BACTERIAL CLASSIFICATION

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Course: **Medical Bacteriology MA 323**

Fall Semester

Week 2

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• Classification of Bacterial Media

-Phenotypic classification

- ➢ Morphological
- ➢ Anatomical
- ➢ Staining
- ➢ Cultural characteristics
- ➢ Environmental factors
- ➢ Biochemical reactions

- Genotypic classification

- DNA-DNA hybridization
- G+C content

➢ Morphological Classification

1. TRUE BACTERIA

- Cocci – These are spherical or oval cells.

-Arrangements

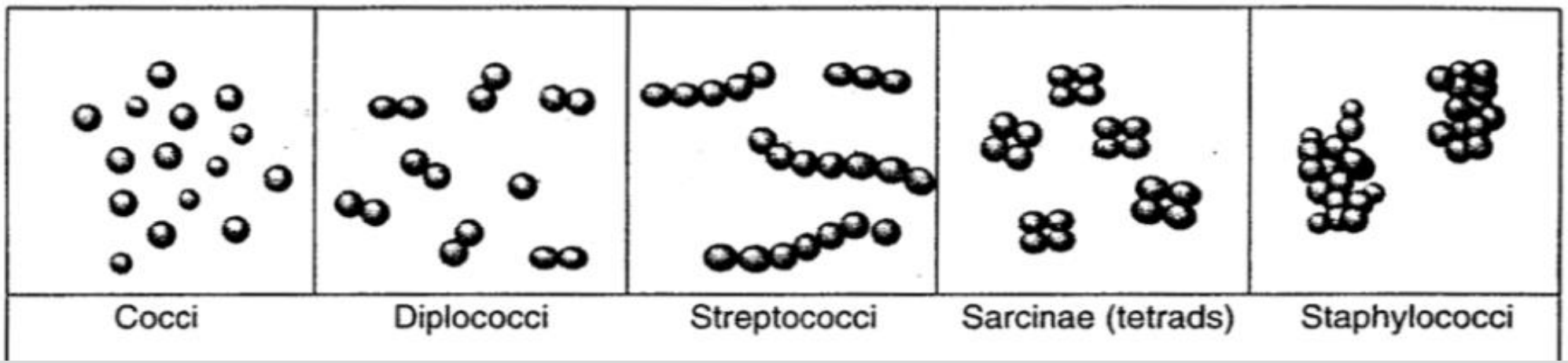
– Monococci (Cocci in singles)
e.g. *Micrococcus luteus*

– Diplococci (Cocci in pairs)
e.g. *Neisseria spp*

– Staphylococci (Cocci in grape-like clusters)
e.g. *Staphylococcus aureus*

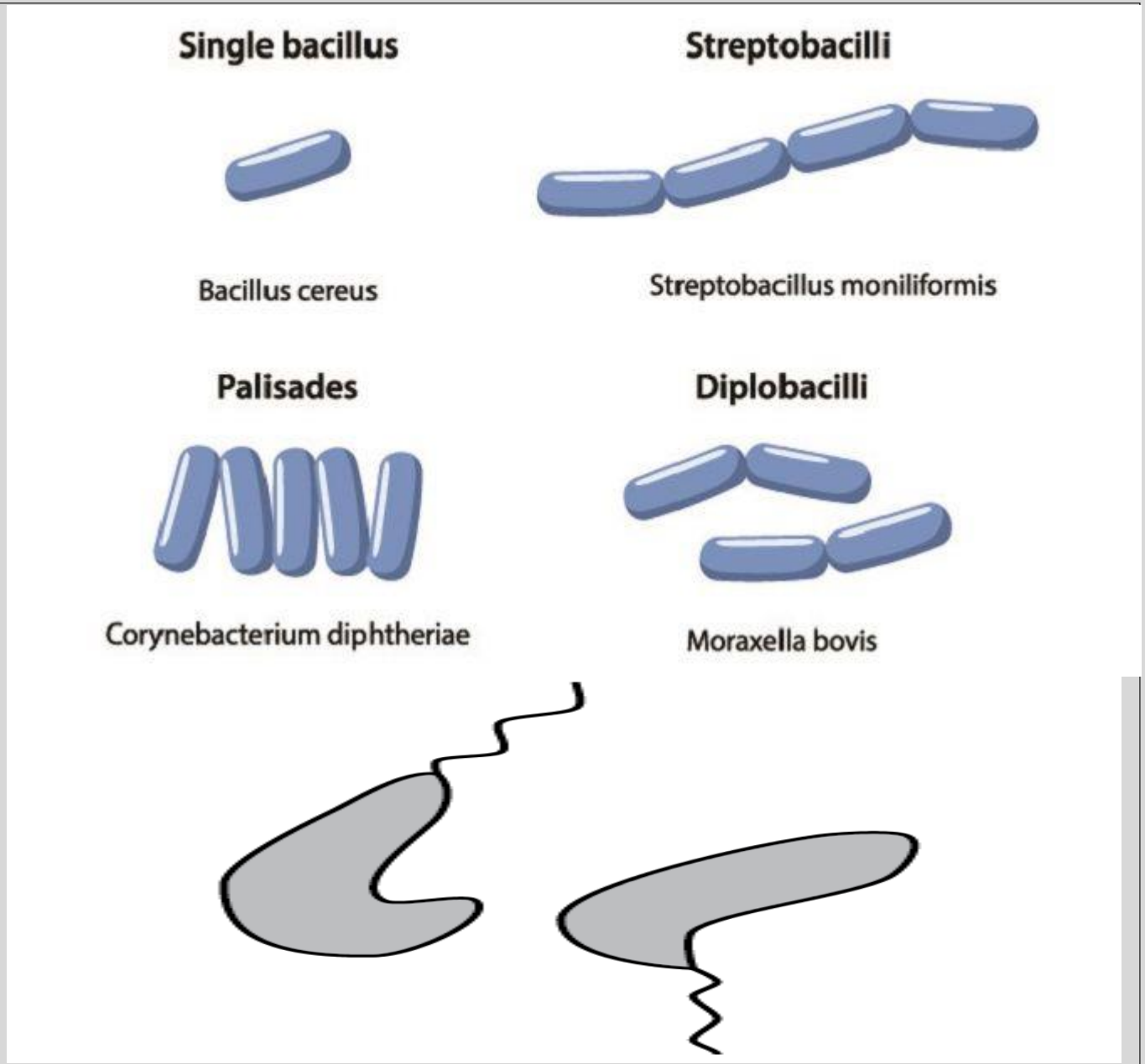
– Streptococci (Cocci in chains)
e.g.*Streptococcus pyogenes*

– Tetrad (Cocci in group of four)
e.g. *Micrococcus* spp.
– Sarcina (Cocci in group of eight)


Cocci
Diplococci
Streptococci
Sarcinae (tetrads)
Staphylococci

- Bacilli

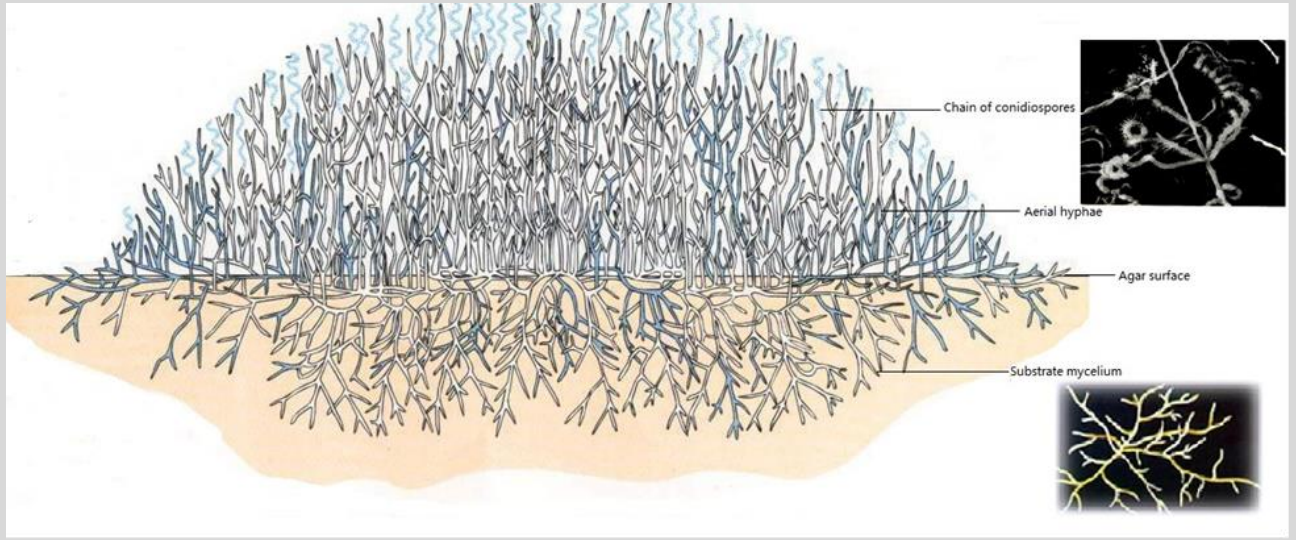
  - Diplobacilli
  - Streptobacilli
  - Palisades – Chinese-letter form
  - Coccobacilli
  - Comma-shape



2. ACTINOMYCETES.

ACTINOMYCETES (actin- ray, mykes-fungus)(actin- ray, mykes-fungus)

- These are rigid organisms like true bacteria but they resemble fungi in that they exhibit branching and tend to form filaments.



- They are termed such because of their resemblance to sun rays when seen in tissue sections.

3. Spirochaetes

- These are relatively longer, slender, non-branched.
- These are relatively longer, slender, non-branched microorganisms of spiral. shape having several coils.
- microorganisms of spiral shape having several coils.

4- Mycoplasmas

- These bacteria lack in rigid cell wall (cell wall lacking)
- Highly pleomorphic and of indefinite shape.
- They occur in round or oval bodies and in interlacing filaments

5- Rickettsia and Chlamydia

- These are very small, obligate parasites, and at one time were considered closely related to the viruses.
- Now, these are regarded as bacteria .

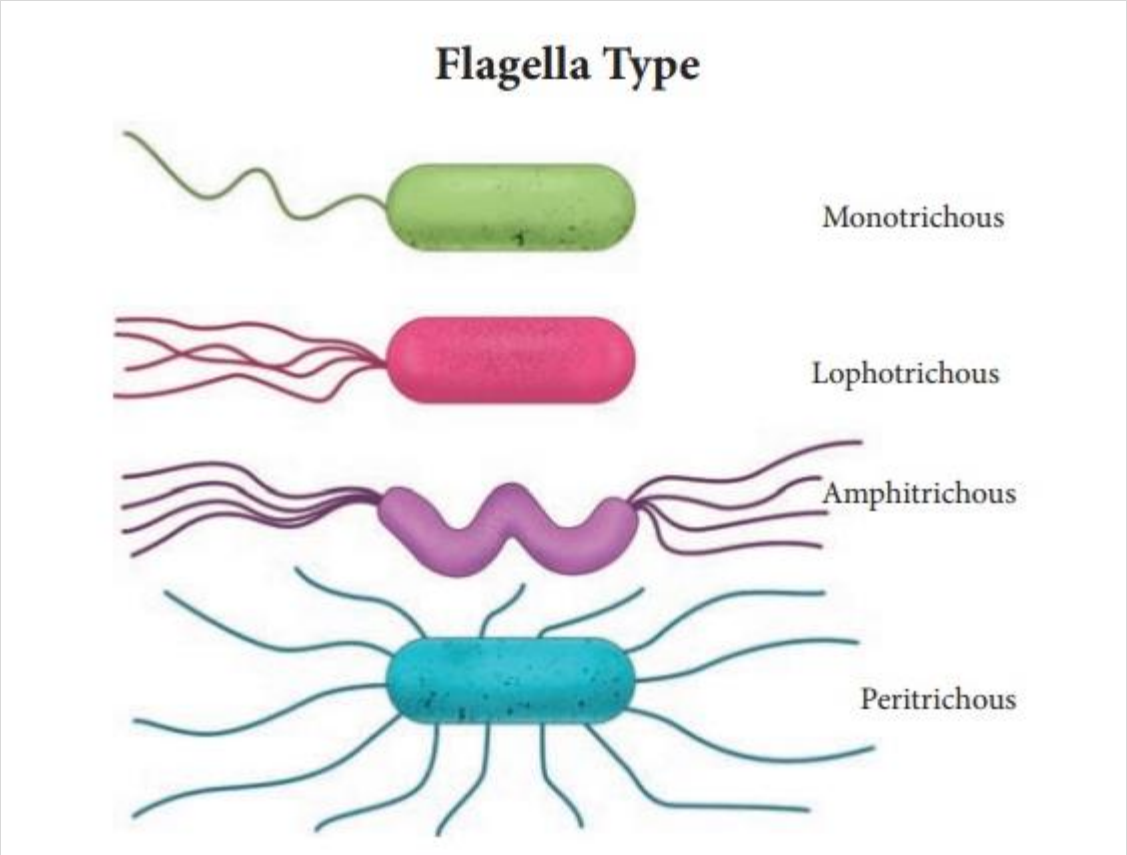
➢ Classification Based on Anatomical features

• Capsule
• Capsulate – *Streptococcus pneumoniae*

• Non-capsulate – *Streptococci viridans*

• Flagella
• Flagellate

•Aflagellate – Shigella spp.



• Spore – Spore-forming – *Bacillus spp*.

• Non-sporing – *Escherichia coli*

➢ Classification Based on Staining reaction

• **GRAM'S STAIN**
- Gram-positive cocci – *Staphylococcus aureus*
- Gram-negative rods – *E. coli*

• **ACID FAST STAIN**

– Acid-fast bacilli –*Mycobacterium tuberculosis*

– Non-acid-fast bacilli – *Staphylococcus aureus*

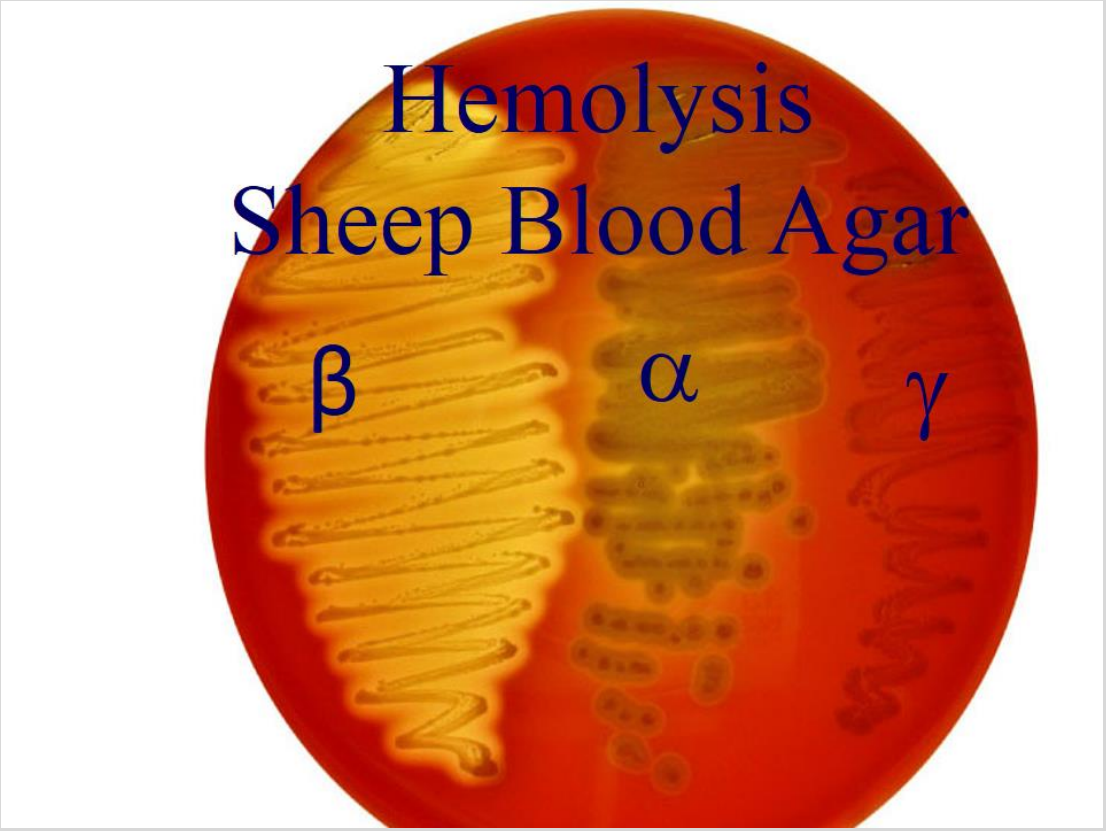
➢ **Based on Cultural characteristics**

- Extra growth factors requirements

- Fastidious – *Hemophilus influenzae*
- Non-fastidious – *Escherichia coli*

- Hemolysis on Blood Agar

- Alpha-hemolysis – *Streptococcus pneumoniae*
- Beta-hemolysis – *Streptococcus pyogenes*
- Gama hemolysis (No hemolysis)



• Pigment production

•Pigment producer – *Staphylococcus aureus*

•Pigment non-producer – *Escherichia coli*

➢ Based on environmental factors

- Temperature
- Oxygen dependence
- pH
- Salt concentration
- Atmospheric pressure

- **Temperature**

- Psychrophiles (15-20 C)

- Mesophiles (20-40 C) (most of the pathogenic and normal flora)
Escherichia coli, Salmonella enterica, Staphylococcus aureus

- Thermophiles (50-60 C)

•Oxygen dependence

• **Aerobe**
• **Obligate aerobes** – Strictly require O2 for their growth (*Pseudomonas aeruginosa)*

• **Microaerophilic** (grow under reduced O2, 5- 10% and increased CO2, 8-10%)- *Campylobacter jejuni, Helicobacter pylori*

•**Facultative** anaerobe (capable of growing either in presence or absence of O2)- *E. coli*

• Obligate anaerobe – *Clostridium spp.*

•pH

•**Acidophiles (Lactobacillus** acidophilus)
• **Alkaliphiles (Vibrio)**
• **Neutralophilic** (pH 6-8) Majority of the medically important bacteria grow best at neutral or slightly alkaline reaction (pH 7.2-7.6)

➢ Other ways of classification

- Motile/Non-motile
- Pathogenic/Non-pathogenic/Opportunistic
- Sensitive/Resistant (to particular antibiotic/ chemicals)
- Lactose fermenter/Lactose non-fermenter
- Gram-negative eubacteria that have cell walls
- Gram-positive eubacteria that have cell walls
- Cell wall-less eubacteria: *Mycoplasma*

Next Lecture
Normal Flora Bacteria