



Staphylococcus

LEC . 7

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QUESTIONS SHOULD BE ANSWER THROUGH LECTURE

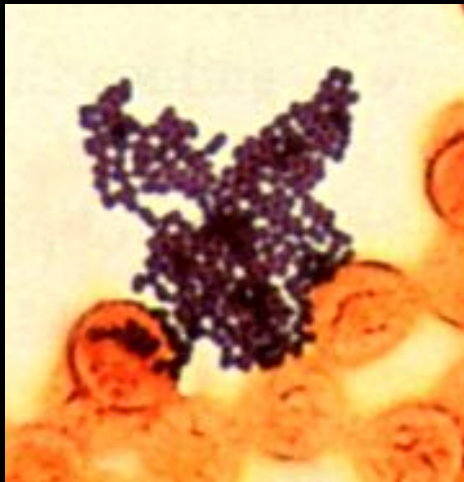
-WHAT IS STAPHYLOCOCCI ??

-WHAT ARE DISEASES THAT CAUSING? AND HOW?

-WHO CAN DIAGNOSE IN LABORATORY?

-WHO CAN DIFFERENTIATE FROM CLOSLEY RELATED SPECIES?

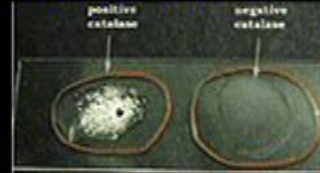
Pyogenic Cocci



Staphylococcus
Gram-positiv

Differential Characteristics

Catalase
 $2\text{H}_2\text{O}_2 \rightarrow \text{O}_2 + 2\text{H}_2\text{O}$
Streptococci vs. Staphylococci



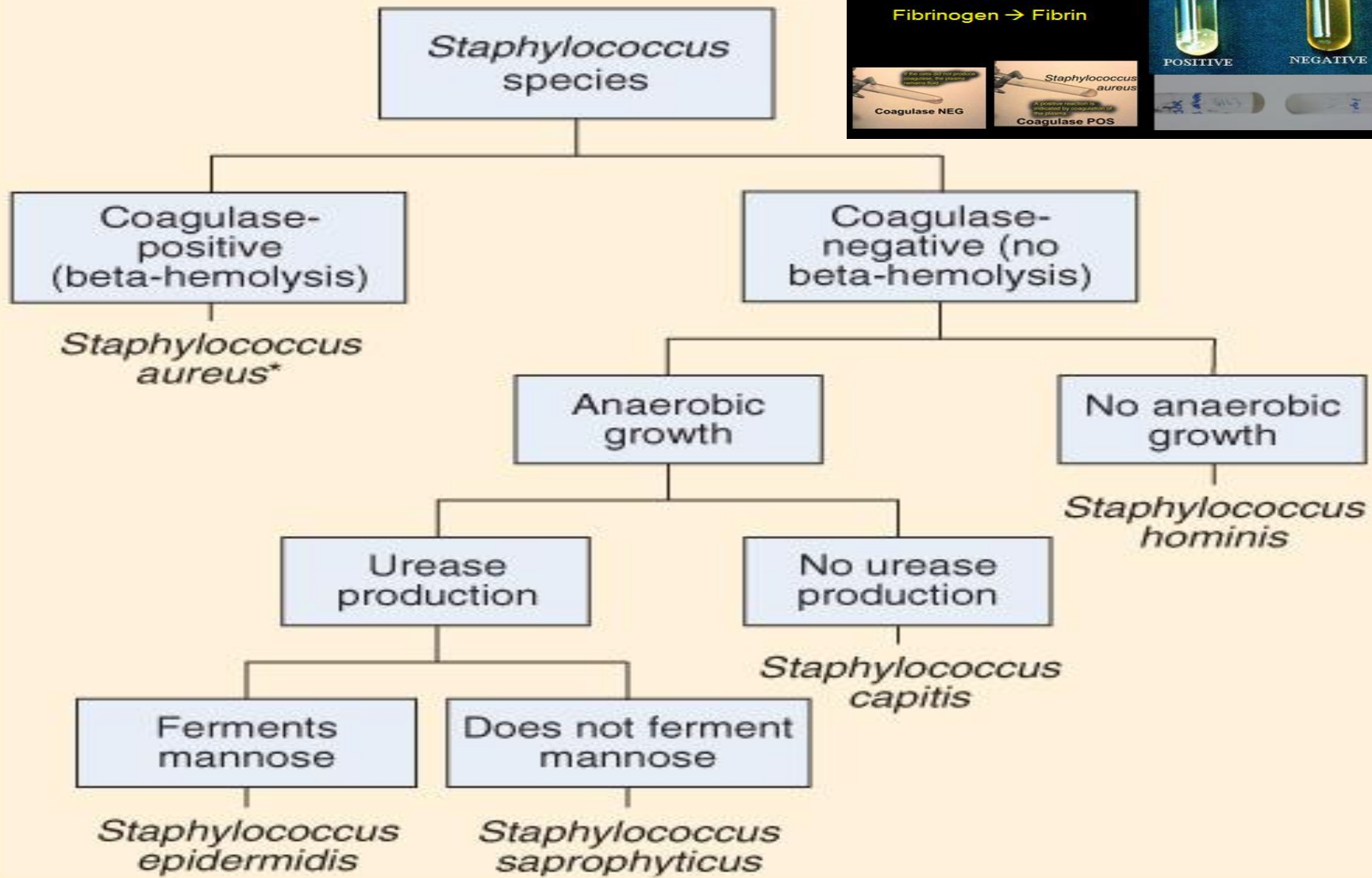
Streptococcus
Gram-positive



Neisseria
Gram-negative
Diplococci

TABLE 18.2

**Separation of Clinical
Species of *Staphylococcus***



*A few strains of *S. aureus* are coagulase-negative.

Structure and Physiology

- **Family :Micrococcaceae**
- **Genus: Micrococcus and Staphylococcus**
- **Species :**
- **Staph. aureus:**
- **Gram-positive cocci, nonmotile, facultative anaerobes**
- **Cells occur in grapelike clusters**
- **Salt-tolerant: tolerate (5-25%NaCl)**
- **Tolerant of desiccation: allows survival on environmental surfaces (fomites)**

Pathogenicity

- **Pathogenicity results from 3 features**
 - ✓ **Structures that enable it to evade phagocytosis**
 - ✓ **Production of enzymes**
 - ✓ **Production of toxins**

Structural Defenses Against Phagocytosis

1. Protein A coats the cell surface

- ✓ Interferes with humoral immune responses by binding to class G antibodies
- ✓ Inhibits the complement cascade

2. Clumping Factor (Bound coagulase)

- ✓ Converts the soluble blood protein fibrinogen in insoluble fibrin molecules that form blood clots
- ✓ Fibrin clots hide the bacteria from phagocytic cells
- ✓ **HOW?**

3. slime layers (often called capsules)

- ✓ Inhibit chemotaxis and phagocytosis by leukocytes
- ✓ Facilitates attachment of *Staphylococcus* to artificial surfaces

Enzymes

1. Coagulase
2. Hyaluronidase
3. Staphylokinase
4. Lipases
5. β -lactamase

Toxins

1. Cytolytic toxins

- ✓ Disrupts the cytoplasmic membrane of a variety of cells **Leukocidin** can lyse leukocytes specifically
- **Superantigenic toxins**
- 2- **Exfoliative (epidermolytic) toxins**: causes the staphylococcal scalded skin syndrome (SSSS).
- 3- **Toxic shock syndrome toxin-1 (TSST-1)**: toxic shock syndrome in humans.
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- 4- **Enterotoxins**: superantigens, staphylococcal food poisoning

Staphylococcal Diseases

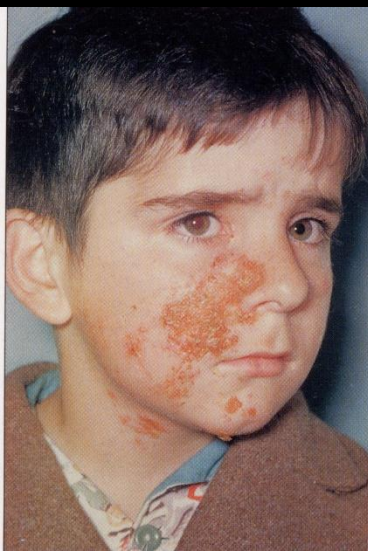
- 3 categories

- ✓ 1- **Noninvasive Disease**

- Food poisoning from the ingestion of enterotoxin-contaminated food

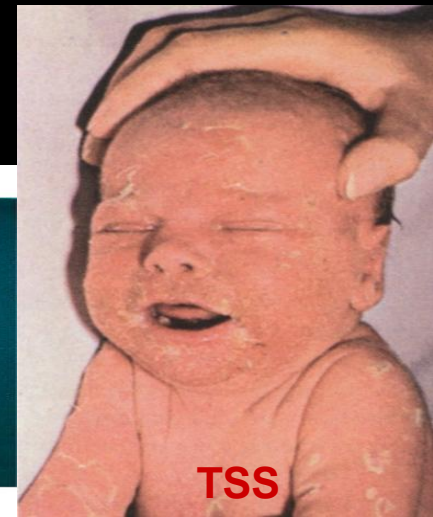
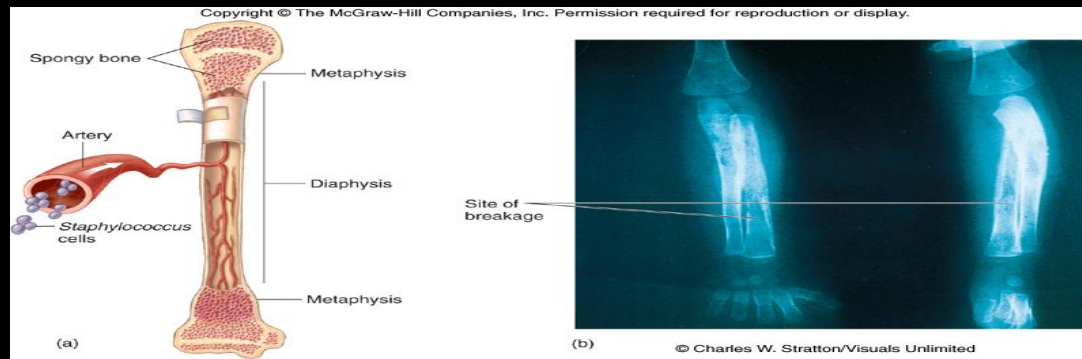
- ✓ 2- **Cutaneous Disease**

- Various skin conditions including scalded skin syndrome, impetigo, folliculitis, and furuncles



✓ 3- Systemic Disease

- Toxic shock
- Bacteremia-
- Endocarditis-
- Pneumonia-
- Osteomyelitis-inflammation of the bone marrow and the surrounding bone
- **DIABETIC FOOT INFECTION**



Factors predisposing to Staph. aureus infections

- **Host factors**

- ✓ **Breach in skin**
- ✓ **Chemotaxis defects**
- ✓ **Opsonisation defects**
- ✓ **Neutrophil functional defects**
- ✓ **Diabetes mellitus**
- ✓ **Presence of foreign bodies**

- **Pathogen Factors**

- ✓ **Catalase**
- ✓ **Coagulase**
- ✓ **Hyaluronidase**
- ✓ **Lipases**
- ✓ **B- lactamase**

Laboratory Diagnosis

- **Specimen**

- Detection of Gram-positive bacteria in grapelike arrangements isolated from pus, blood, or other fluids

- **Culture**

(MSA, Chapman Stone Agar, Staph 110 , Baird-parker Agar, V.J.Agar,,

- CHROMagar ,*Staphylococcus* agar And TPY Agar & Broth)



- **Biochemical Reactions**

- **Phage Typing:** Epidemiological Typing Of *Staph. aureus* By Examining Differences In Lytic Patterns Based On Susceptibilities To The 23 Lytic Bacteriophages In The International Set(from 1975) For Human *Staph. aureus* Isolates

- **Antibiogram** is an *in-vitro* testing for the sensitivity of an isolated bacteria strain to different antibiotics

- **Treatment**
 - ✓ **Vancomycin & Methicillin is the drug of choice to treat staphylococcal hospital and non – hospital acquired infections**
 - **Methicillin is a semisynthetic form of penicillin and is not inactivated by β -lactamase**
 - **MRSA:** MRSA (ORSA): methicillin (oxacillin)-multiresistant *Staph. aureus*, resulting from acquisition of *mecA*
 - **MRSA strains are usually also resistant to tetracyclines, erythromycins and aminoglycosides.**
 - **VIRSA** : vancomycin intermediate resistant *S. aureus*
 - **two vancomycin-resistant strains (VRSA), have been isolated in USA since 2002.**

• Prevention

- ✓ Hand antisepsis is the most important measure in preventing nosocomial infections
- ✓ Also important is the proper cleansing of wounds and surgical openings, aseptic use of catheters or indwelling needles, an appropriate use of antiseptics

2. Staphylococcus epidermidis

- Skin commensal
- Has predilection for plastic material
- Ass. With infection of IV lines, prosthetic heart valves
- Causes urinary tract infection in catheterised patients

3. Stapylococcus saprophyticus

- **Skin commensal**
- **Imp. Cause of UTI in sexually active young women**
- **Usually sensitive to wide range of antibiotics**

Test	<i>Staph. aureus</i>	<i>Staph. epidermidis</i>	<i>Staph. saprophyticu s</i>
coagulase	pos	neg	neg
Mannitol fermentation	pos	neg	pos
Novobiocin susceptibility	S	S	R

Novobiocin Susceptibility



More than 17 mm = Sensitive



Less than 17 mm = Resistant