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Lecture. 4
Two stage

College of Technology & Health Sciences
Department of Medical Laboratory Technique

Staphylococcus, Streptococcus, Enterococcus

Staphylococcus

The genus staphylococcus consists of 32 species, most of which are pathogens or commensals **associated with skin**, **skin glands** and **mucous membranes**.

Growth characteristics

The bacteria belonging to this genus **are aerobic and facultative anaerobic**, **catalase positive**, **oxidase negative**, **non-motile**, **non-spore forming and are arranged in clusters**, **pairs**, or **tetrads**. The genus name staphylococcus refers to the fact that these gram-positive cocci grow in a pattern resembling **a cluster of grapes.** Staphylococcus aureus is the most important human pathogen. The other important human pathogens are coagulase negative, which include staphylococcus epidermidis, staphylococcus saprophyticus, and staphylococcus haemolyticus.

Properties of the bacteria

Morphology

Staphylococci show following features:

- They are Gram-positive cocci, measuring around 1 μm in diameter.
- They are non-motile and non-sporing.
- They are non-capsulated. They, however, contain a microcapsule, which can be visualized by electron microscope only, but not by a light microscope.

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Culture

Staphylococci are aerobes and facultative anaerobes but can grow in the absence of oxygen also. They grow at a temperature range of 10 - 42°C (optimum temperature 37°C) and a pH range of 7.4 - 7.6 (optimum pH 7).

Blood agar: Staphylococci aureus produces a clear zone of hemolysis (beta hemolysis) surrounding the colonies on blood agar.

Selective media: Mannitol salt agar is the commonly used selective medium for isolation of S. aureus from clinical specimens containing normal bacterial flora (e.g., stools). Most strains of S. aureus ferment mannitol with acid production, which gives rise to yellow zone formation around the colonies.

Hemolysins: S. aureus are golden yellow and produces four hemolysins: alpha, beta, gamma and delta hemolysins.

Laboratory diagnosis

Laboratory diagnosis of staphylococcal infections is based on the demonstration of staphylococci, in appropriate clinical specimens, by culture and microscopy.

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Streptococcus

Streptococci **are aerobic and facultative anaerobic** Gram positive **cocci**, **arranged in pairs, or chains**. Streptococci are part of the **normal flora in humans**. They are **spherical or ovoid cocci**, and have **hyaluronic acid capsules**. Streptococci divide in one plane and thus occur in pairs or in chains of varying lengths, especially in liquid media and clinical specimens.

Properties of the bacteria Morphology

- They are catalase negative by which they are distinguished from staphylococci.
- They are fastidious bacteria requiring enriched medium, such as blood agar for their growth.
- They are non-motile and non-spore.
- Some strains of S. pyogenes and some strains of group C streptococci produce capsule during the first 2- 4 hours of growth.

Enterococcus

Enterococcus species are enteric streptococci which are found naturally in the **intestinal tract of human.** The enterococci **are facultative anaerobes**. **They require complex nutrients for their growth**.

They are opportunistic pathogens and differ from the streptococcus species in two important respects:

1. They tolerate bile salts and grow on MacConkey agar as red, pin-point colonies.

2. Some isolates are motile.

Characteristics of enterococci

The enterococci are gram-positive cocci typically arranged in pairs and short chains, and is non-motile and non-capsulate. The cocci are facultatively anaerobic and grow optimally at 35°C, although most isolates can grow in the temperature range l0ºC to 45°C. They grow readily on blood agar media, with large, white colonies appearing after 24 hours of incubation; the colonies are typically non-hemolytic but can be α hemolytic or b-hemolytic.

Distinctive features of enterococci

The Enterococci possess several distinctive features separating them from streptocooci: The enterococci grow in the presence of 6.5 %NaCl, 40 % bile, at pH 9.6, at 45°C and in 0.1 percent methylene blue. It survives heating at 60°C for 30 min, a feature distinguishing it from streptococci, and also grows within a wider range of temperatures (10-45°C). On MacConkey medium they produce deep pink colonies.

Identification

The identification of enterococcus species is made on biochemical characteristics. E. faecalis can be identified by its ability to ferment mannitol, sucrose and sorbitol, and to grow on tellurite blood agar producing black colonies with gas production.