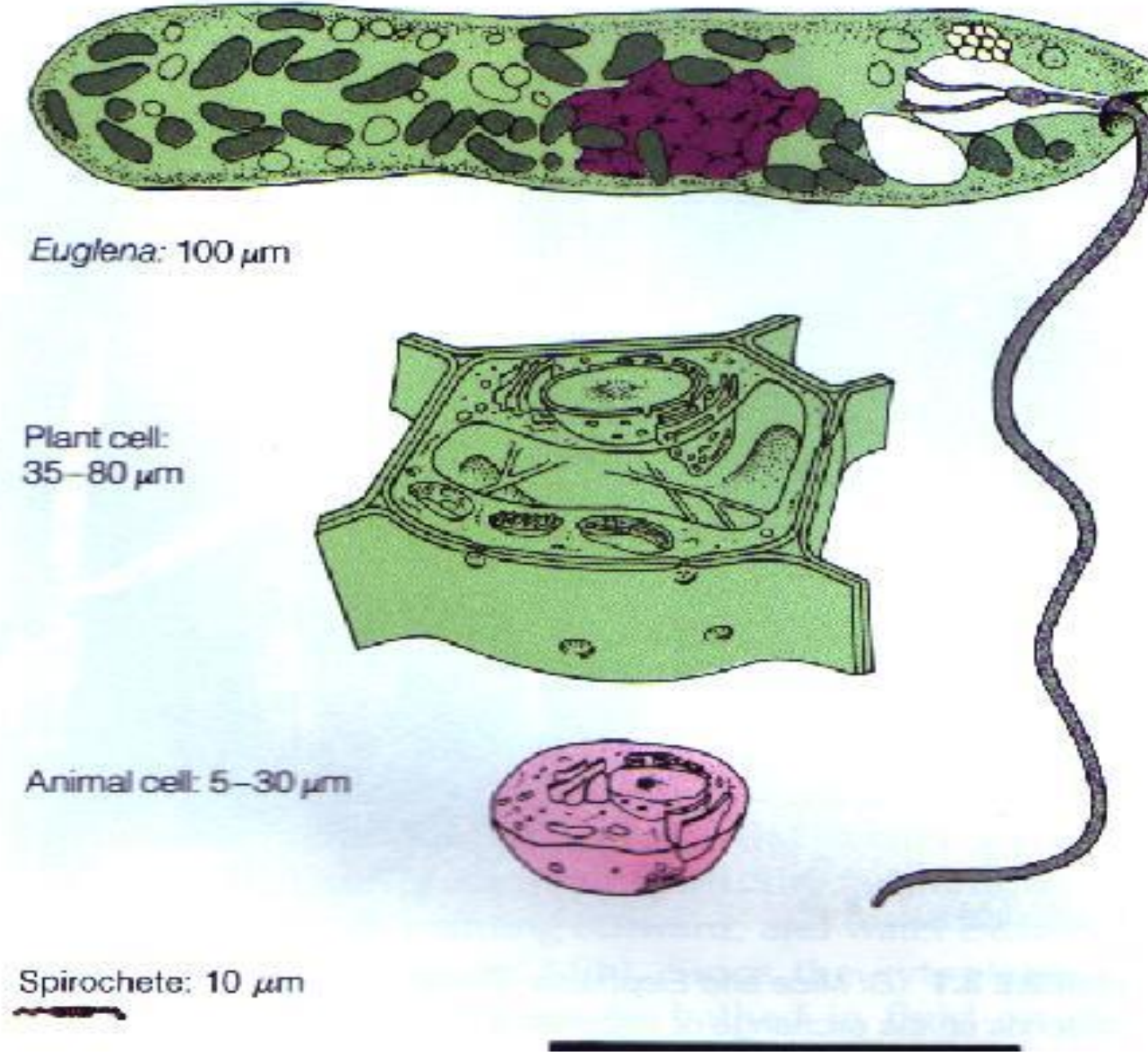


- **Coccobacilli**
  - cells in between round and rod shape
- **Vibrio**
  - curved cell

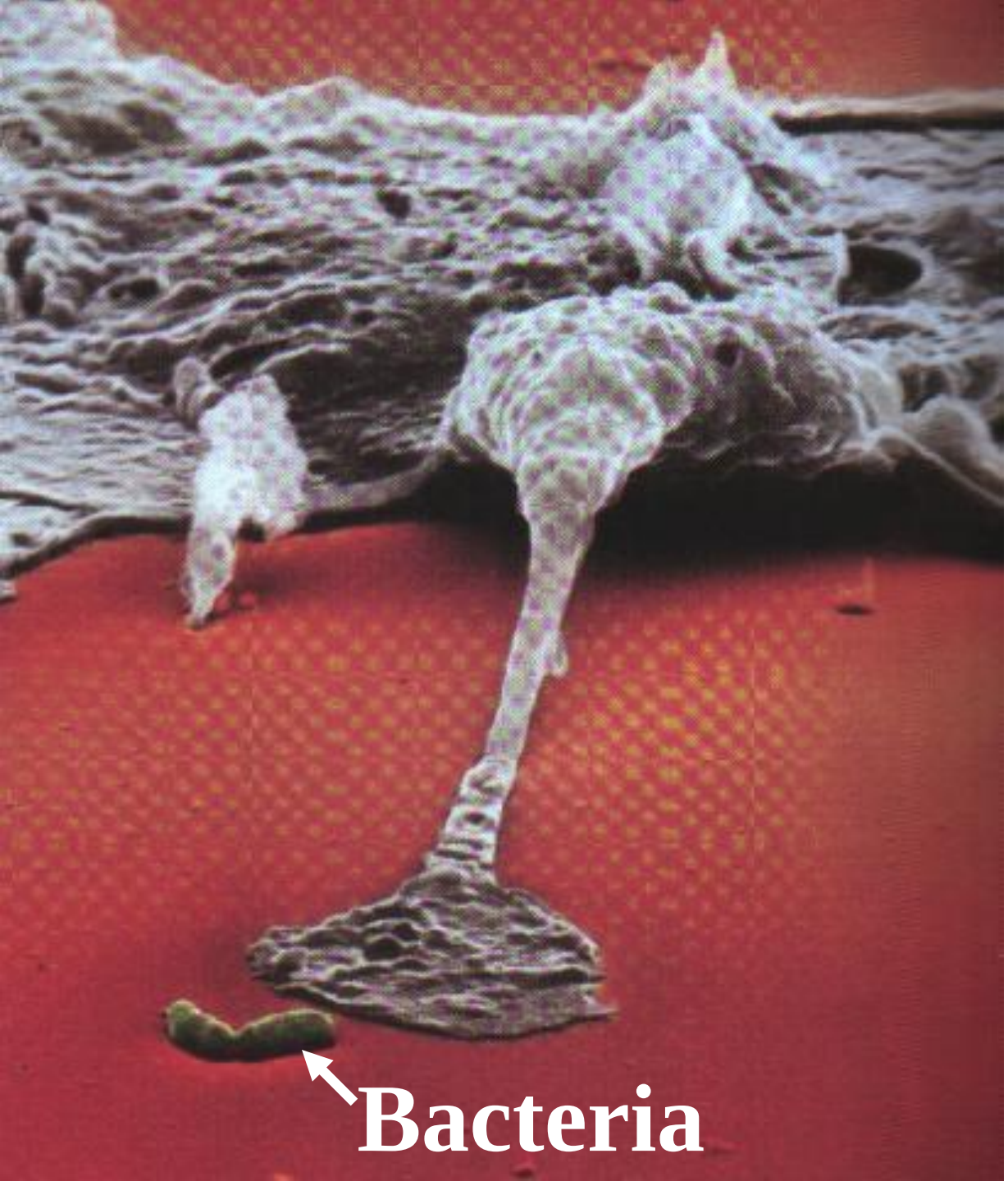
- **Spirillum**
  - spirilla, plural
  - rigid, wave-like shaped cell
- **Spirochete**
  - Corkscrew shaped cells

SIZE OF BACTERIA

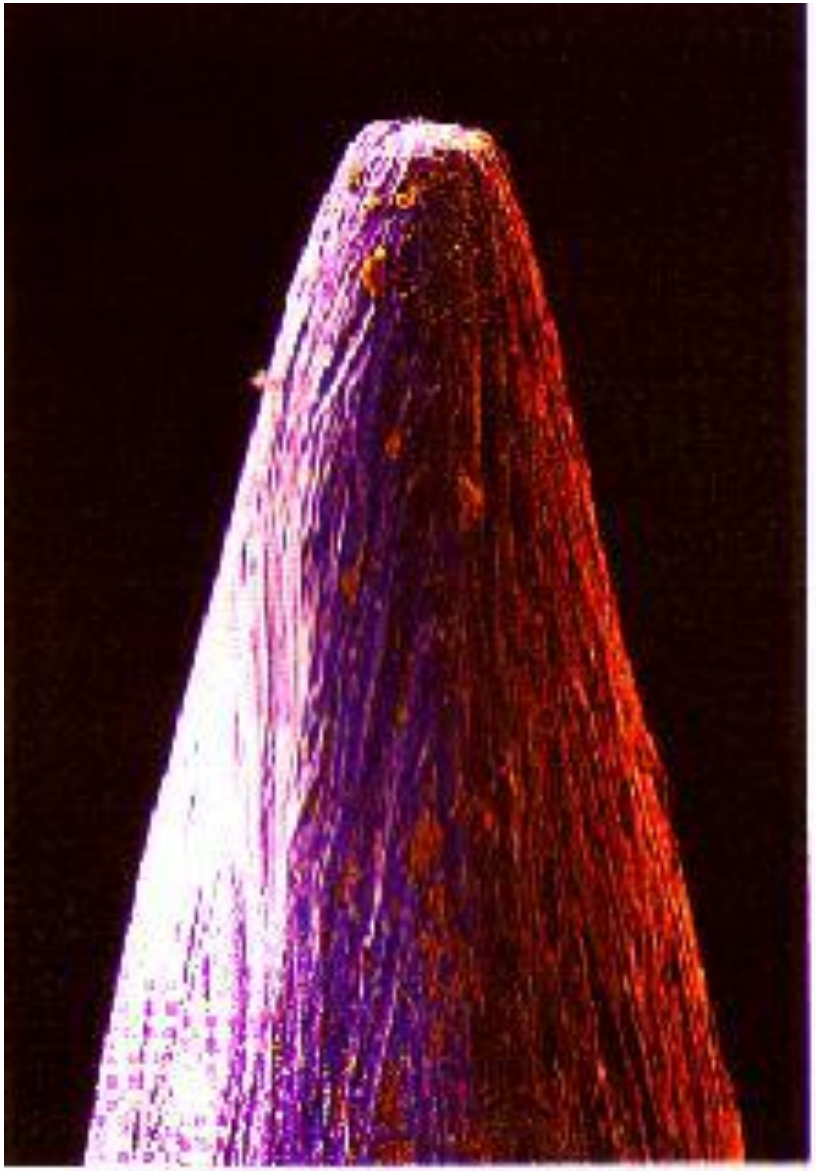
- **Bacteria are very small in size**
  - **cocci are approx. 0.5 to 1.0 µm in diameter.**
  - **rods range from 2 to 5 µm in length by 0.5 to 1.0 µm in width**
  - **Spirochetes are longer (up to 20 µm) and narrower (0.1 to 1.0 µm)**
- **varies with the medium and growth phase**
- **usually smallest in the logarithmic phase of growth.**



Bacteria are very small compared to cells with nuclei

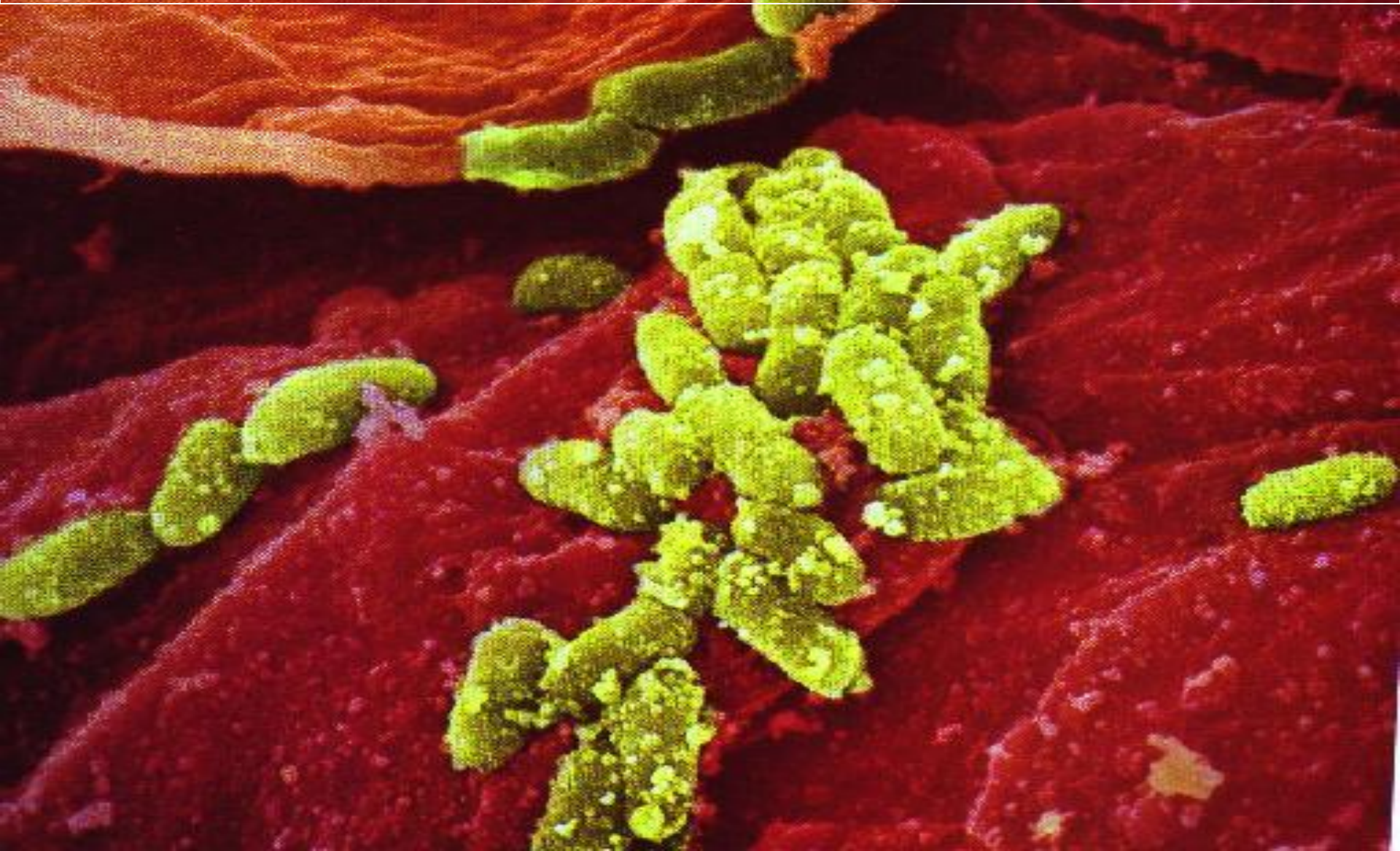


Bacteria compared to a white blood cell that is going to eat it



Bacteria on pin-head

Clean skin has about 20 million bacteria per square inch



Surface area/volume ratio

The surface area/volume ratio of a spherical bacteria of 1 µm in diameter is high (6:1) as compared to a spherical eukaryotic cell having a diameter of 20 µm (0.3:1).

Consequently:

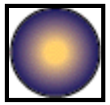
- **the intake of nutrients and removal of waste products is quick - the bacteria has high rate of growth and metabolism.**
- **no circulatory mechanism for nutrients is needed - the cytoplasmic streaming is absent.**

ARRANGEMENT OF BACTERIAL CELLS

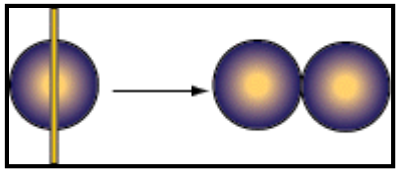
Cocci

- ***Diplococci*** **- Cells divide in one plane and remain attached predominately in pairs, e.g. pneumococci.**
- ***Streptococci*** **- Cells divide in one plain and remain attached to form chains, e.g *Streptococcus***
- ***Tetracocci*** **- Cells divide in two planes and forms groups of four cells. (also called as 'tetrads'), e.g. *Aerococcus*.**
- ***Sarcinae*** **- Cells divide in three planes, in a regular pattern producing a cubodial arrangement of cells.**
- ***Staphylococci*** **- Cells divide in three planes, in an irregular pattern producing bunches of cocci, e.g. *Staphylococcus aureus***

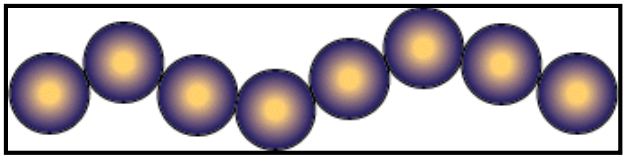
Spherical is called coccus.



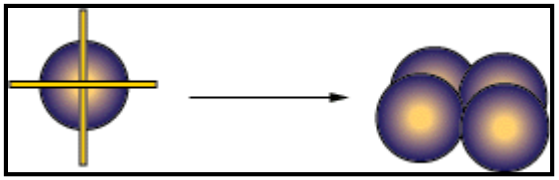
Division along the same plane forms chains; 2 cocci together - Diplococcus



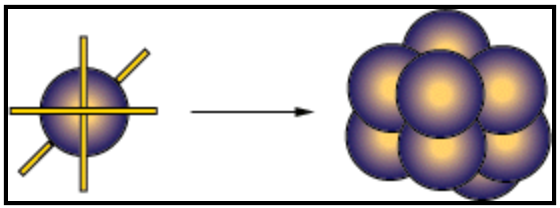
4 - 20 in chains - Streptococcus.



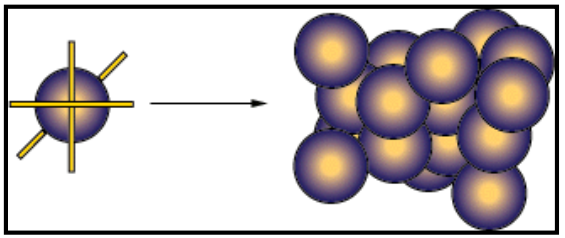
Division along 2 different planes - Tetrads



Division along 3 planes regularly - Sarcinae

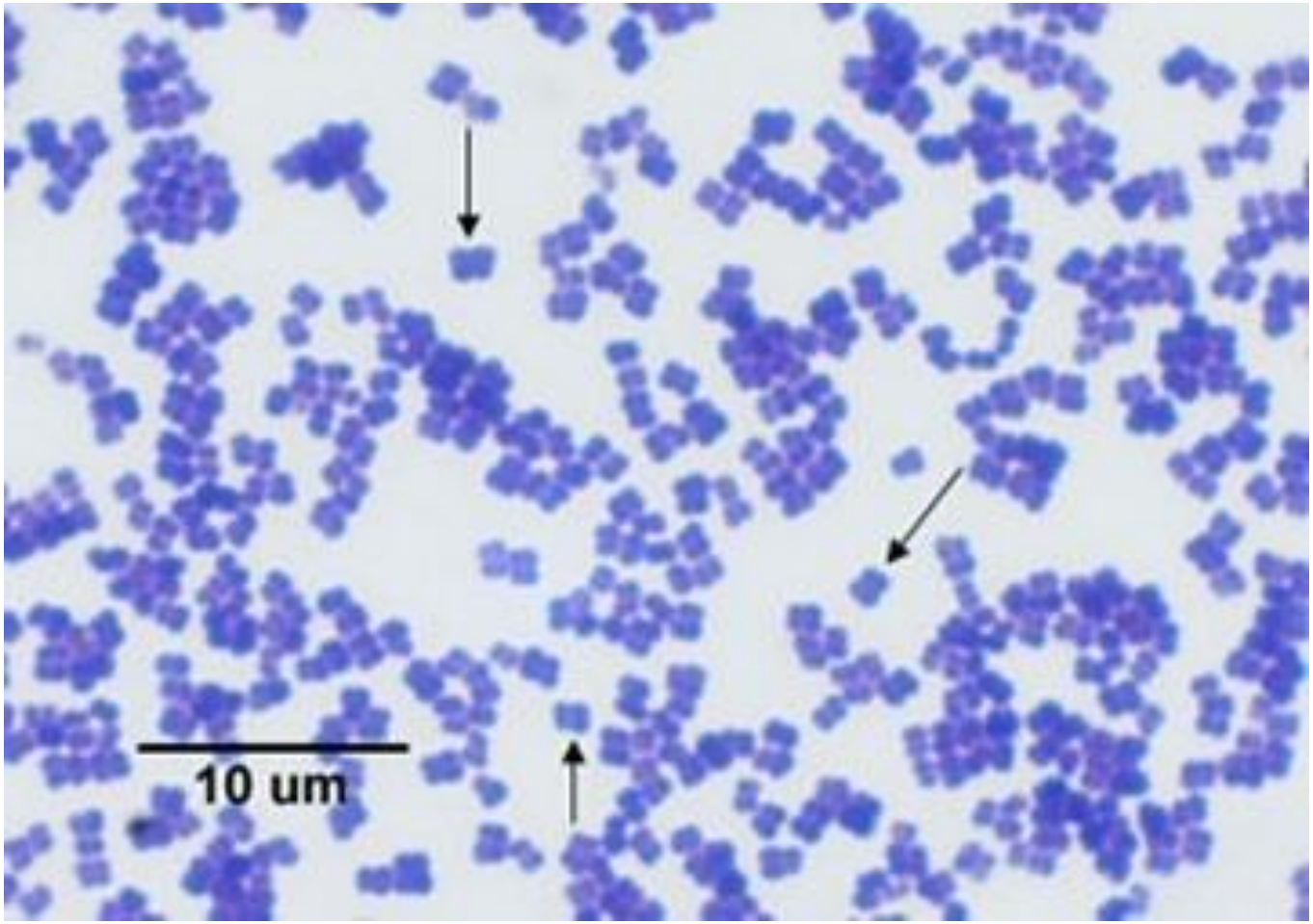


Division along 3 planes irregularly - Staphylococci

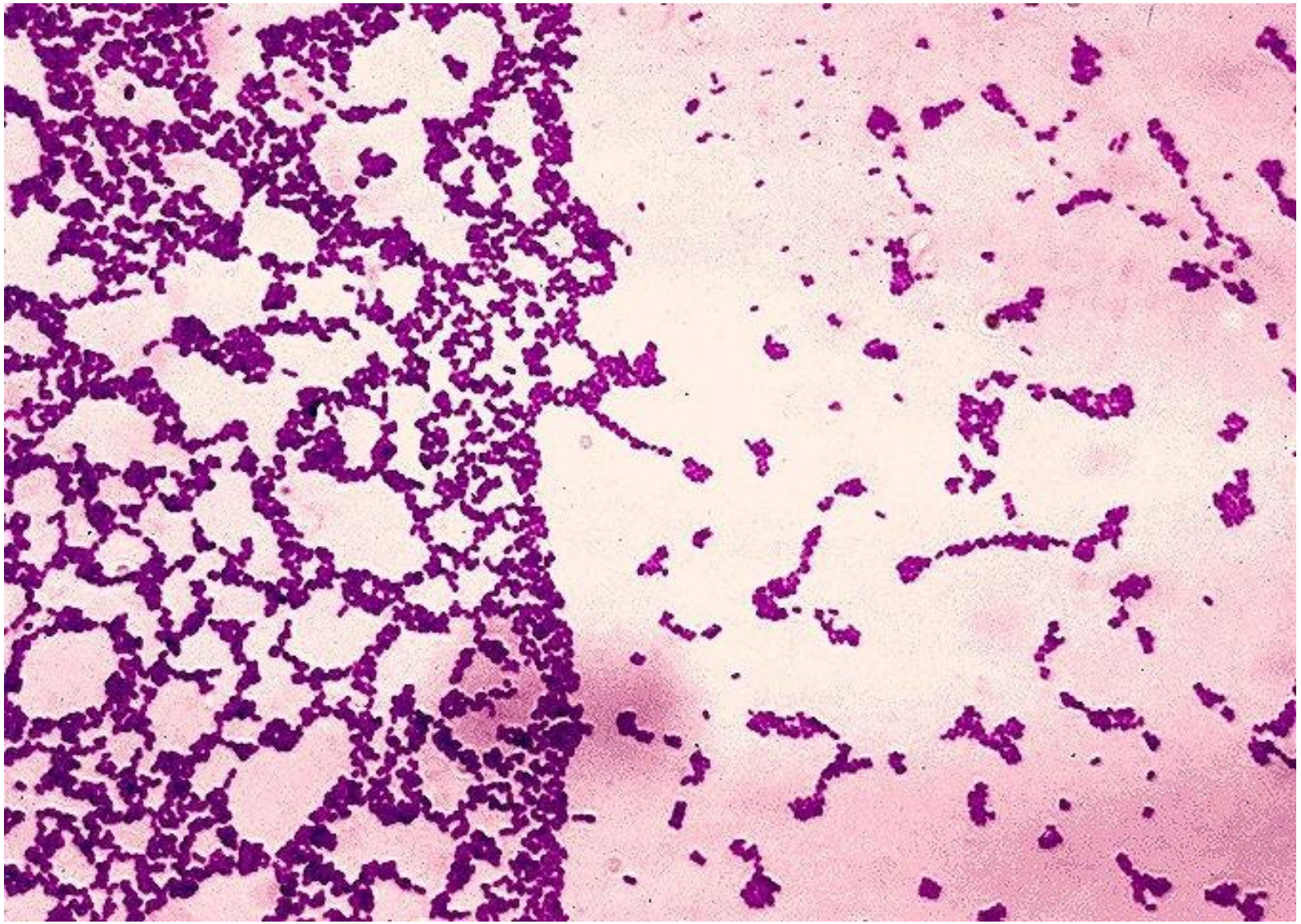


Small cocci occurring singly or in small groups

A tetrad appears as a square of four cocci (arrows)



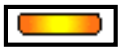
COCCI ARRANGED IN CLUSTERS



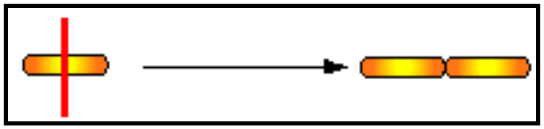
Bacilli

- ***Single***
- ***Diplobacilli*** **- in pairs**
- ***Streptobacilli*** **– in chains, e.g.** ***Bacillus subtilis***
- ***Trichomes*** **- rod-shaped bacteria arranged in chains with a larger area of contact between adjacent cells, e.g.** ***Beggiatoa*** **spp.**
- ***Palisade*** **– the cells are lined side by side as match sticks, e.g.** ***Mycobacterium tuberculosis.***
- ***Chinese letter like*** **– e.g.,** ***Corynebacterium spp.***
- ***Filamentous*** **– long, mycelium like branching, mono-nuclear, e.g.** ***Actinomycetes***
- ***Hyphae*** **– long, branched, multinucleate filaments, e.g.** ***Streptomyces*****.**

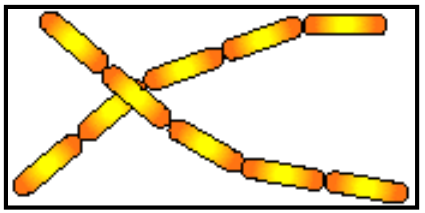
Rod shape is called Bacillus.



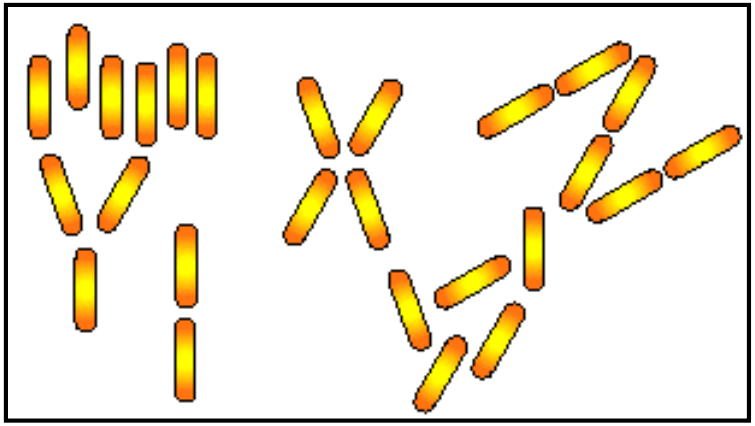
Two bacilli together - Diplobacilli



Chains of bacilli are called Streptobacilli



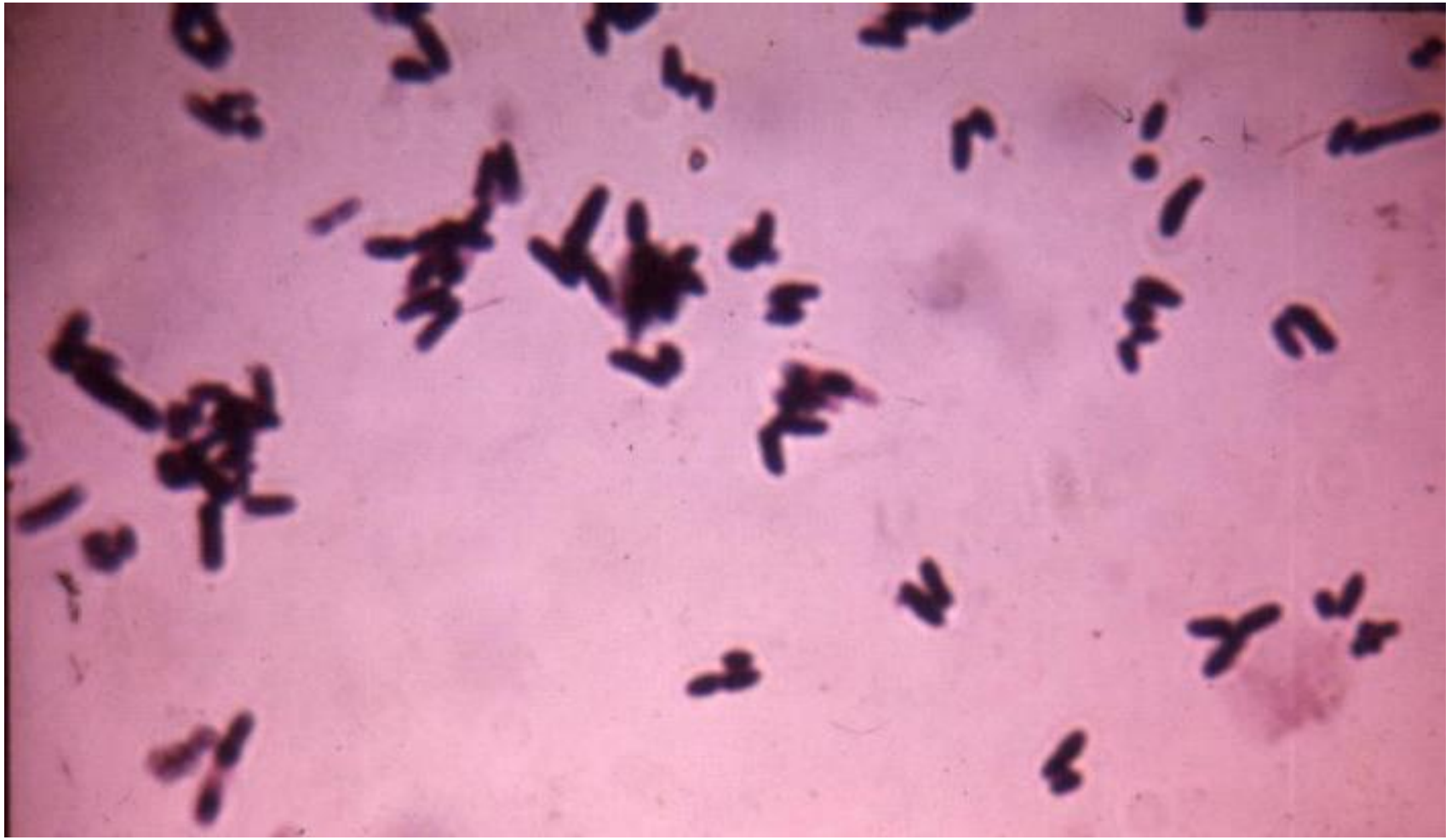
Palisades - Rods side by side or in X, V or Y figures




Long, thin rods

BACILLI ARRANGED IN LONG CHAINS

CHINESE LETTER LIKE ARRANGEMENT



Basic Bacterial Structure

Being small offers bacteria unique opportunities for survival and reproduction

Bacterial Structure: Cell Envelope

- Components of the bacterial cell envelope:
  - **Cytoplasmic Membrane**
  - **Cell Wall**
  - **Capsule**
  - **Slime**
  - **Flagella**
  - **Fimbriae/Pilli**

Bacterial Structure: Intracellular Structures

- Intracellular components:
  - **Nucleoid**
  - **Ribosomes**
  - **Inclusion granules**
  - **Endospores**

STRUCTURES OF BACTERIA

Structure	Function
Cell Wall	Protects and gives shape
Cell Membrane	Regulates movement of materials, contains enzymes important to cellular respiration
Cytoplasm	Contains DNA, ribosomes, essential compounds
Chromosome	Carries genetic information
Plasmid	Contains some genes obtained through recomb.
Capsule & Slime Layer	Protects the cell and assist in attaching cell to other surfaces
Endospore	Protects cell agains harsh enviornments
Pilus	Assists the cell in attaching to other surfaces
Flagellum	Moves the cell

MYCOPLASMAS (PPLO)

- naturally lack cell walls
- Gram-negative
- size ranges from 50-60 to 100-250 nm
- highly pleomorphic eubacteria
- five genera require sterols and three do not.
- no free-living Mycoplasma; strictly parasitic
- parasitize a wide range of organism including humans, plants, animals, and insects.

MYCOPLASMAS

- facultative anaerobes and obligate anaerobes.
- growth on artificial media is slow with a generation time ranging up to nine hours in some species.
- supplementation with other factors, such as serum, may be required
- utilize glucose or arginine as the major source of energy.
- ‘fried egg’ or ‘nipple shaped’ colonies, which can be stained by Dienes’ stain.

RICKETTSIA AND CHLAMYDIA

- coccoid to rods in shape, with a diameter of 0.3-0.7 μm.
- Gram-negative type cell walls
- except one rickettsia (*Rochalimaea*), all are obligate intracellular parasites.
- contain both DNA and RNA.