

**Ірін- қабыну процесстерінің
қоздырғыштары.**

Стафилококктар.

Мақсат: стафилококктарға жалпы сипаттама беру

Жоспар:

- 1. Таксономия
- 2. Морфология
- 3. Дақылды өсіру
- 4. Патогенді факторлары
- 5. Антигендік құрылымы
- 6. Микробиологиялық диагностикасы
- 7. Емдеу
- 8. Профилактика

Classification

- **Family** **Micrococcaceae**
- **Genus** ***Micrococcus and Staphylococcus***

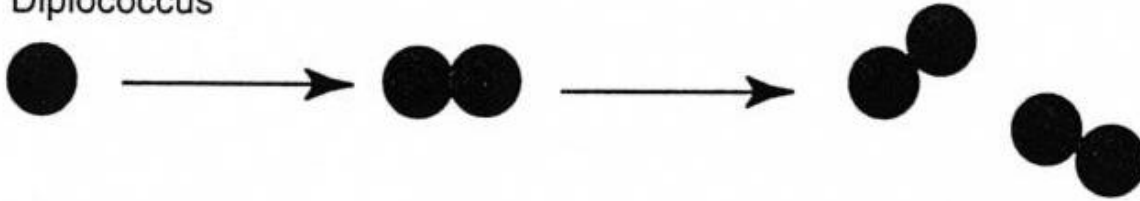
- **Species**
S. aureus
S. saprophyticus
S. epidermidis
M. luteus



**more
than 30
species**

Morphology

Diplococcus



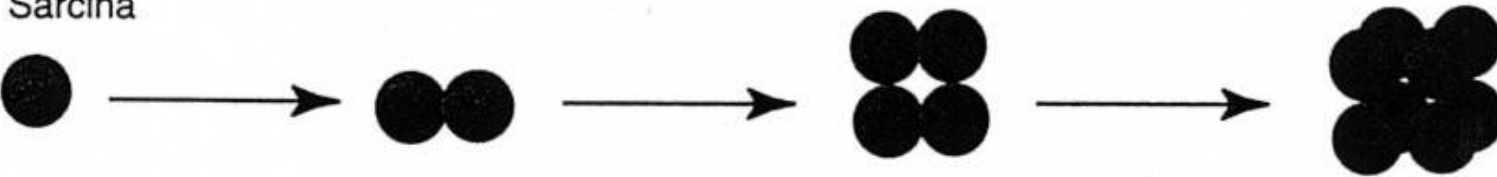
Streptococcus



Tetrad



Sarcina

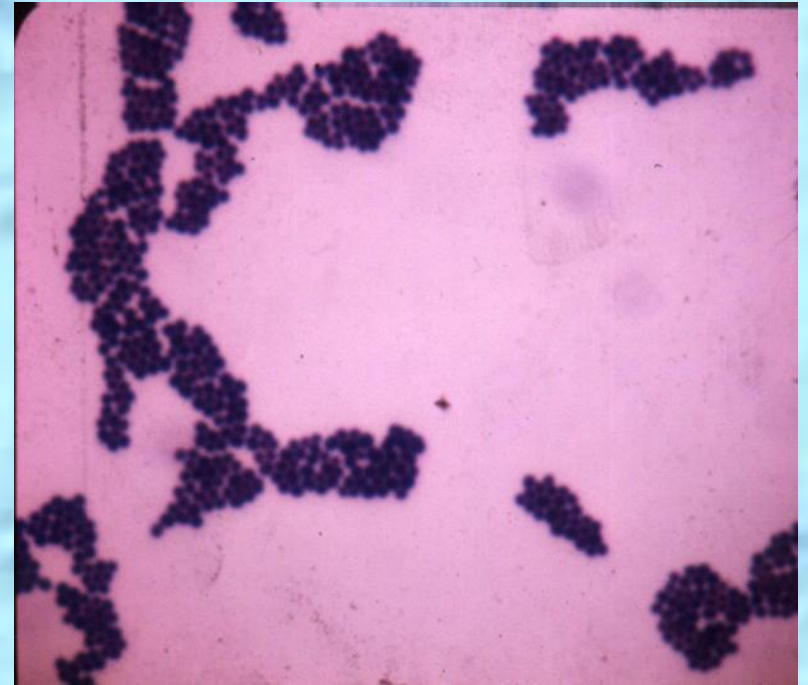
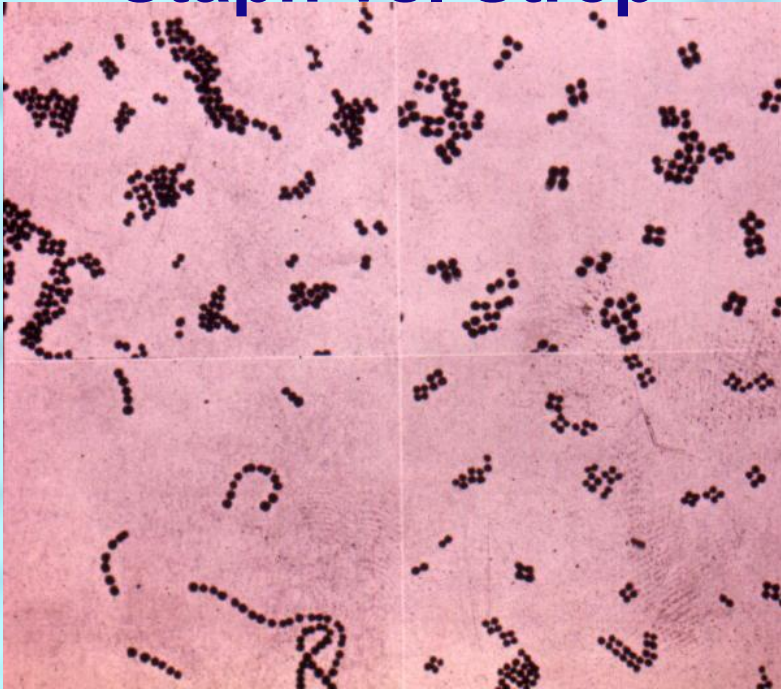


Staphylococcus

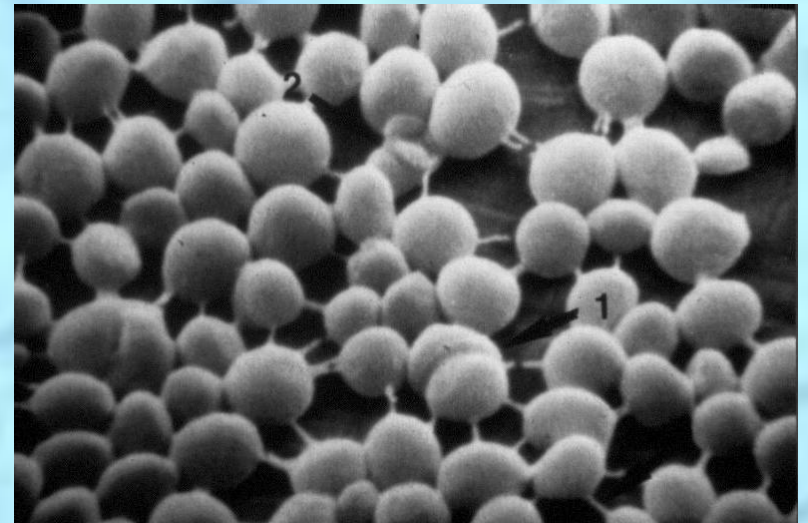


Morphology

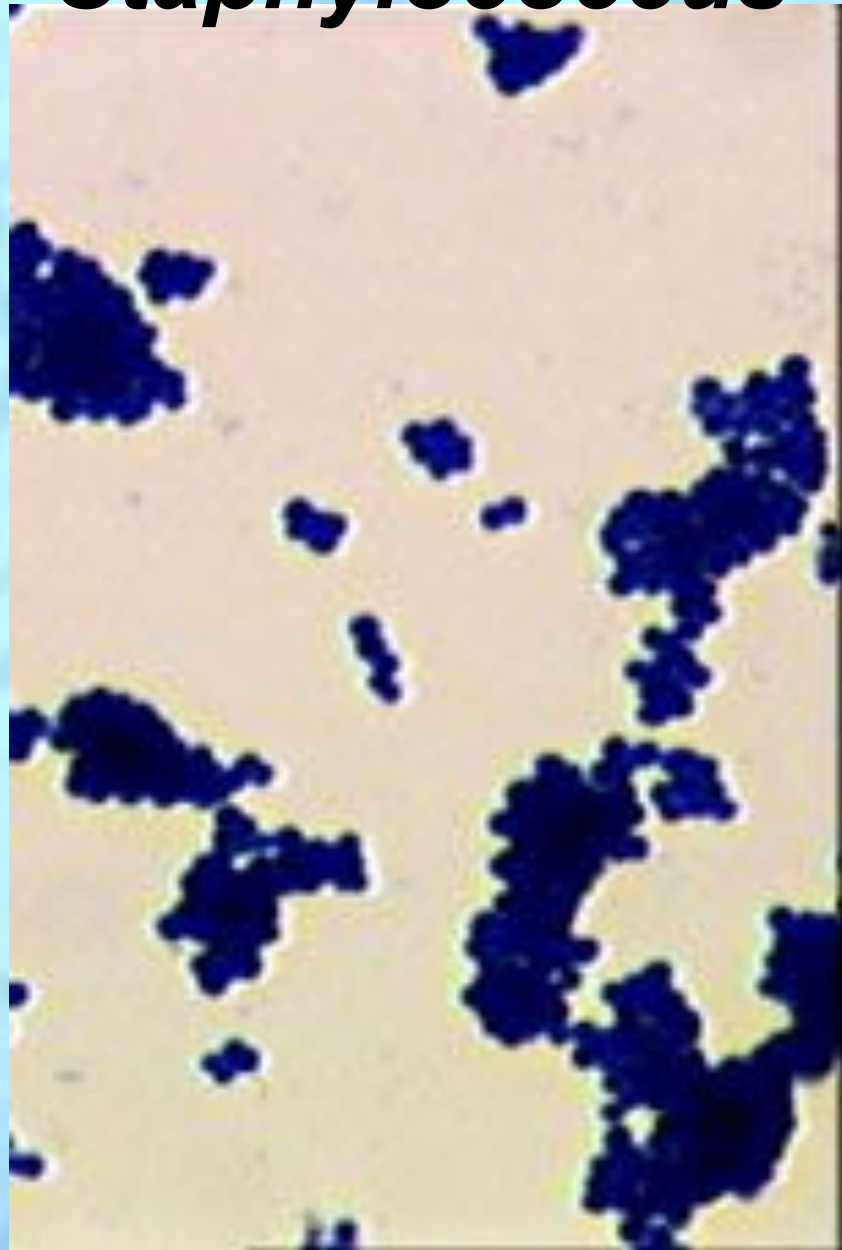
Staph vs. Strep



**Gram-positive cocci
in clusters**



Staphylococcus

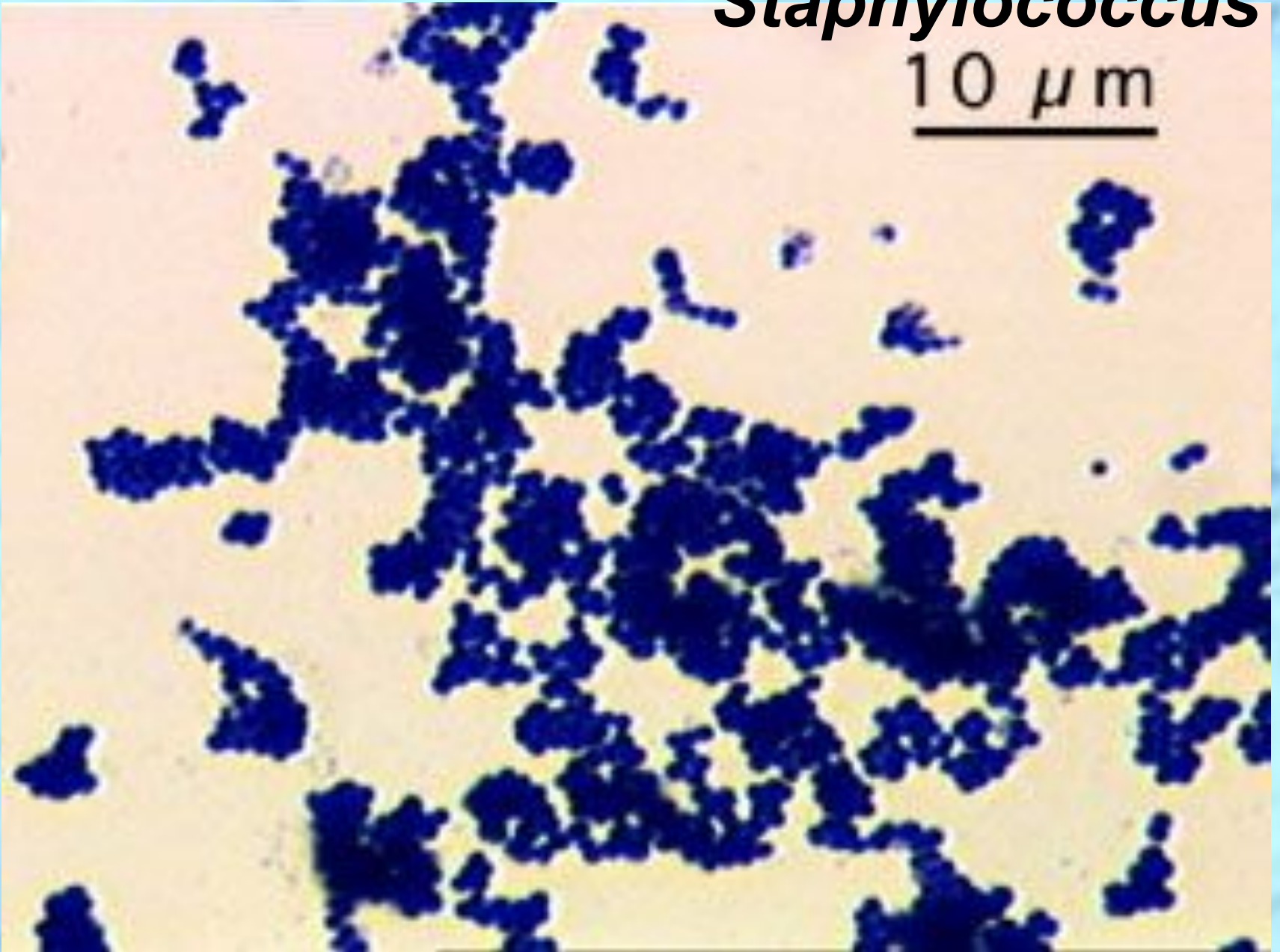


Streptococcus

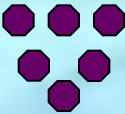
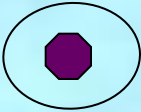


Staphylococcus

10 μ m



Стафилококктардың морфологиясы және тинкториальды қасиеттер

<i>Staphylococcus aureus</i>		
Қасиеті	Графикалық бейнесі	Ескерту
Пішіні		Шар тәрізді
Бояу	Гр (+)	Күлгін түсті
Өзара орналасуы		Жүзім тәрізді
Капсула		Бар
Жгутиктер		Жоқ
Споралар		Жоқ

Стафилококктардың дақылды қасиеттер

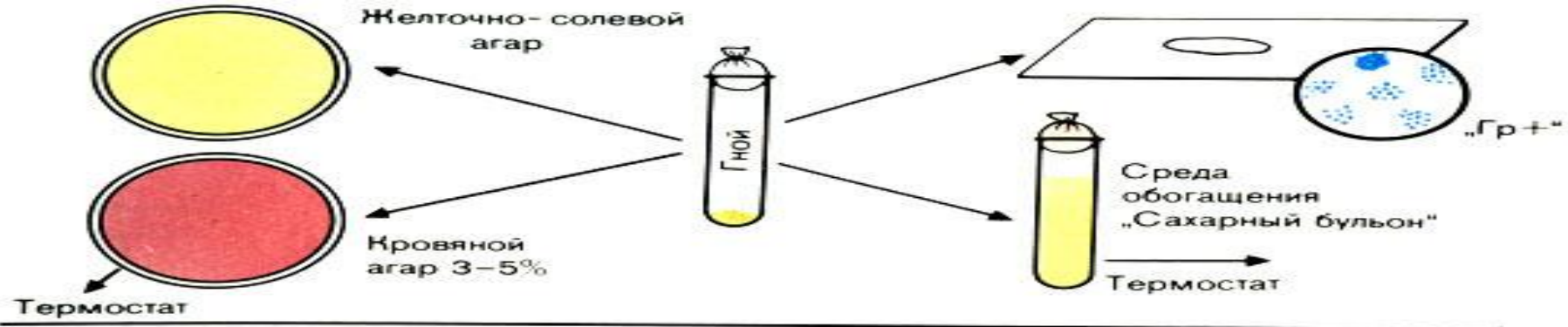


Биохимиялық ферментацияның свойства

стафилококков



1-й день



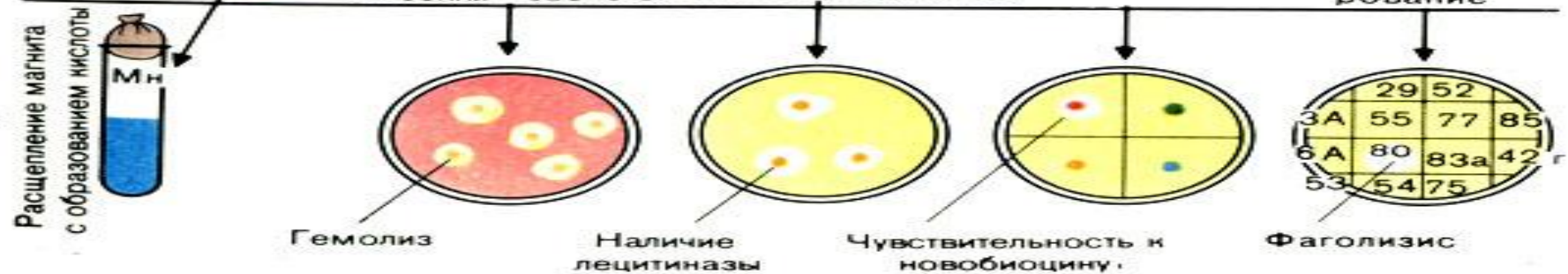
2-й день



3-й день



4-й день



Патогендік факторлары

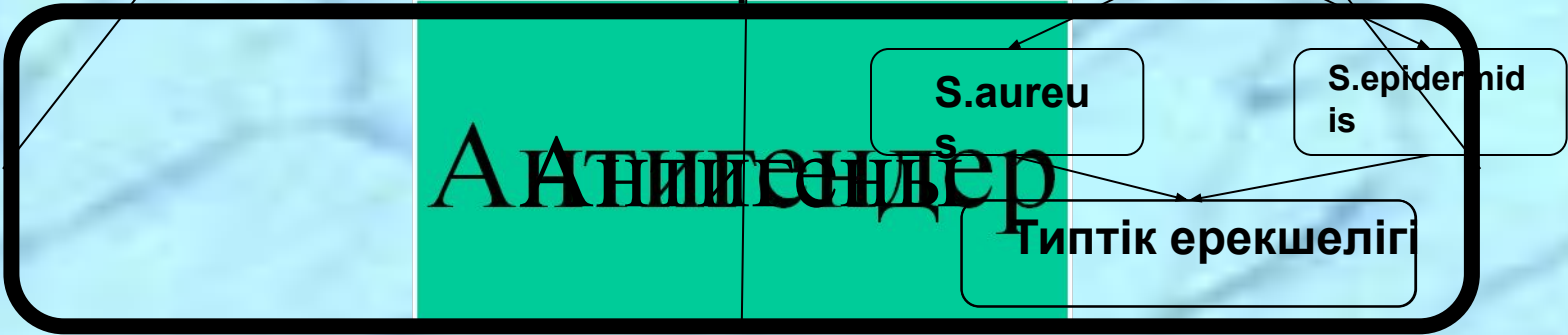
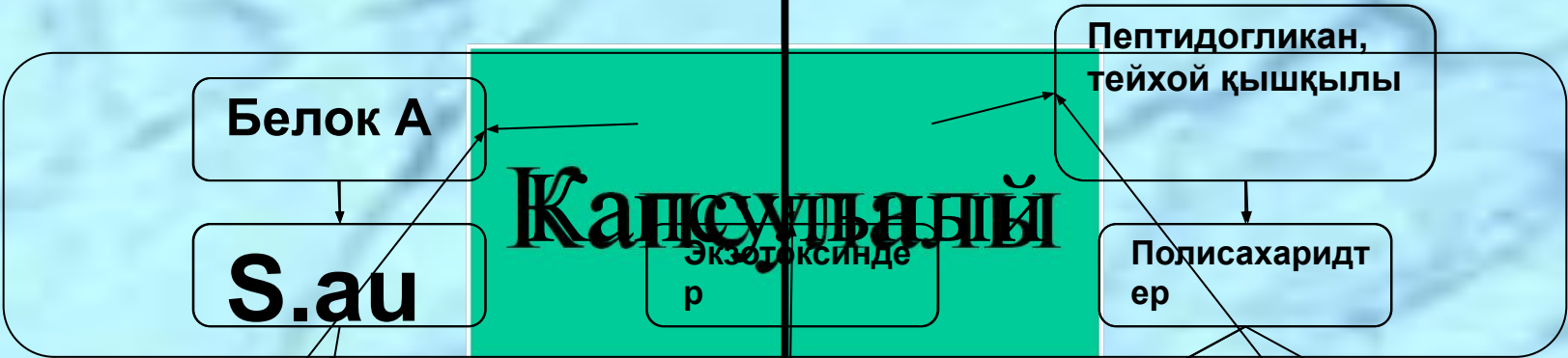
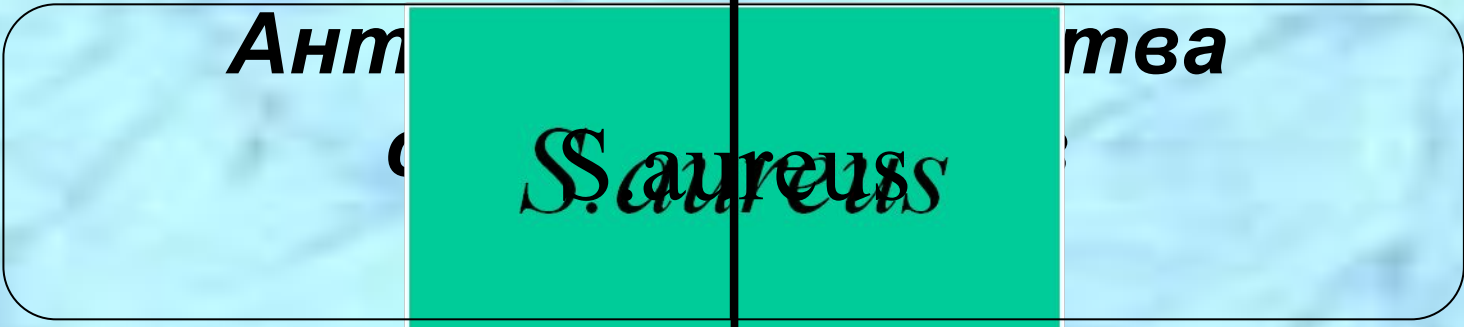
Вируленттік факторлары	Биологиялық әсері
ҚҰРЫЛЫМЫ: Капсула Ақуыз А Пептидогликан Тейхой қышқылы	Фагоцитпен қарым-қатынасты басу Антиденелердің Fc-фрагментімен байланысуы Эндогенді пирогендердің өнімін (эндотоксин тәрізді әсер), лейкоциттердің хемоаттрактантын (абсцестердің қалыптасуы) күшейту Жасуша мембранасында катиондардың мөлшерін реттейді, фибронектинді байланыстырады
БАСҚА КОМПОНЕНТТЕРІ: Каратиноидты пигменттер NaCl мен май қышқылдарына тұрақтылық	Оттегінің бактерицидтік қасиетін инактивациялау Тер және май бездерінде көбею

Патогендік факторлары

Вируленттік факторлары	Биологиялық әсері
ТОКСИНДЕР: Мембраналық токсиндер немесе гемолизиндер (альфа-, бета-гамма-, дельта-токсиндер), лейкоцидин Эксфолиатинді токсин Токсикалық шок синдромының токсині Энтеротоксиндер (А-Е)	Көптеген жасушаларға, соның ішінде лейкоциттерге, эритроциттерге, макрофагтарға, фибробластарға улы Эпидермистің гранулярлы қабатында десмосомалардың-жасуша аралық байланыстарды бұза отырып «күйген тері» синдромын тудырады. Суперантиген (Т-лимфоциттердің поликлоналды белсенділігі, цитокиндердің өнуін күшейтеді) Нейротропты, вазотропты әсері бар Суперантиген. Нейротропты әсер, энтероциттерге әсер (стафилококтық тағамдық интоксикациясы)

Патогендік факторлары

Вируленттік факторлары	Биологиялық әсері
ФЕРМЕНТТЕР:	
Плазмокоагулаза (коагулаза)	Фибриногеннің фибринге конверсиясы, олар фагоцитпен («псевдокапсула») байланысына кедергі келтіреді
Гиалуронидаза	Дәнекер тіңді бұзу
Липаза, лецитовителлаза	Липидтерді ыдырату
Стафиллокиназа (фибринолизин)	Фибринді ұйындыларды бұзу
Дезоксирибонуклеаза	ДНҚ ыдырату, ірінді сұйылту



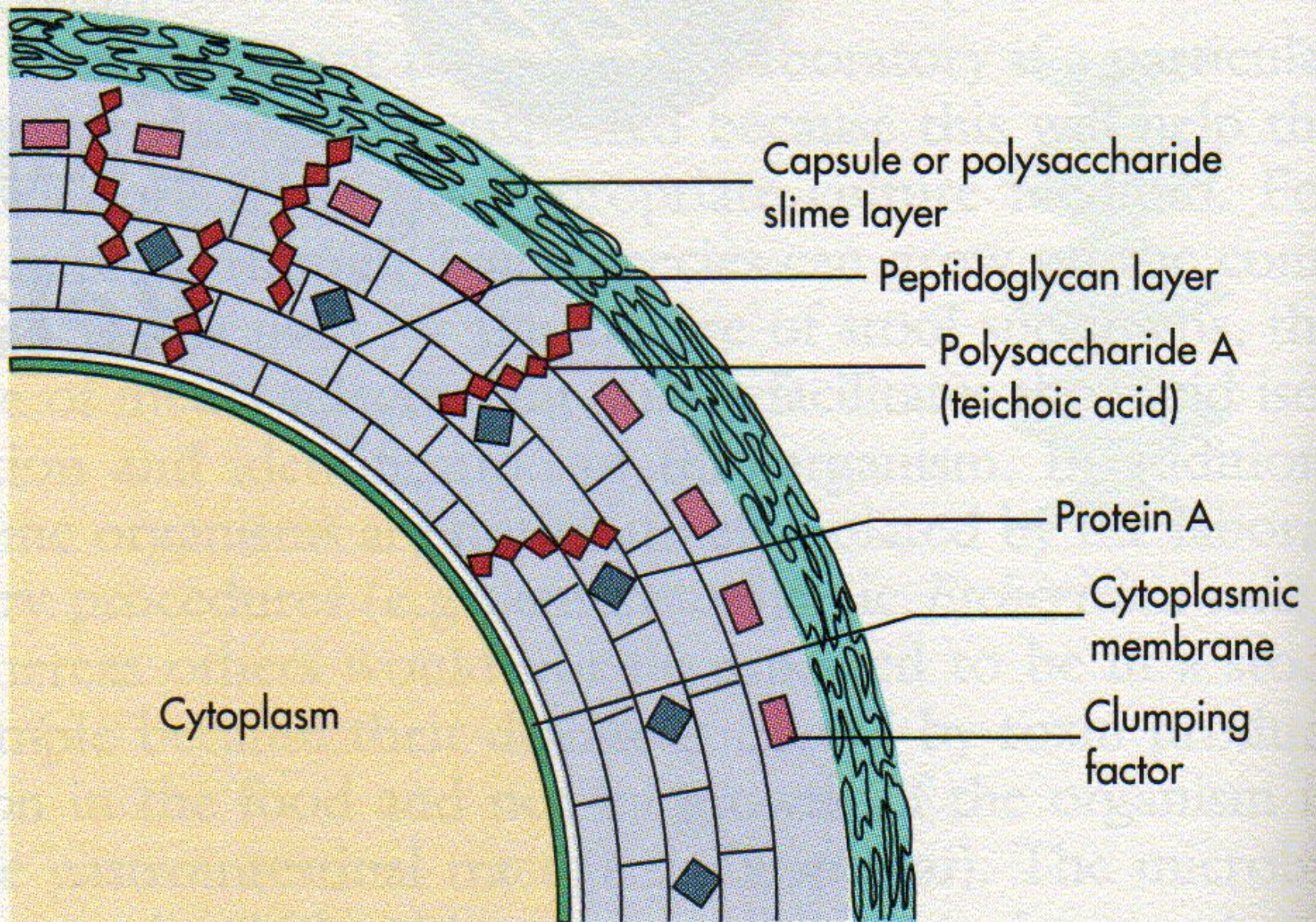


TABLE 22–2. *Staphylococcus*, *Micrococcus*, *Stomatococcus*, and *Alloiococcus* and Their Diseases

Organism	Diseases
<i>Staphylococcus aureus</i>	Toxin-mediated (food poisoning, toxic shock syndrome ^{SSSS}); cutaneous (impetigo, folliculitis, furuncles, carbuncles, wound infections); other (bacteremia, endocarditis, pneumonia, empyema, osteomyelitis, septic arthritis)
<i>Staphylococcus epidermidis</i>	Bacteremia; endocarditis; surgical wounds; urinary tract infections; opportunistic infections of catheters, shunts, prosthetic devices, and peritoneal dialysates
<i>Staphylococcus saprophyticus</i>	Urinary tract infections, opportunistic infections
<i>Staphylococcus capitis</i>	Bacteremia, endocarditis, urinary tract infections, wound infections, pneumonia, bone and joint infections, opportunistic infections
<i>Staphylococcus haemolyticus</i>	Bacteremia, endocarditis, urinary tract infections, wound infections, and opportunistic infections
<i>Micrococcus</i> spp.	Opportunistic infections
<i>Stomatococcus mucilaginosus</i>	Bacteremia, endocarditis, opportunistic infections
<i>Alloiococcus otitidis</i>	Chronic middle ear infections

Endocarditis
4 ≡ Blood (*S. aureus*)
3 ≡ Blood (other species)

Staphylococcal
scalded skin syndrome
4 ≡ Nasopharynx
1 ≡ Skin
1 ≡ Blood

Pneumonia
3 ≡ Sputum
2 ≡ Blood

Staphylococcal
food poisoning
3 ≡ Food
1 ≡ Feces

Toxic shock syndrome
4 ≡ Vagina/wound
1 ≡ Blood

Cutaneous infections
(impetigo, furuncle,
carbuncle)
4 ≡ Skin
1 ≡ Blood

Septic arthritis
4 ≡ Synovial fluid
3 ≡ Blood

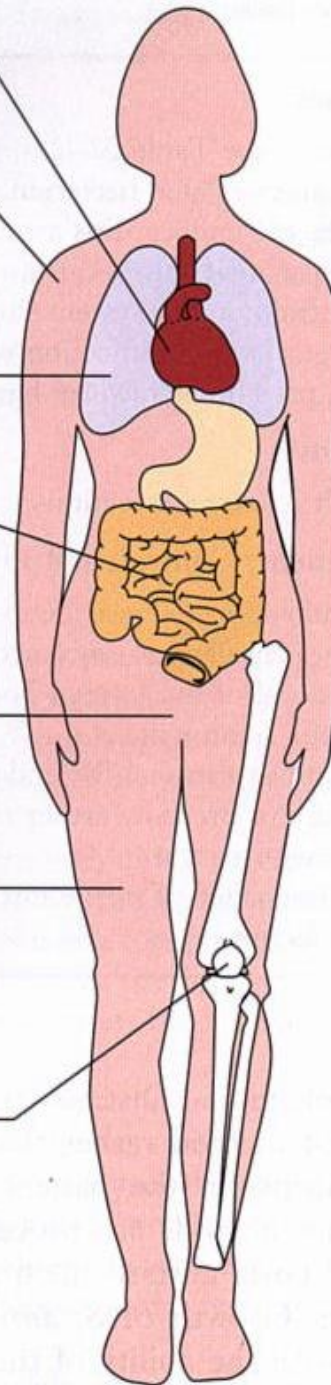


TABLE 22–3. *Staphylococcus aureus* Virulence Factors

Virulence Factors	Biologic Effects
Structural Components	
Capsule	Inhibits chemotaxis and phagocytosis; inhibits proliferation of mononuclear cells; facilitates adherence to foreign bodies
Peptidoglycan	Provides osmotic stability; stimulates production of endogenous pyrogen (endotoxin-like activity); leukocyte chemoattractant (abscess formation); inhibits phagocytosis
Teichoic acid	Regulates cationic concentration at cell membrane; binds to fibronectin
Protein A	Inhibits antibody-mediated clearance by binding IgG ₁ , IgG ₂ , and IgG ₄ Fc receptors; leukocyte chemoattractant; anticomplementary
Cytoplasmic membrane	Osmotic barrier; regulates transport into and out of cell; site of biosynthetic and respiratory enzymes
Toxins	
Cytotoxins (α , β , δ , γ , P-V leukocidin)	Toxic for many cells, including leukocytes, erythrocytes, macrophages, platelets, and fibroblasts
Exfoliative toxins (ETA, ETB)	Serine proteases that split the intercellular bridges in the stratum granulosum epidermis
Enterotoxins (A–E, G–I)	Superantigens (stimulates proliferation of T cells and release of cytokines); stimulates release of inflammatory mediators in mast cells, increasing intestinal peristalsis and fluid loss, as well as nausea and vomiting
Toxic Shock Syndrome Toxin-1	Superantigen (stimulates proliferation of T cells and release of cytokines); produces leakage or cellular destruction of endothelial cells
Enzymes	
Coagulase	Converts fibrinogen to fibrin
Catalase	Catalyzes removal of hydrogen peroxide
Hyaluronidase	Hydrolyzes hyaluronic acids in connective tissue, promoting the spread of staphylococci in tissue
Fibrinolysin	Dissolves fibrin clots
Lipases	Hydrolyzes lipids
Nucleases	Hydrolyzes DNA
Penicillinase	Hydrolyzes penicillins

Clinical Manifestations/Disease

- **SKIN**

- ✓ folliculitis
- ✓ boils (furuncles)
- ✓ carbuncles
- ✓ impetigo (bullous & pustular)
- ✓ scalded skin syndrome
 - Neonates and children under 4 years



Clinical Manifestations/Disease

- **Other infections**

- ✓ Primary staphylococcal pneumonia
- ✓ Food poisoning vs. foodborne disease
- ✓ Toxic shock syndrome

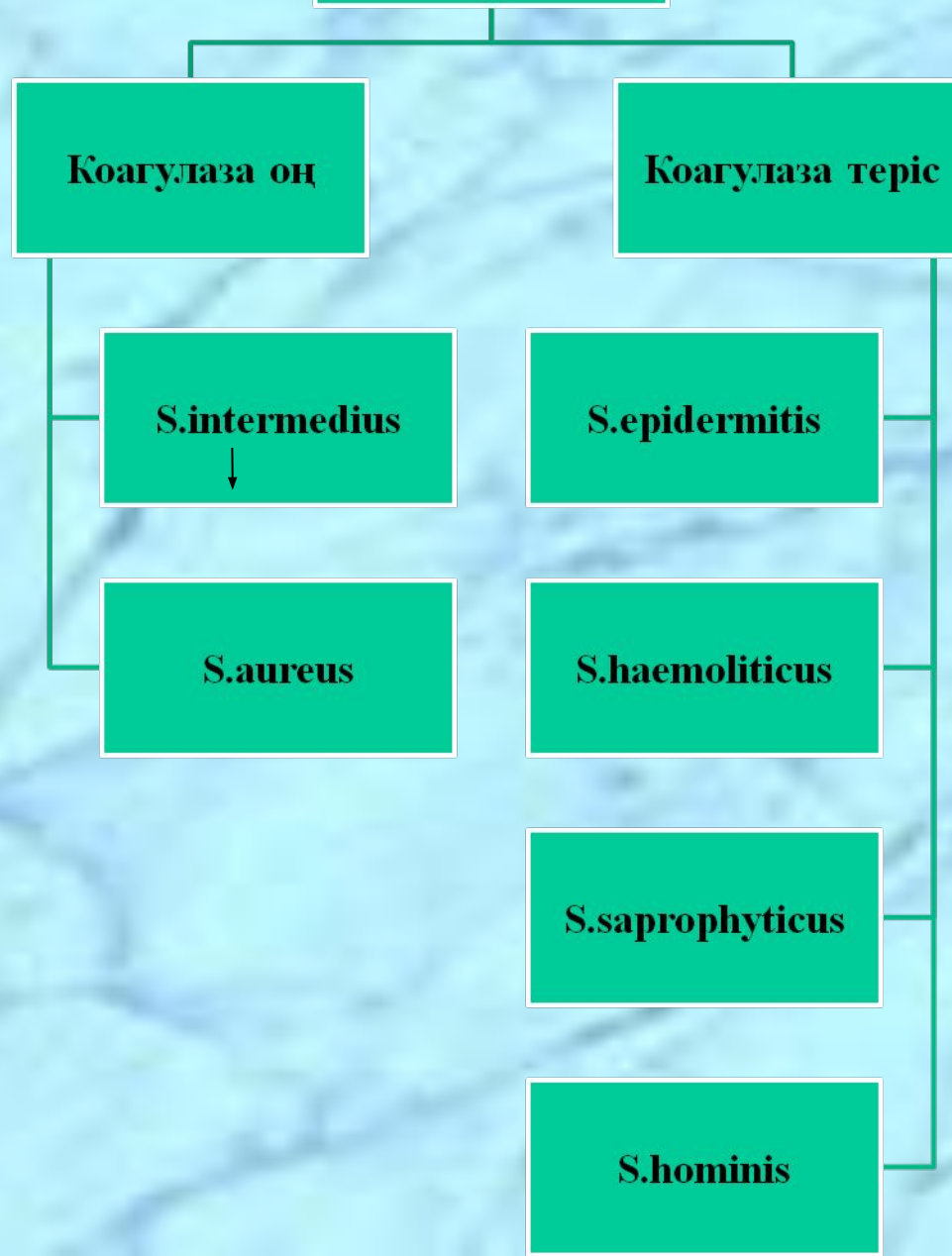


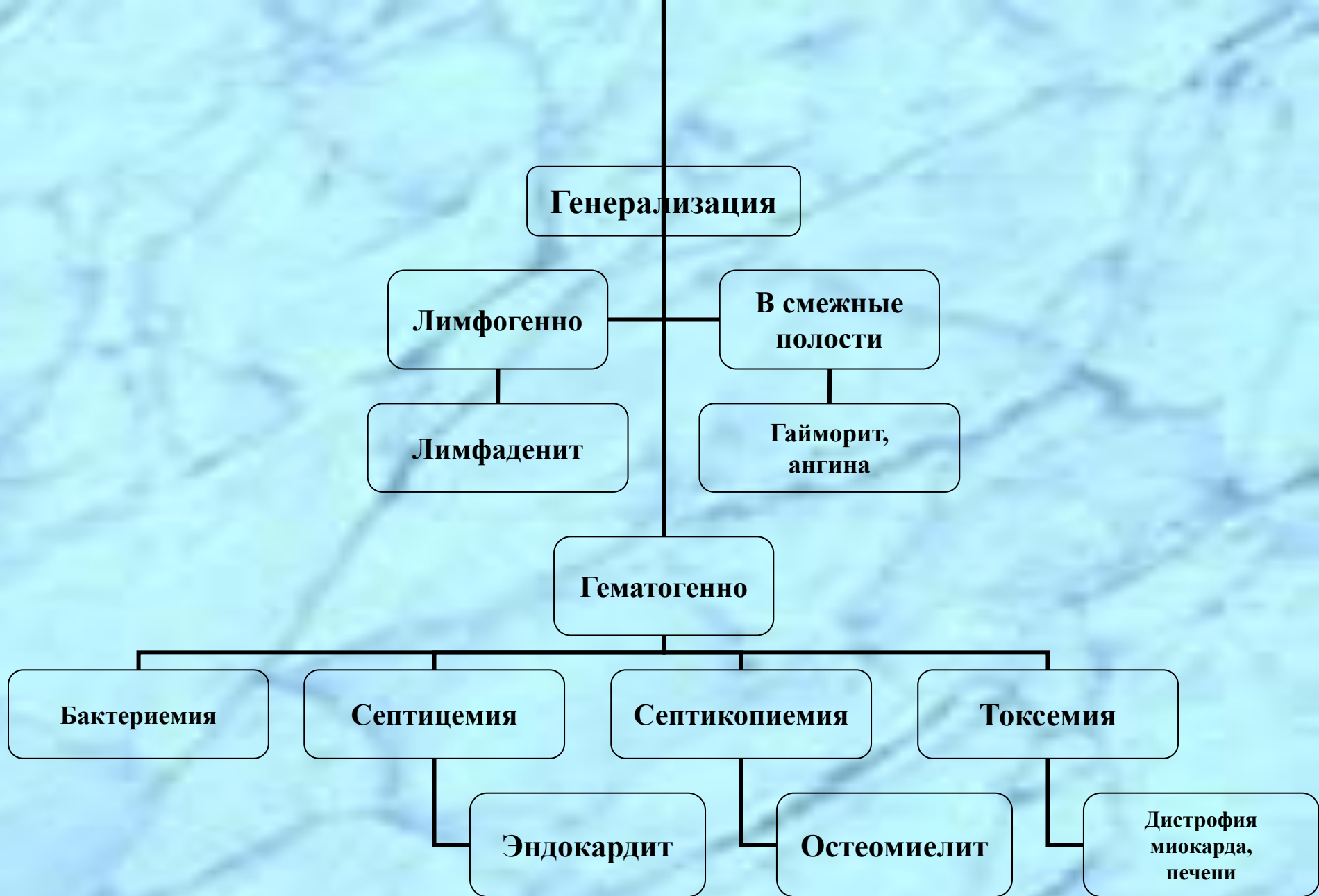
Metastatic Infections

- **Bacteremia**
- **Osteomyelitis**
 - ✓ disease of growing bone
- Pulmonary and cardiovascular infection



Стафилококктар





Coagulase-Negative Staphylococci

- ***Staphylococcus epidermidis***
- ***S. saprophyticus***

BOX 22–2. Summary of Coagulase-Negative Staphylococcal Infections

Physiology and Structure

Gram-positive cocci arranged in clusters.

Facultative anaerobe (capable of aerobic and anaerobic growth).

Catalase-positive but coagulase-negative.

Species-specific teichoic acid.

Capsule (“slime” layer) present.

Virulence

Refer to Table 22–3.

Epidemiology

Normal human flora on skin and mucosal surfaces.

Organisms can survive on dry surfaces for long periods.

Person-to-person spread through direct contact or exposure to contaminated fomites (although most infections are with the patient’s own organisms).

Patients at risk are those with foreign bodies (e.g., suture, prosthesis, shunt, catheter).

The organisms are ubiquitous, so there are no geographic or seasonal limitations.

Diseases

Diseases—see Table 22–2.

Catheter-related bacteremia.

Subacute endocarditis associated with previously damaged or artificial heart valve.

Central nervous system shunt infection.

Surgical wound infection when a foreign body (e.g., suture, prosthesis, medical hardware) is present.

Diagnosis

As with *S. aureus* infections.

Treatment, Control, and Prevention

The antibiotics of choice are oxacillin (or other penicillinase-resistant penicillin) or vancomycin for oxacillin-resistant strains.

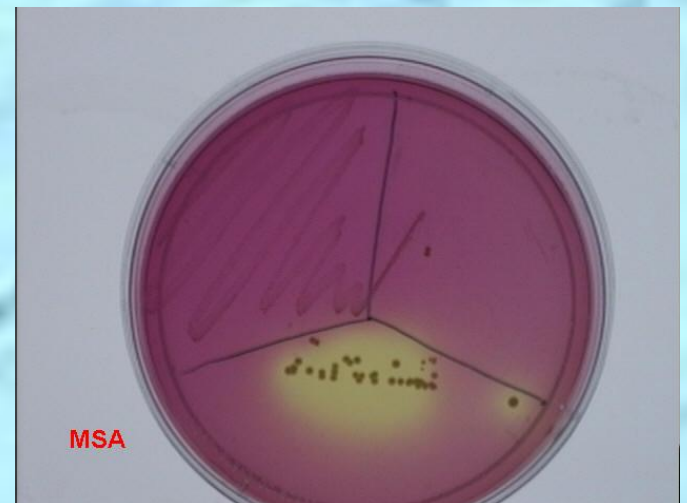
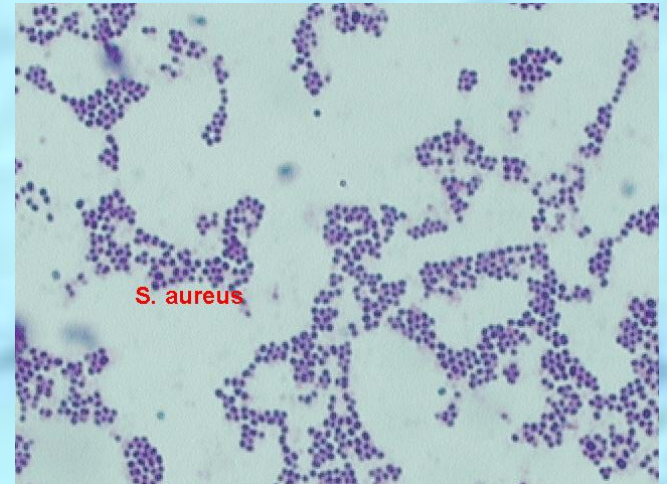
Removal of the foreign body is frequently required for successful treatment.

Prompt treatment for endocarditis or shunt infections is necessary to prevent further tissue damage or immune complex formation.

Maintenance of sterile intravascular catheters helps prevent infections.

Staphylococcal Lab ID & Diagnostic Tests

- Microscopic
- Lab isolation
- **Coagulase positive**
✓ *S. aureus*



Mannitol Salts Agar (MSA)

Negative



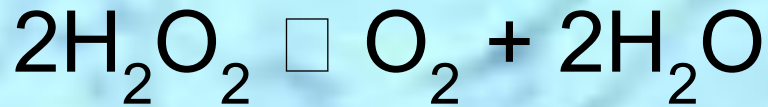
Positive



Staphylococcus aureus

Differential Characteristics

Catalase

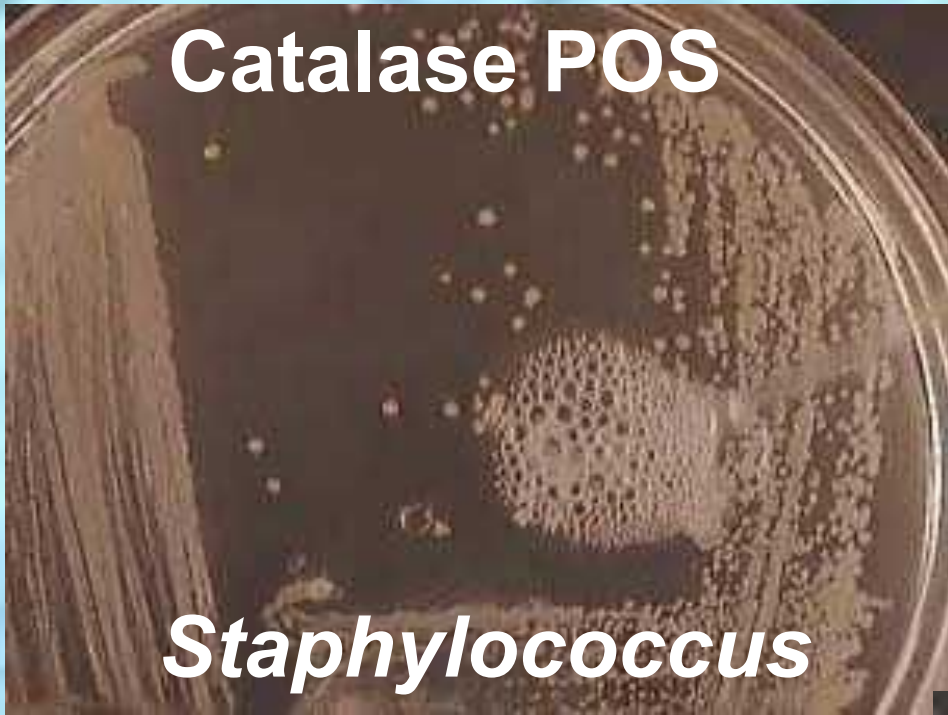


Streptococci vs. Staphylococci



Catalase POS

Staphylococcus



Catalase NEG

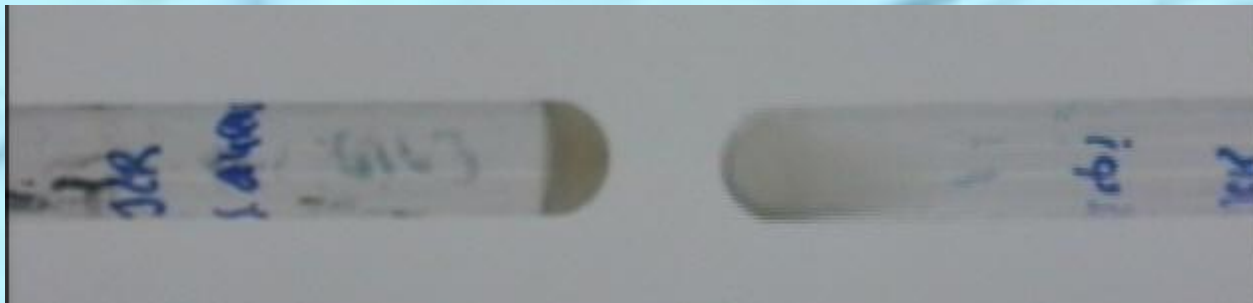
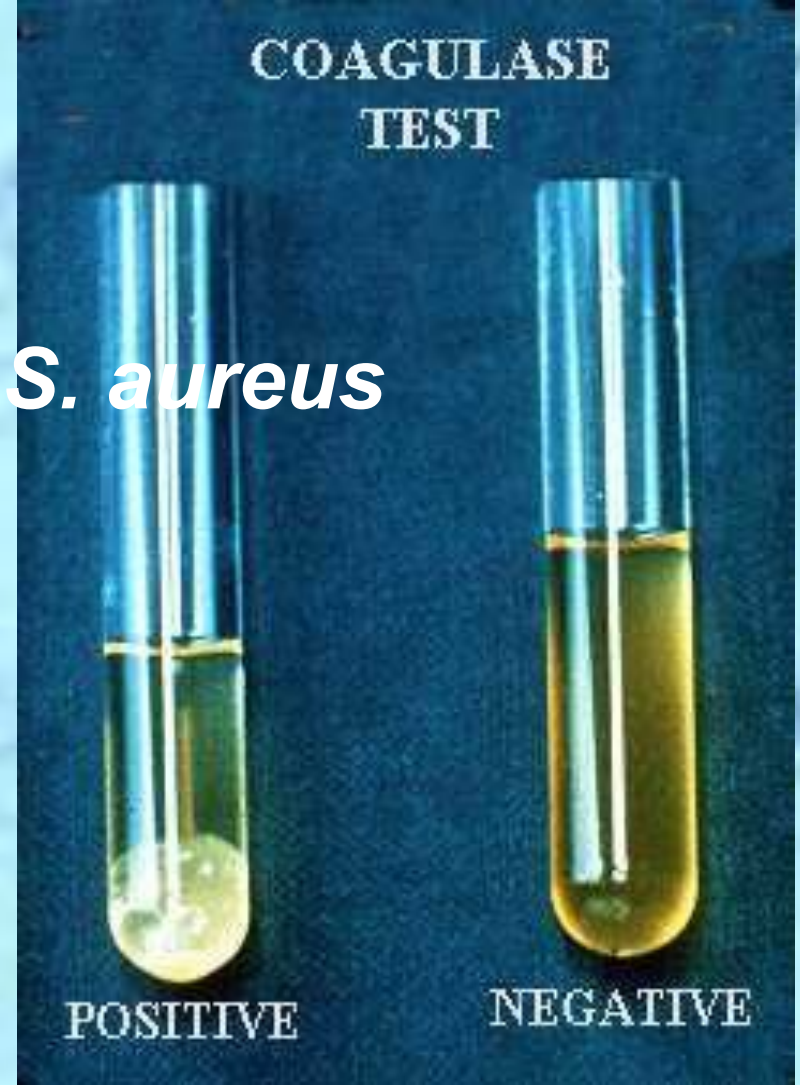


Differential Characteristics

Coagulase

Fibrinogen $\square$ Fibrin

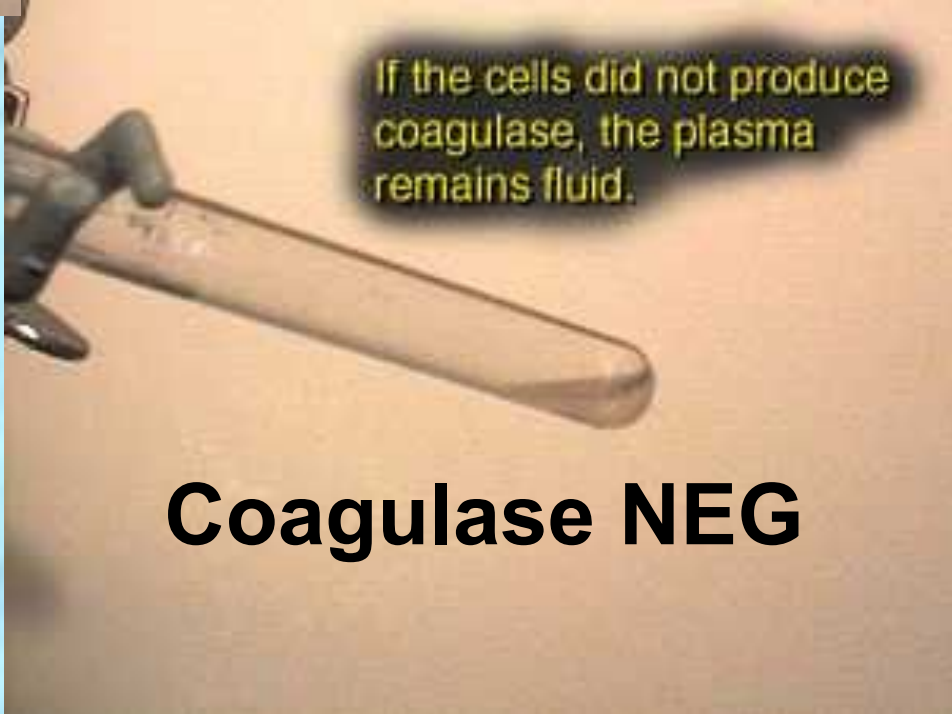
S. aureus



*Staphylococcus
aureus*

A positive reaction is indicated by coagulation of the plasma.

Coagulase POS



If the cells did not produce coagulase, the plasma remains fluid.

Coagulase NEG

Классификация по гемолитической активности



α- (дают частичный
гемолиз и
позеленение среды)

β- (полностью
гемолизующие)

γ- (дающие
визуально
необнаруживаемый
гемолиз)
стрептококки

Gram-Positive Cocci

FAMILY Streptococcaceae (catalase negative)

Group A: β -hemolytic *Streptococcus pyogenes*

Group B: β -hemolytic (occasionally α or γ) *S. agalactiae*

Group C: β -hemolytic (α or γ) *S. anginosus*, *S. equismilis*

Group D: α or γ hemolytic (β) *S. bovis*

Group F: β -hemolytic *S. anginosus*

Group G: β -hemolytic *S. anginosus*

Viridans streptococci: (no group specific CHO)

α or γ hemolytic *S. mutans* and

***S. salivarius*, *S. sanguis*, *S. mitis* and *S. milleri* groups**

***Streptococcus pneumoniae* (no group CHO)(α -hemolytic)**

***Enterococcus* (Group D CHO) γ hemolytic (α or β)**

Enterococcus faecalis*, *E. faecium

FAMILY Micrococcaceae (catalase positive)

Coagulase-positive *Staphylococcus aureus*

Coag.-neg. *Staphylococcus epidermidis*, *S. saprophyticus*

REVIEW

Treatment

- **Drain infected area**
- **Deep/metastatic infections**
 - ✓ **semi-synthetic penicillins**
 - ✓ **cephalosporins**
 - ✓ **erythromycin**
 - ✓ **clindamycin**
- **Endocarditis**
 - ✓ **semi-synthetic penicillin + an aminoglycoside**

Prevention

- **Carrier** status prevents complete control
- Proper hygiene, segregation of carrier from highly susceptible individuals
- Good **aseptic techniques** when handling surgical instruments
- **Control of nosocomial** infections



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- [Geraci J¹, Neubauer S^{2,3}, Pöllath C¹, Hansen U⁴, Rizzo F^{5,6}, Krafft C⁷, Westermann M⁸, Hussain M², Peters G², Pletz MW^{2,3}, Löffler B^{1,2}, Makarewicz O^{10,11}, Tuchscher L^{12,13}](#). The Staphylococcus aureus extracellular matrix protein (Emp) has a fibrous structure and binds to different extracellular matrices. [Sci Rep.](#) 2017 Oct 20;7(1):13665. doi: 10.1038/s41598-017-14168-4.
- [Albert G¹, Ricse M¹, Narvaez J¹, Rodriguez J¹, Nolla JM¹, Dominguez-Luzon MA², Vaquero CG¹](#). Prevalence of nasal colonization with Staphylococcus aureus in patients with rheumatoid arthritis. [Curr Rheumatol Rev.](#) 2017 Oct 20. doi: 10.2174/1573397113666171020102300
- [Lazaris A¹, Coleman DC¹, Kearns AM², Pichon B², Kinnevey PM¹, Earls MR¹, Boyle B³, O'Connell B^{3,4}, Brennan GI⁴, Shore AC¹](#). Novel multiresistance cfr plasmids in linezolid-resistant methicillin-resistant Staphylococcus epidermidis and vancomycin-resistant Enterococcus faecium (VRE) from a hospital outbreak: co-location of cfr and optrA in VRE. [J Antimicrob Chemother.](#) 2017 Aug 28. doi: 10.1093/jac/dkx292.