

PASSION ACADEMIC TEAM *YU - MEDICINE*

Sheet# 3 (Part 2) - MICROBIOLOGY

Lec. Date :

Lec. Title : Streptococcus Pneumonia

Written By :



**If you come by any mistake , please
kindly report it to
shaghafbatch@gmail.com**

**RESPIRATORY
SYSTEM**

LOWER RESPIRATORY TRACT INFECTION

Streptococcus pneumoniae

LUNG INFECTION



Dr. Waleed Al Momani
Associate professor
Medical microbiology
Faculty of medicine
Yarmouk uninersity

Streptococcus pneumoniae



- *S. pneumoniae* was isolated independently by Pasteur and Steinberg more than 100 years ago.
 - Also called “pneumococcus”
- Pneumococcal disease is still a leading cause of morbidity and mortality.

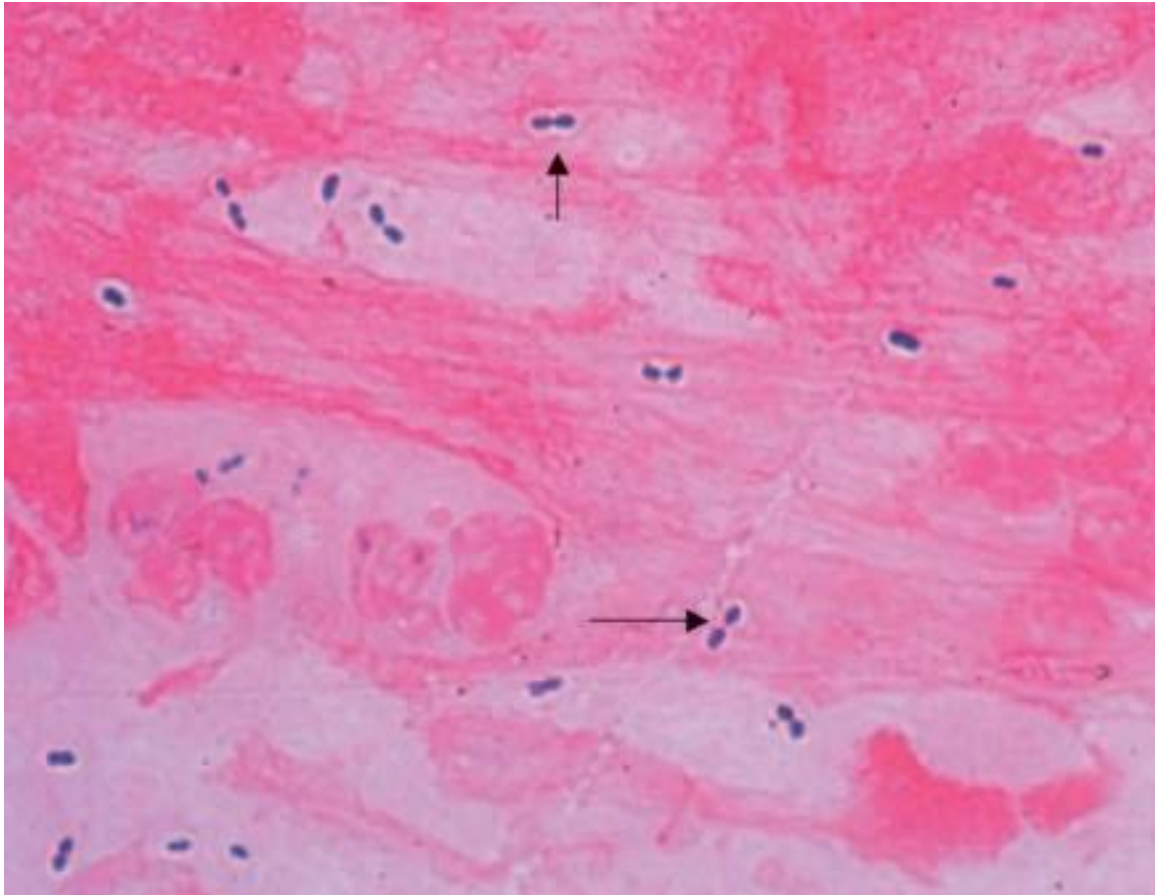
most common causative agent of lower respiratory tract infection in adult and children is pneumococcus

PHYSIOLOGY AND STRUCTURE

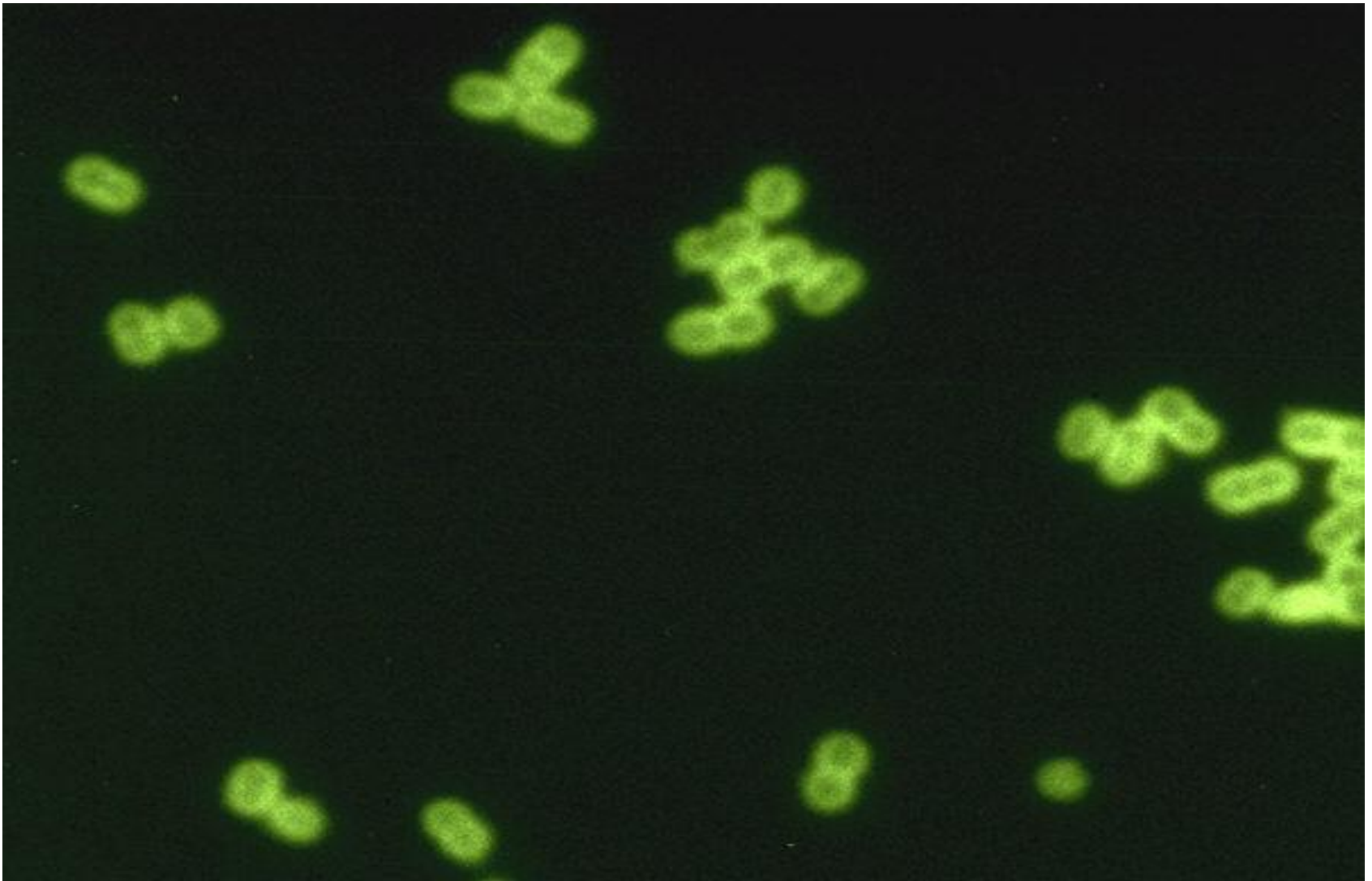


- Gram + coccus **gram + , diplococcus**
- 0.5 to 1.2 μm in diameter, oval or lancet shaped, and arranged in pairs and short chains.
- Older cells decolorize readily and appear gram-negative.

diagnosis easy, treatment and vaccine available but mortality rate is very high



Streptococcus pneumoniae in sputum of patient
with pneumonia



Streptococcus pneumoniae (diplococcus). Fluorescent stain

PHYSIOLOGY AND STRUCTURE



- *S. pneumoniae* has fastidious nutritional requirements and can grow only on enriched media supplemented with blood products.
- **α-hemolytic** on blood agar تتميز ب

fastidious : it need specific media to grow , so we use blood (enriched media)

PHYSIOLOGY AND STRUCTURE



- *S. pneumoniae*, like all streptococci, lacks catalase.
- All virulent strains have surface capsules

same bacteria without capsule >>>>> nonpathogenic

capsule

positive side >>> we can produce vaccine

negative side >>> virulence factor

PHYSIOLOGY AND STRUCTURE



- Serologic classification of strains; currently, 90 serotypes are recognized.
- Purified capsular polysaccharides from the most commonly isolated serotypes are used in the pneumococcal vaccine.

Pathogenesis



- Pneumococcal adherence to nasopharyngeal cells
- Aspiration of respiratory secretions containing these pneumococci is the initial step leading to pneumonia

Risk factors include:

- **Chronic pulmonary diseases**
 - **Damage to bronchial epithelium** from smoking or air pollution
 - **Respiratory dysfunction from alcoholic intoxication**
 - **Anesthesia**
 - **Trauma**
- unconscious patients in ICU die because pneumonia (pneumococcus)

Pathogenesis operate in two stages:

1. Capsule and some surface proteins of intact organisms act to block phagocytosis.
2. Organisms begin to disintegrate causing injury

Autolysin  Pneumolysin

mortality rate of pneumonia =80% سببها S.pneumoniae

Virulence determinants

1. Capsule

2. Pneumolysin

Pneumolysin's toxicity for pulmonary endothelial cells and direct effect on cilia

Epidemiology



- Pneumococci can be found in 5% to 40% of healthy persons depending on age, season, and other factors.

found in healthy persons as normal flora

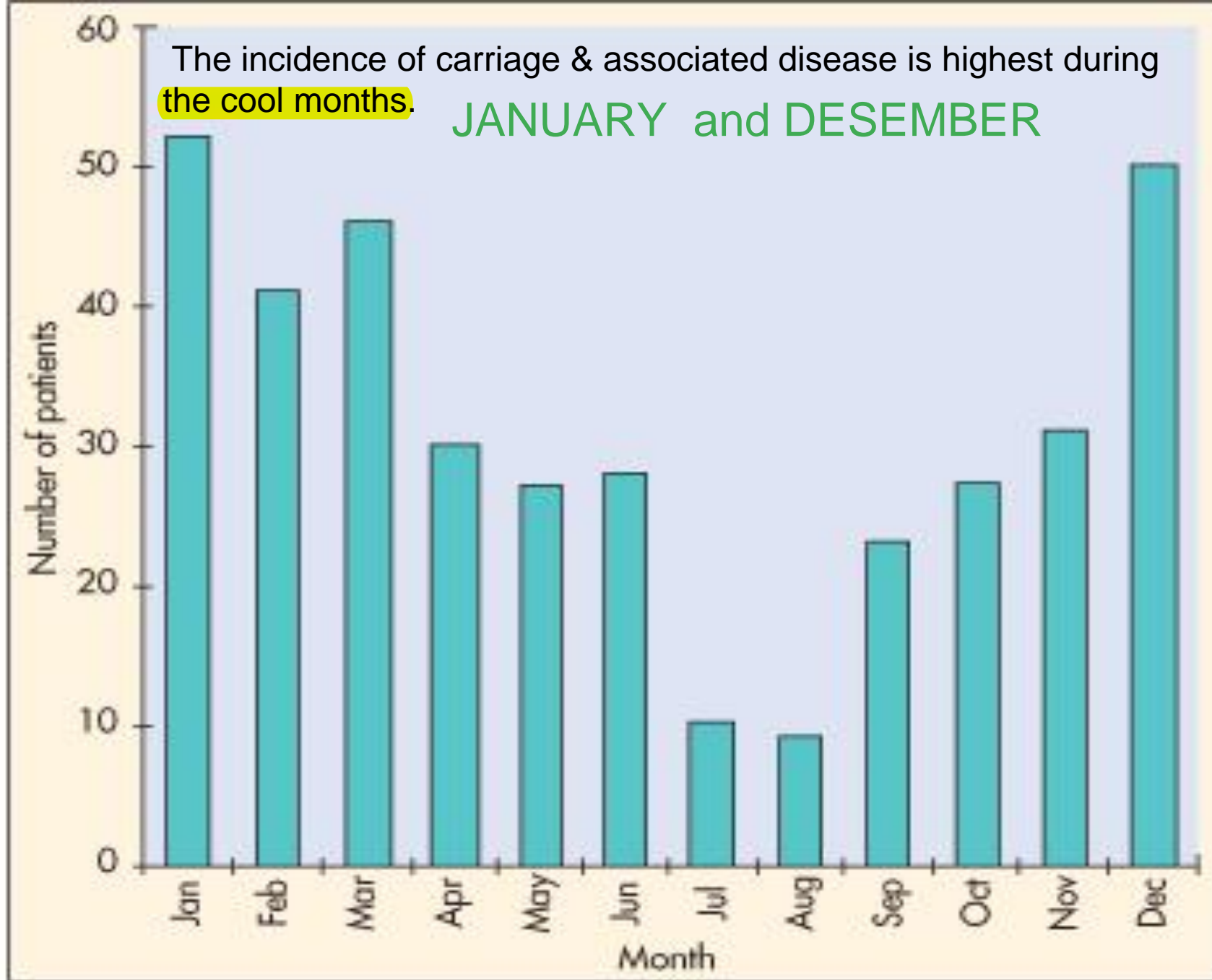
- Most infections are endogenous
- Person-to-person by direct contact or from the microaerosols created by coughing and sneezing in close quarters
endogenous= when organisms overcome immune system (immunocompromised or cilia تعطل) cause infection in the lung

- Typically a secondary infection (after the flu, etc.)
- Most common in the very young (<2 years) and in the elderly (>60 years)
- Although the organism is ubiquitous, disease is more common in cool months

- Worldwide, more than 5 million children die every year from pneumococcal disease
- Alcoholism, diabetes mellitus, chronic renal disease, asplenia, and some malignancies are associated with more frequent and serious pneumococcal infection

The incidence of carriage & associated disease is highest during the cool months.

JANUARY and DECEMBER



Pneumonia



- 500,000 cases per year in USA
- Acute onset, consisting of a severe shaking chill and sustained fever
- Symptoms of a viral respiratory tract infection 1 to 3 days prior.
- Cough with blood-tinged sputum

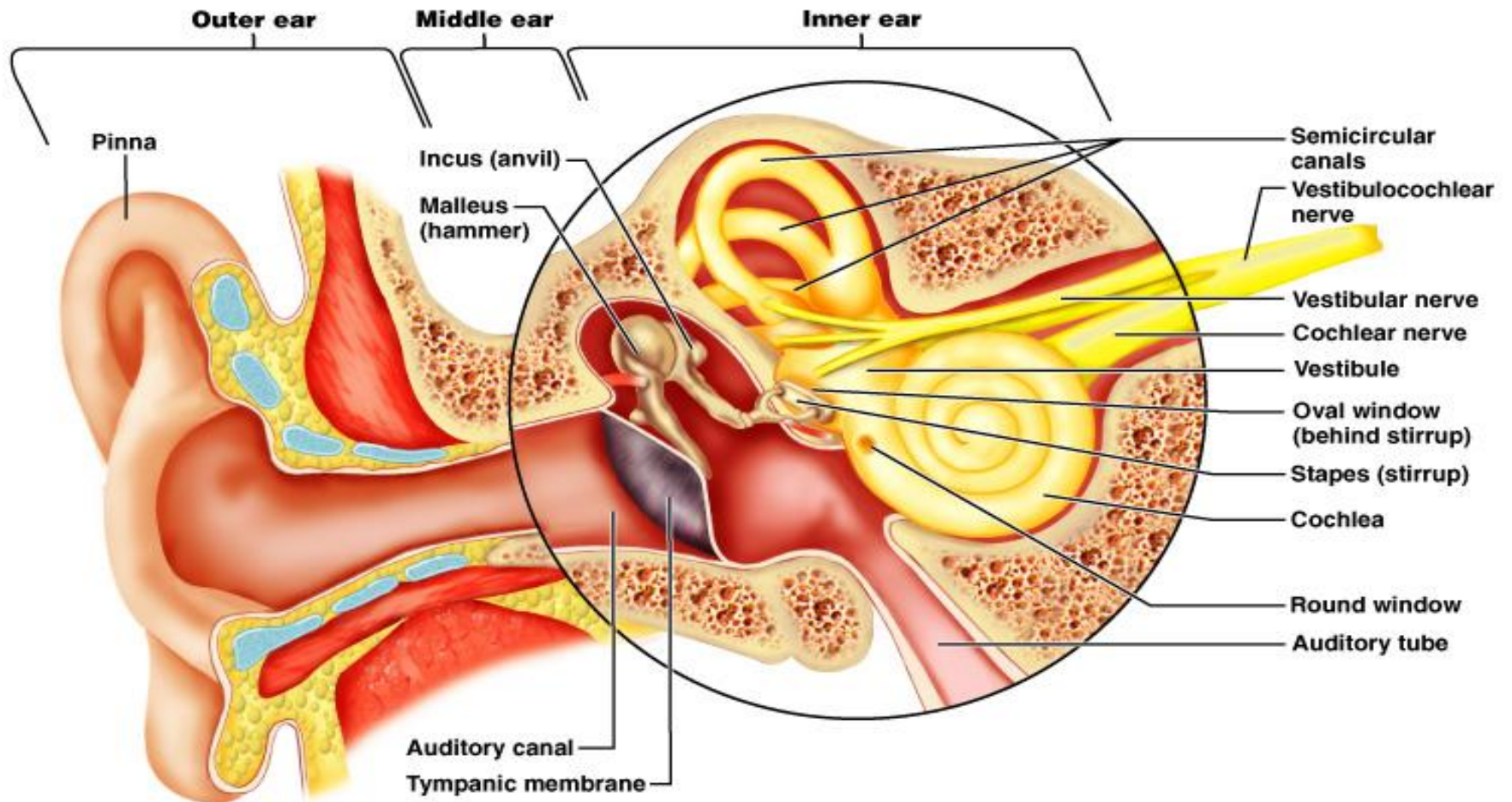
- Chest pain (pleurisy).
- **Lobar pneumonia** *S. pneumoniae* يميز
pus in one lobe
- Pulmonary consolidation
- Rapid recovery following the initiation of appropriate antimicrobial therapy, with complete resolution in 2 to 3 weeks.

Sinusitis and Otitis Media



- Over 7 million cases per year
- Acute infections of the paranasal sinuses and middle ear.
- Usually preceded by a viral infection of the upper respiratory tract
 - polymorphonuclear leukocytes (PMN) infiltrate and obstruct the sinuses and ear canal.

- Middle ear infection (otitis media) is primarily seen in young children
- Bacterial sinusitis can occur in patients of all ages.

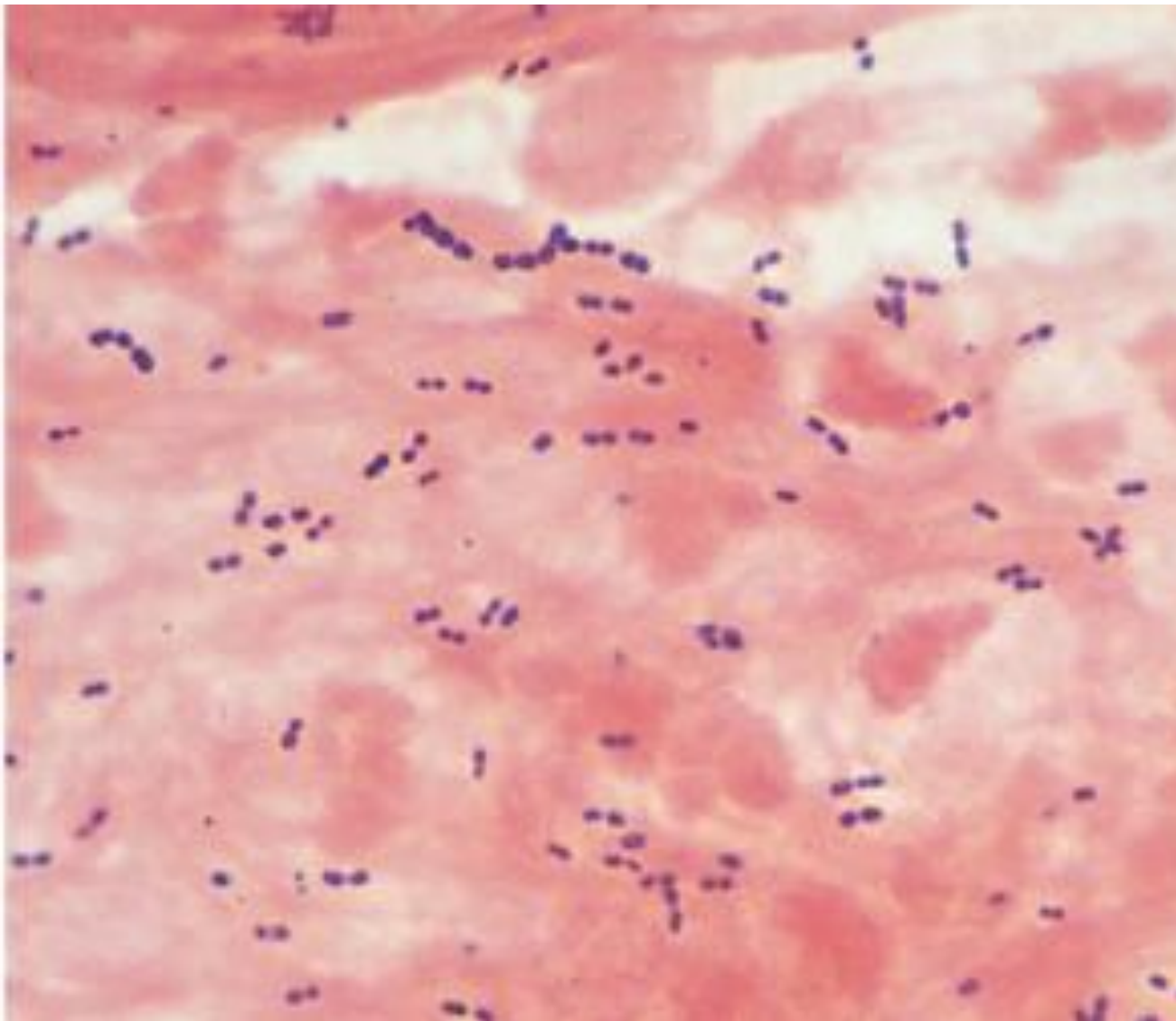


Copyright © 2006 Pearson Education, Inc., publishing as Benjamin Cummings.

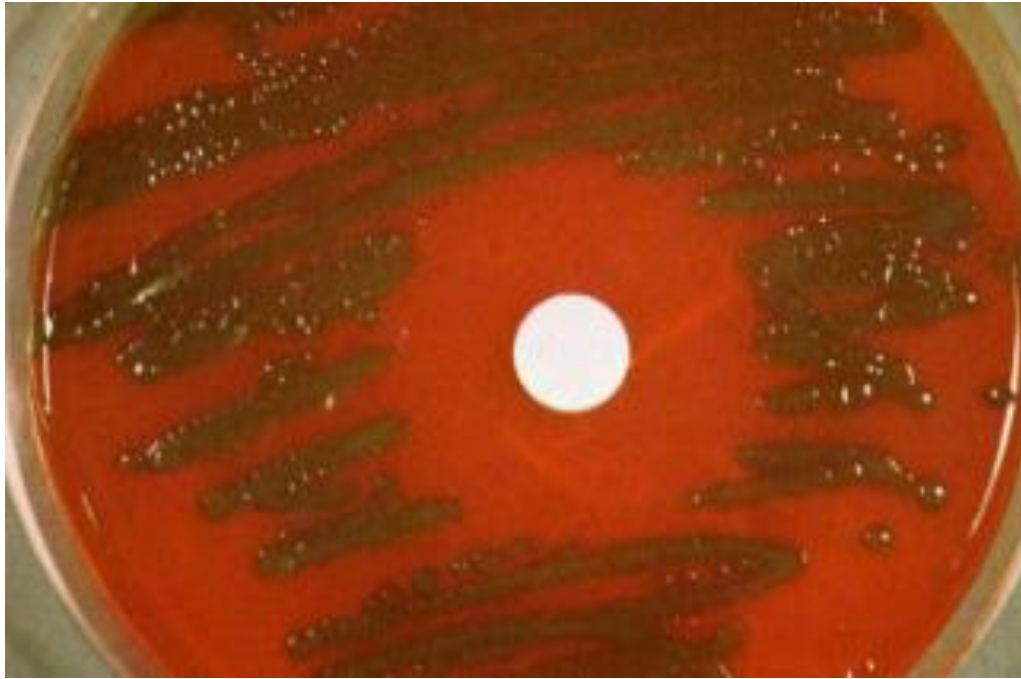
Lab Diagnosis



1. Gram smears of material from sputum
2. Streptococcus pneumoniae grows well overnight on blood agar
3. Susceptibility to the ethylhydrocupreine (optochin)
4. Bile solubility



Gram stain of *Streptococcus pneumoniae*.



Streptococcus pneumoniae A mucoid strain on blood agar showing alpha hemolysis (green zone surrounding colonies)

The zone of inhibition around a filter paper disc impregnated with optochin

Optochin or bile solubility distinguish from viridans streptococci

Treatment



- Penicillin is the drug of choice for susceptible strains
 - Antibiotic resistance is increasingly common
- In cases of allergy to penicillin or penicillin-resistant strains other drugs are used
 - Cephalosporins
 - Erythromycin
 - Chloramphenicol
 - Vancomycin

Prevention, and Control



Two pneumococcal vaccines

1. Pneumococcal polysaccharide vaccine (PPV) (1977) - >2 years
2. Pneumococcal conjugate vaccine (PCV7), (2000) – 2 month
3. 13-valent (PCV13) conjugate vaccine - 2010