Chlamydia, Mycoplasma & Legionella

Chlamydia

Importance

■ Commonest cause for **preventable blindness**

■ Second common cause for **atypical pneumonia**

■ Commonest cause for **non-gonococcal urethritis**

Microbiology

Chlamydia differ from conventional bacteria due to,

- **Small** size
- **No peptidoglycan** in the cell wall
- **Unable to produce ADP/ ATP**
- **Obligate intracellular** parasite

They are bacteria because,

- have **both DNA, RNA**, ribosome and cell wall
- divide by binary fission
- have variety of metabolically active enzymes
- growth **can be inhibited by antibiotics**

  eg - Tetracycline, Erythromycin

Morphology

- Very small
- Non motile
- Gram (-) ve bacteria
- Stain poorly with Gram stain
- Demonstrated by Giemsa stain, Iodine or immunofluorescence
- Has a **biphasic life cycle**

Physiology and Structure

Elementary bodies (EB)

- Small (0.3 - 0.4 μm)
- Extracellular form
- Resistant to harsh conditions
- Non-replicating, non-metabolically active
- Infectious form

Physiology and Structure

Reticulate bodies (RB)

- Larger (0.8 - 1 μm)
- Intracellular form
- Metabolically active form
- Replicating form
- Non-infectious

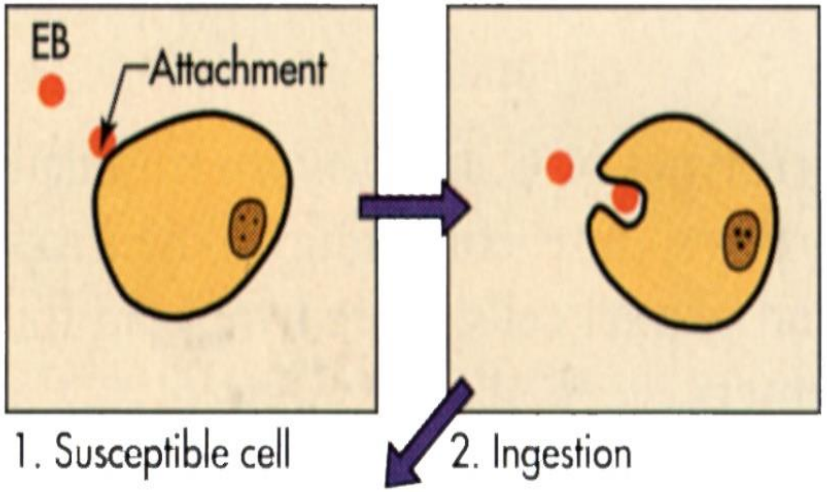
Developmental Cycle of Chlamydia

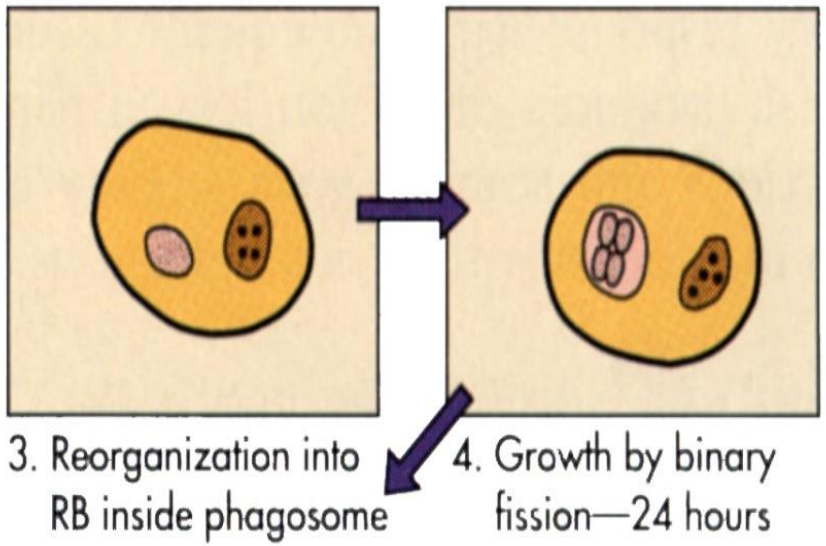
1. EB bind to host cells
   - Epithelial
   - Macrophage

2. Internalization
   - Endocytosis
   - Phagocytosis

3. Inhibition of phagosome-lysosome fusion

4. Reorganization into RB & Growth of RB



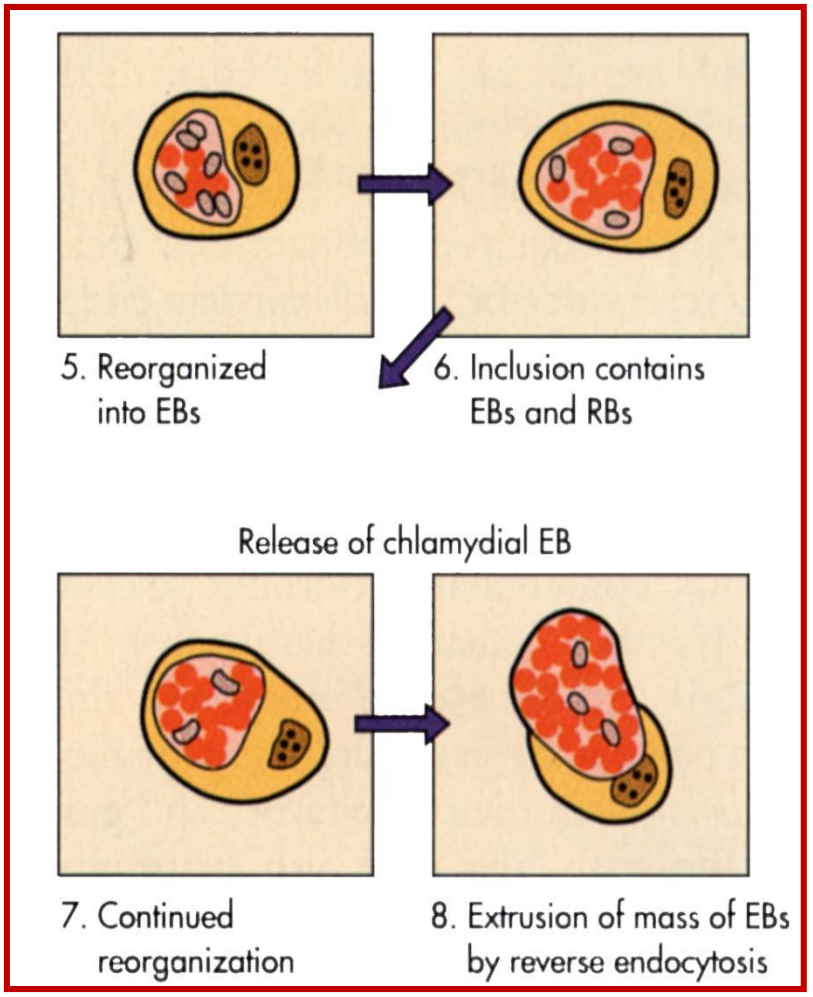


Developmental Cycle of Chlamydia

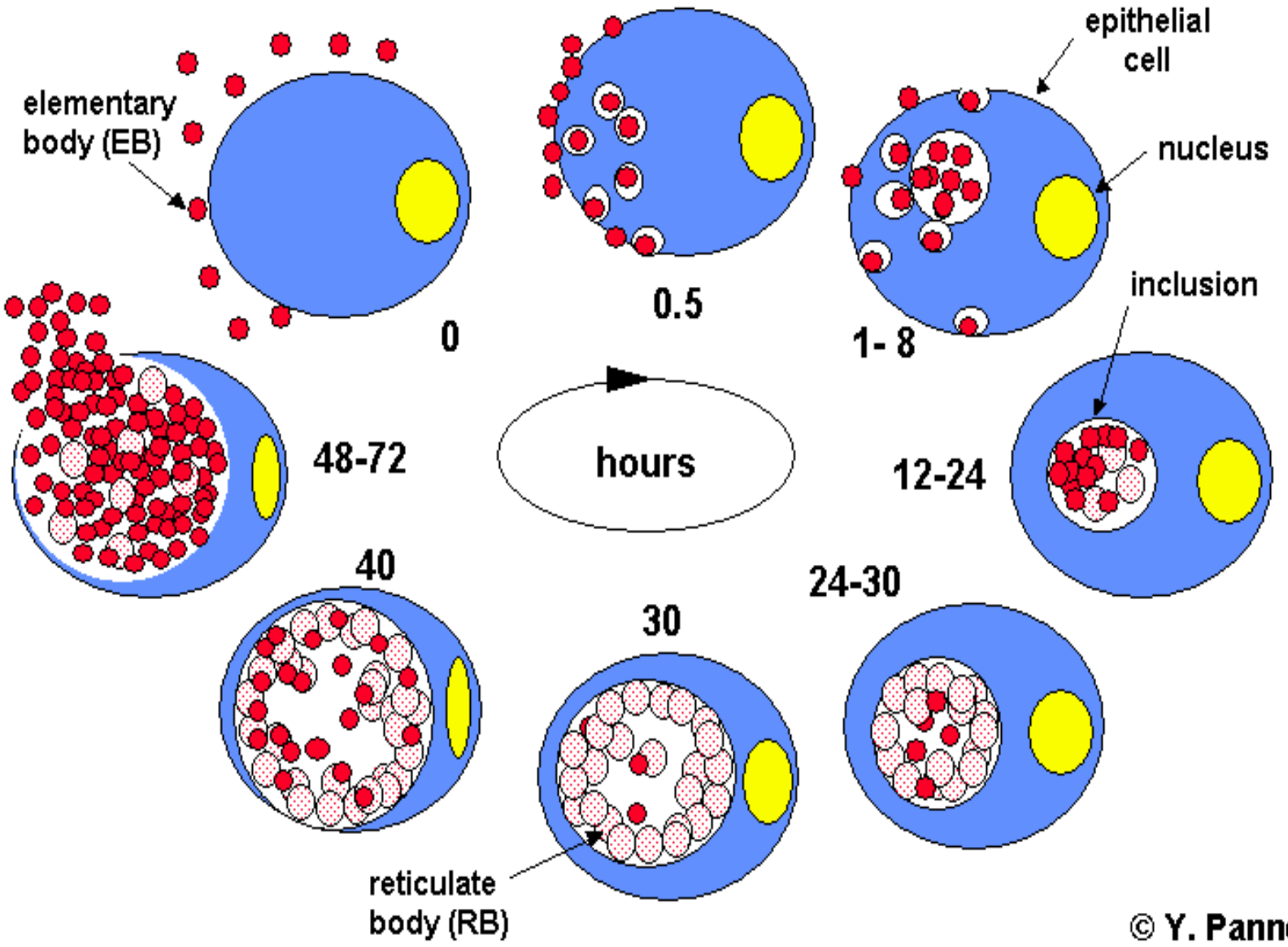
5. Reorganization into EB

6. **Inclusion** bodies

8. Release of EB



Developmental cycle of *C.trachomatis*



Medically important species

C. trachomatis

C. pneumoniae

C. psittaci

Chlamydia trachomatis

Consists of 2 biovars

- **Trachoma biovar**

  consists of 14 serovars (serological variants)(A-K)

  - A,B,C - cause **trachoma**
  - D-K - cause ocular & genital infections

- **LGV biovar**

  Consists of 3 serovars (L1- L3)

  Causes **Lymphogranuloma venerum**

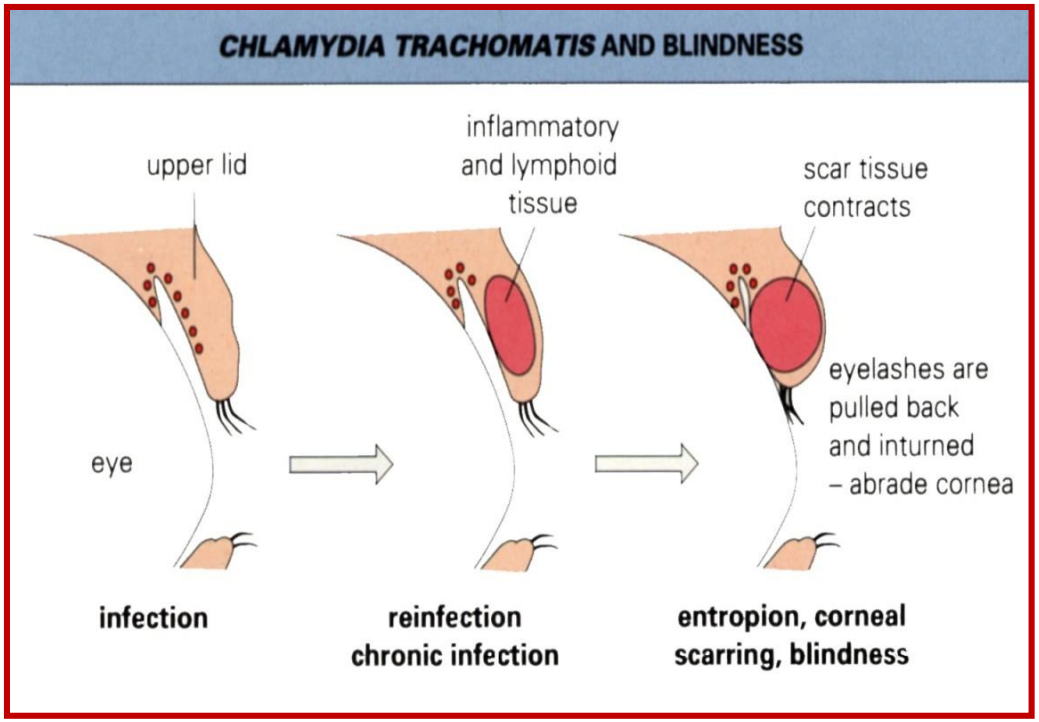
Trachoma

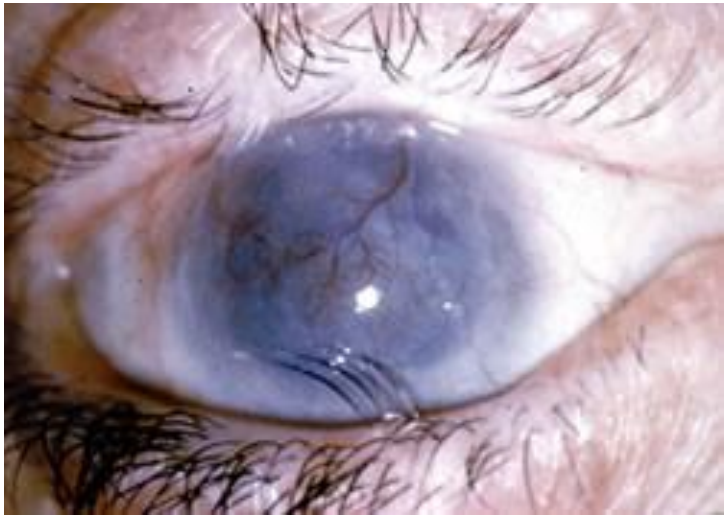
Chronic or repeated infection of the eye lid

Eyelids turn in and abrade the cornea

Corneal ulceration & scaring

Blindness





Inclusion conjunctivitis

Occur in neonates and adults

In neonates, infection results from infected birth canal

– Apparent 5-12 days after birth

Hyperemia & mucoid eye discharge

Usually resolves without complications

Rarely causes blindness

DD: **viral conjunctivitis**

Lymphogranuloma venereum

- Sexually transmitted disease
- 3 stages

1. 1ry lesion: ulcerating papule at site of inoculation (genital mucosa)

   Spread to draining LN

2. Suppurating regional lymph nodes

   (inguinal buboes)

   Inguinal abscess

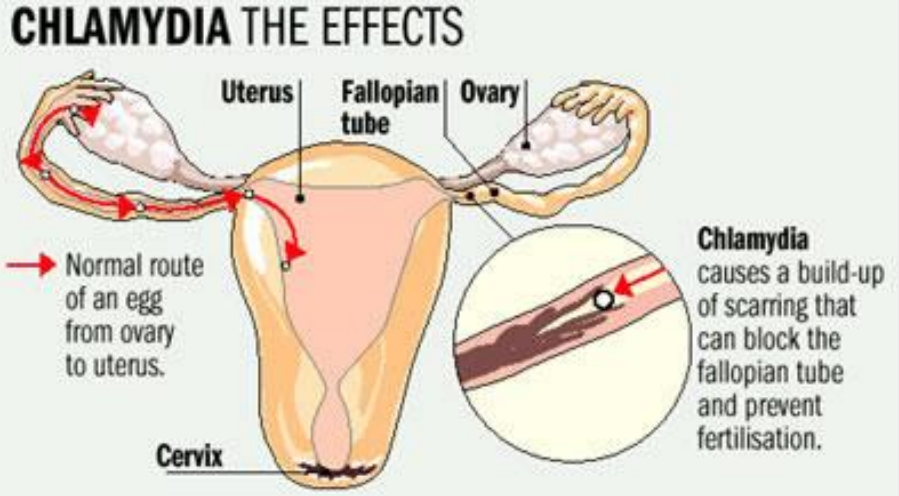
   Suppurative discharge

3. **Chronic granulomatous lesion**

Urogenital Infections

Females

- **Asymptomatic** (80%)
- Cervicitis, urethritis and salpingitis
- Postpartum fever
- Increased rate
  - Premature delivery
  - Ectopic pregnancy



Males

- **Symptomatic** (75%)
- Urethritis

Cause of nongonococcal urethritis (35 - 50%)

CF: Dysuria

Urethral discharge

White / gray / **clear**

Reiter's Syndrome

- Conjunctivitis, polyarthritis and genital or gastrointestinal inflammation
- 50 - 65 % have *C. trachomatis* infection
- 80% have antibodies to *C. trachomatis*

Chlamydia pneumoniae

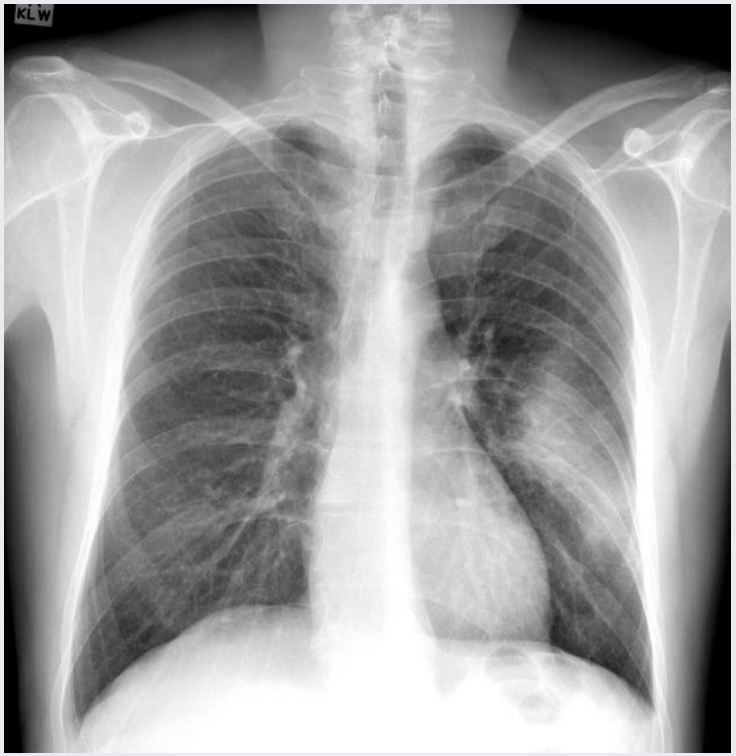
- Natural host - human
- Causes acute respiratory tract infections

Atypical pneumonia

Sinusitis

Pharyngitis

Bronchitis



Other associations

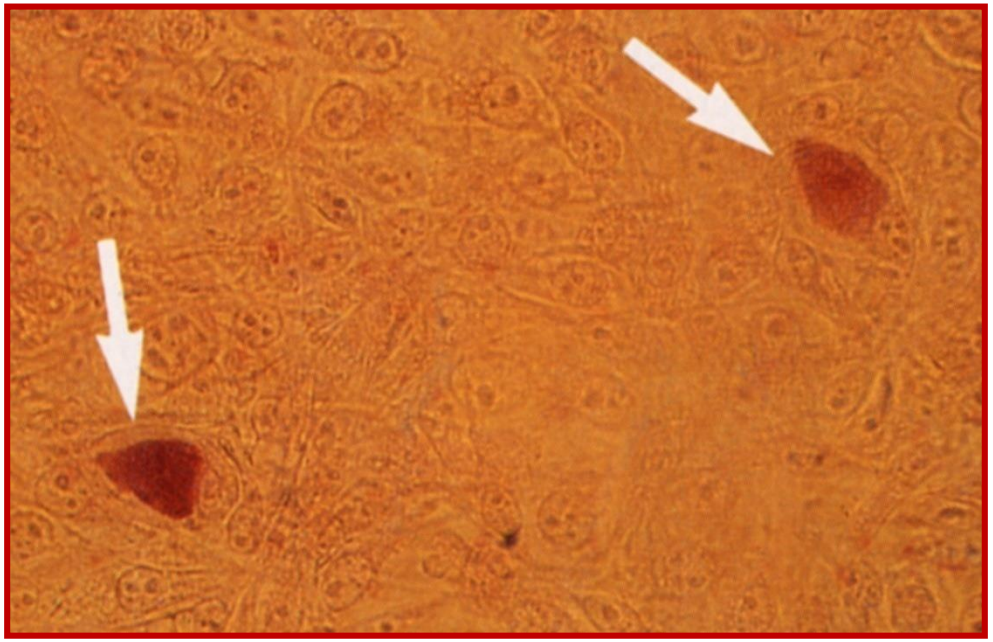
- **Athelesclerotic cardio vascular diseases**
- Adult onset asthma

Diagnosis of Chlamydia

Cytology

Iodine-staining inclusions

Iodine-stained inclusion bodies

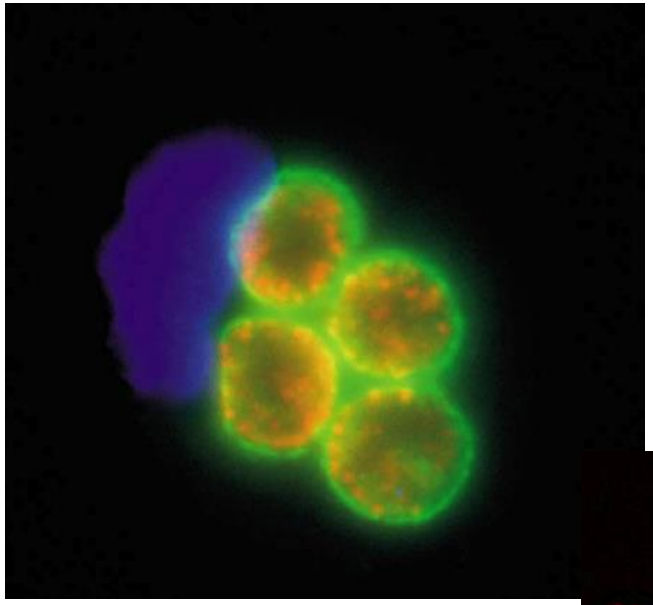


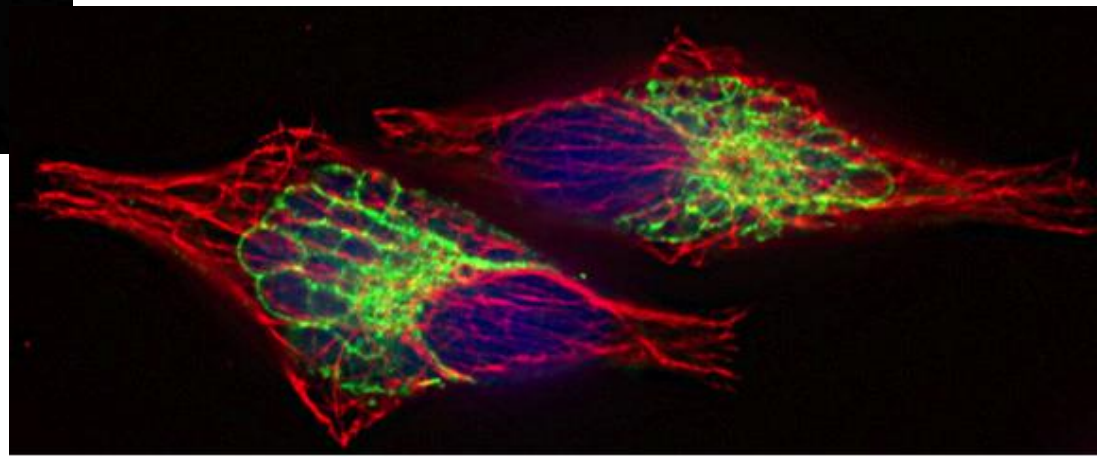
Culture

- Specimens need transport medium
- Grow in a **cell culture media**
- After 48 -72 hrs

  C. trachomatis with inclusion bodies can be seen by immunoflurescence stain / Iodine staining

The Chlamydial inclusion membrane





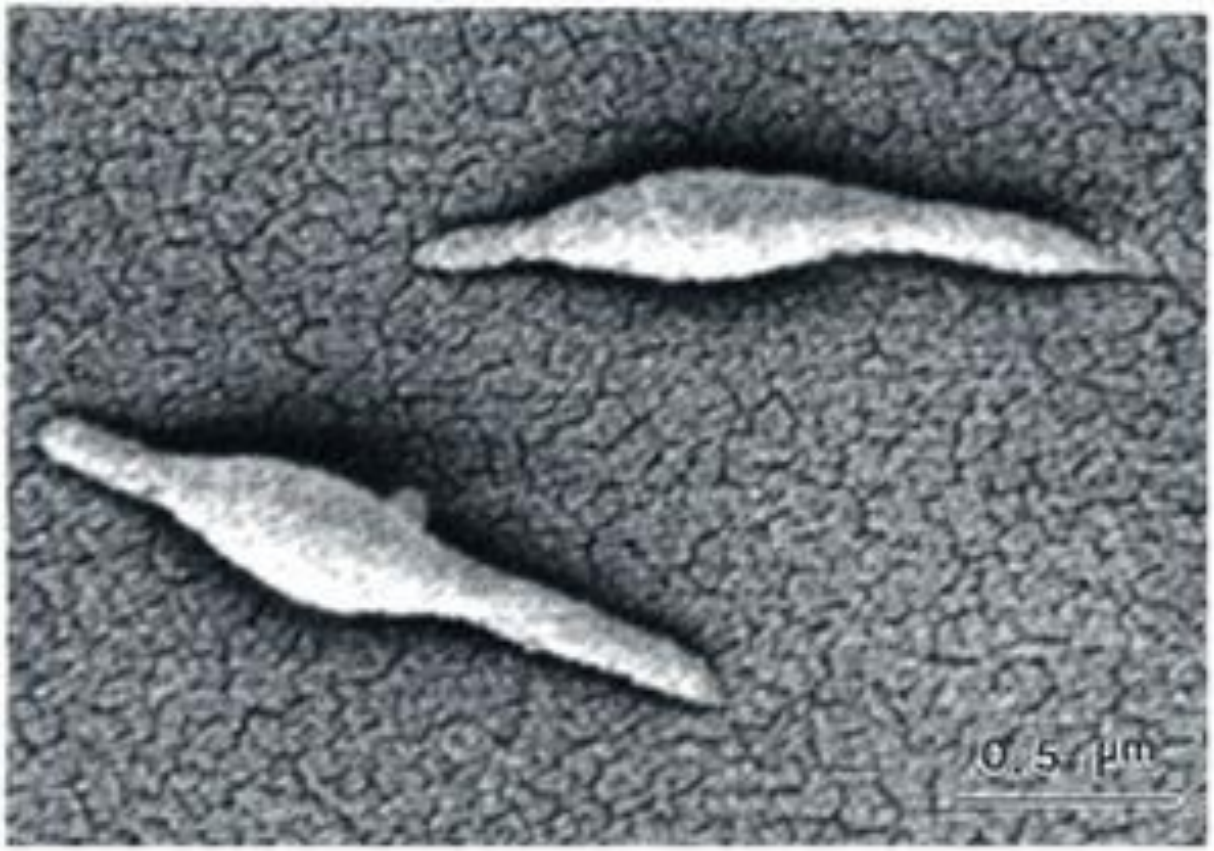
Diagnosis

- **Antigen detection (ELISA or IF)**
  - Group specific LPS
  - Strain specific outer membrane proteins
- **Serology**
  - Detection of high titer IgM antibodies can be helpful
  - CFT / Micro IF test
- **Molecular detection**
  - PCR / Nucleic acid probes

Treatment and Prevention

- Tetracycline - DOC in adult
- Erythromycin - neonates, pregnancy
- Treatment coupled with improved sanitation
- Safe sexual practices
- Treatment of patients and their sexual partners

Mycoplasma



Family: *Mycoplasmataceae*

Genus: *Mycoplasma*

Species: ***M. pneumoniae***

Species: *M. hominis*

Species: *M. genitalium*

Genus: *Ureaplasma*

Species: *U. urealyticum*

Mycoplasma

Importance

- Commonest cause for **atypical pneumonia**
- Causes array of respiratory & genital tract infections

Mycoplasma

- **Smallest** free-living bacterium
- Small genome size
  - Require complex media for growth
  - Nutritionally fastidious
- Only bacterium with **no cell wall**
- Pleomorphic
- **Resistant to antibiotics act on cell wall**
  - e.g. penicillin
- Slow grower

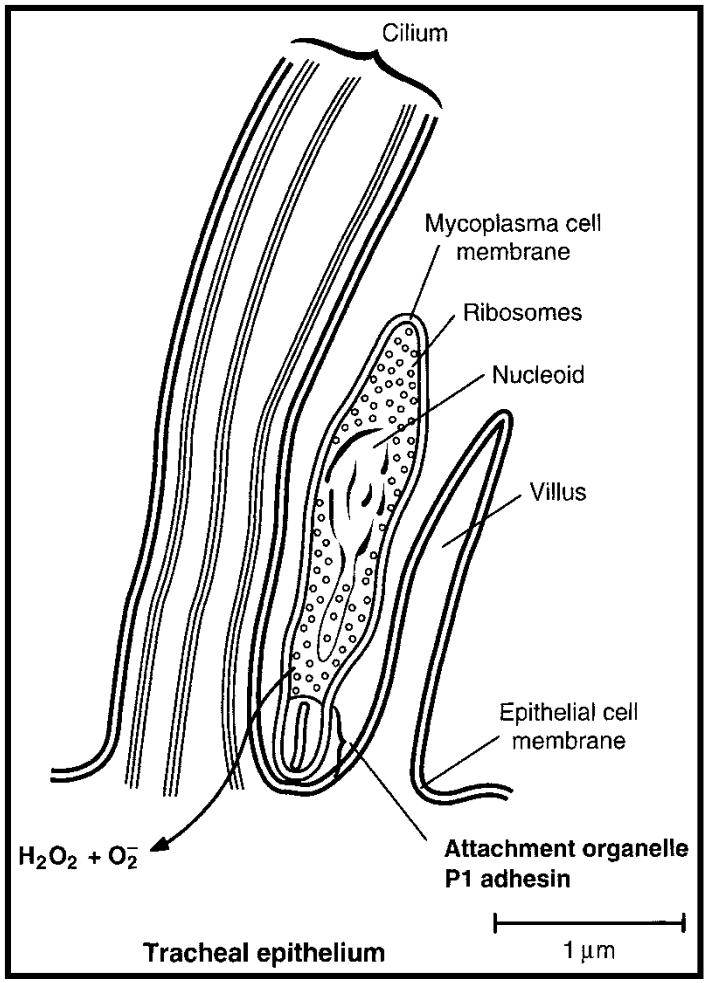
Mycoplasma pneumoniae

Epidemiology

- Most cases occur as singly or as family o/bs
- Causes **mini epidemics** in closed populations
- Highest attack rates in **children 5 -20 yrs old**
- Prevalent in colder months
- **Tx -** aerosol route (Confined populations)
- **IBP -** 2-3 / 52

Pathogenesis - Mycoplasma

- **Adherence**
  - Via P1 pili
  - Movement of cilia ceases
  - Clearance mechanism stops
- **Toxic metabolic products**
  - Peroxide and superoxide
- **Immunopathogenesis**



Clinical manifestations - *M. pneumoniae*

- Respiratory infection
  - Sub clinical illness
  - URT infection
  - Tracheobronchitis
    - 70-80% of infections
  - **Pneumonia**
    - Approximately 10% of infections

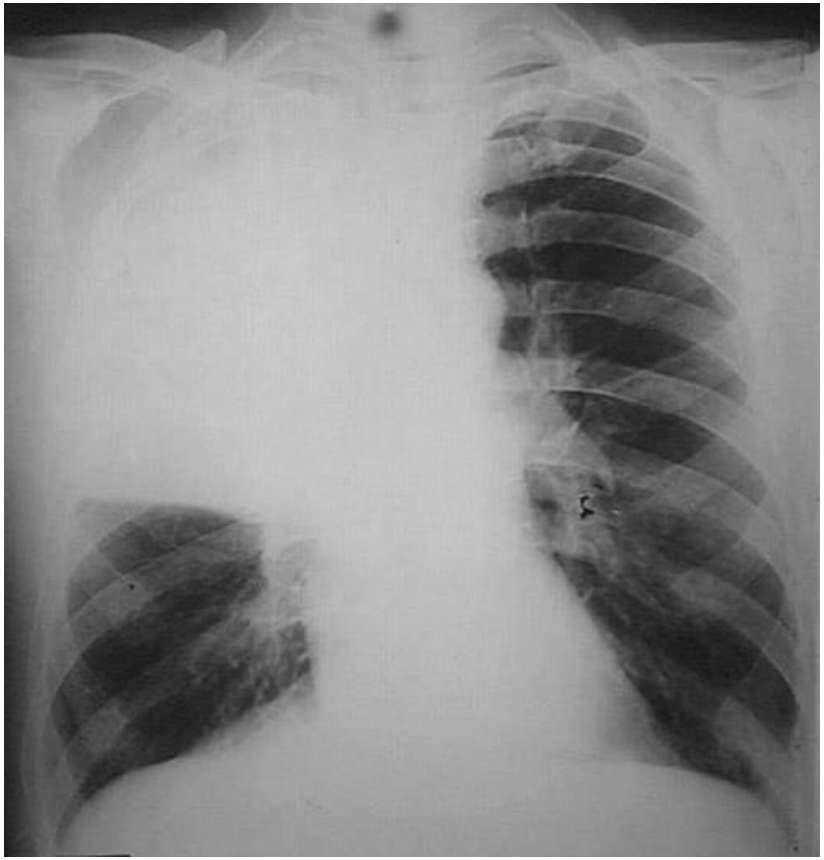
Pneumonia - *M. pneumoniae*

- Incubation - 2-3 / 52
- Fever, headache and malaise
- Persistent non-productive cough
- Respiratory symptoms
  - **Radiological signs precede symptoms**
- Organisms **persist** in RT
- **Slow resolution**
- Rarely fatal

Pneumonia - *M. pneumoniae*

- "Primary atypical pneumonia"
  - Cough
    - Become more severe
    - Non – productive /
    - May yields whitish sputum

- **On Ex**
  - Not terribly ill (*walking pneumonia*)
  - **Greatest disparity between physical finding & radiological evidence**



Typical lobar pneumonia caused by Pneumococci

X-ray shows bilateral interstitial infiltrates
Can be caused by viral pneumonia, pneumocystis, **mycoplasma**, chlamydia, coxiella, and sometimes legionella

Extra pulmonary involvement

- Affect almost every organ system
- Due to **immune modulation** (autoimmunity)

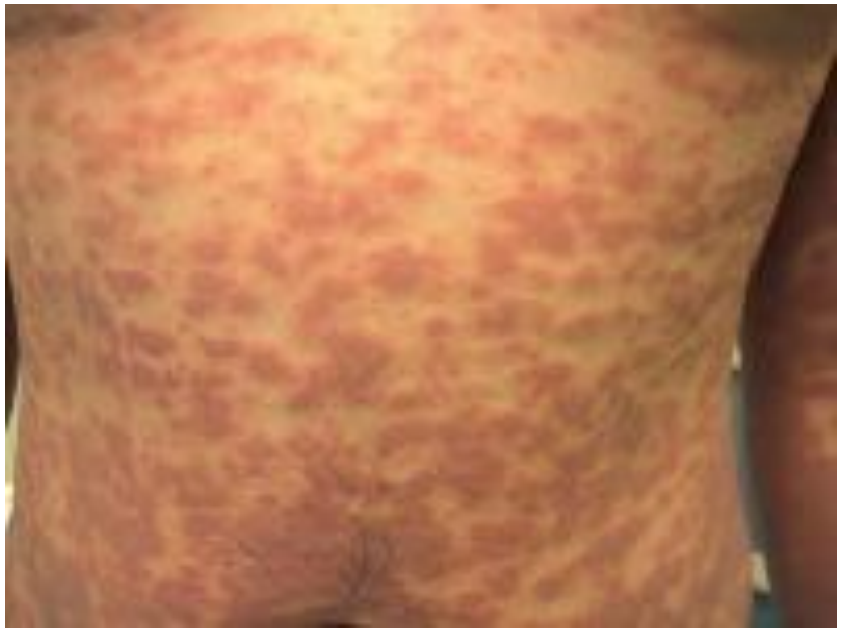
Dermatological involvement

Transient dermatological conditions

Macular, morbilliform, papulovesecular eruptions

Urticarial rash

Stevens–Johnson syndrome (SJS)



Cardiac complications

- Arrhythmia
- ECG abnormalities

Neurological Cx

- Aseptic meningitis
- Gullian – Barre syndrome

Musculoskeletal Cx

- Polyarthralgia

M. hominis, M. genitalium & U. urealyticum

Clinical syndromes

M. hominis - pyleonephritis, PID, postpartum fever

M. genitalium - nongonococcal urethritis

U. urealyticum - nongonococcal urethritis

Laboratory Diagnosis - *M. pneumoniae*

- **Microscopy**
  - Difficult to stain

- **Culture**
  - Sputum or throat washings
  - Need special transport medium
  - On Mycoplasma base agar
  - Produce fried egg appearance colonies in 2-3 weeks
  - Not done routinely

Serological diagnosis - *M. pneumoniae*

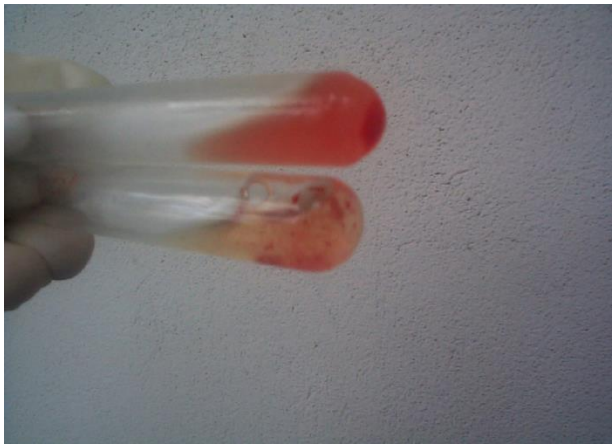
Serology

ELISA

- Test Specific antibodies
- (IgM / 4 fold rise of IgG indicates recent infection)
- Commercially available

Cold agglutinins

Non-specific



Molecular detection

PCR

Identify DNA specific for Mycoplasma spp

Treatment and Prevention
M. pneumoniae

- **Treatment**
  - Macrolides (Resistance has developed) / Tetracycline
  - Newer fluoroquinolones
  - **Can not use cell wall synthesis inhibitors**

- **Prevention**
  - Avoid close contact
  - No vaccine

Legionella

- Gram (-) ve bacillus
- Natural habitat - **water**
- >50 spp
- Most important spp – *L. pneumophila*

  3 subspp

  L.P. spp pneumophila

  (most important)

Pathogenesis

- *Legionella* species are obligate or facultative **intracellular pathogens**.

- Infect human **macrophages** and **monocytes**
- intracellular replication of the bacterium

- **Activated T cells** produce lymphokines that stimulate increased antimicrobial activity of macrophages.

- This **cell-mediated activation** is key to halting the intracellular growth of legionellae.

Clinical importance

Legionnaires' disease

IBP – 2-10 d

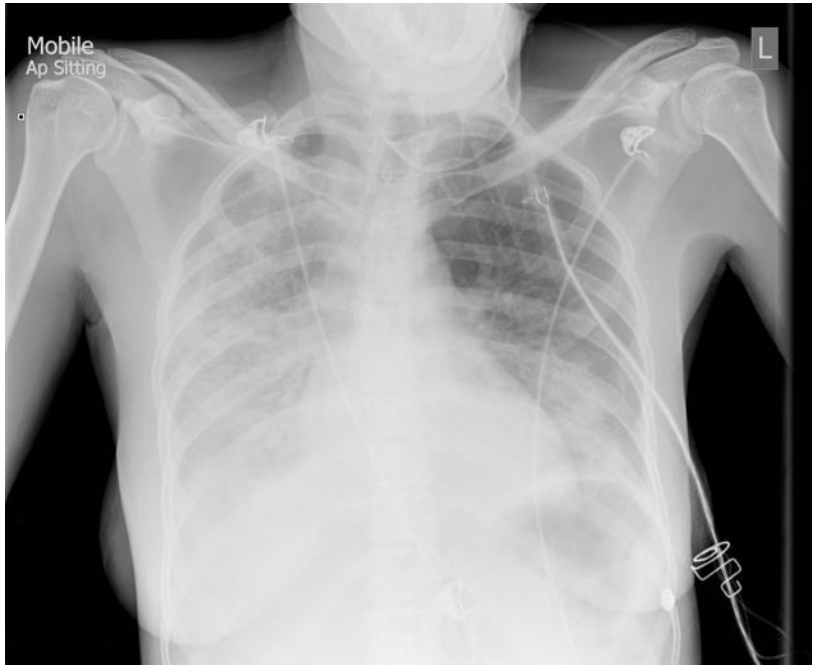
High fever

Respiratory distress

Confusion

hallucination

focal nerological signs



Diagnosis

- Detection of whole organism (in sputum)
  - Culture
  - FAT
- **Antigen detection (in urine)**
  - ELISA
- Antibody detection (in serum)
  - FAT
  - ELISA

Treatment

- Erythromycin
- Azythromycin