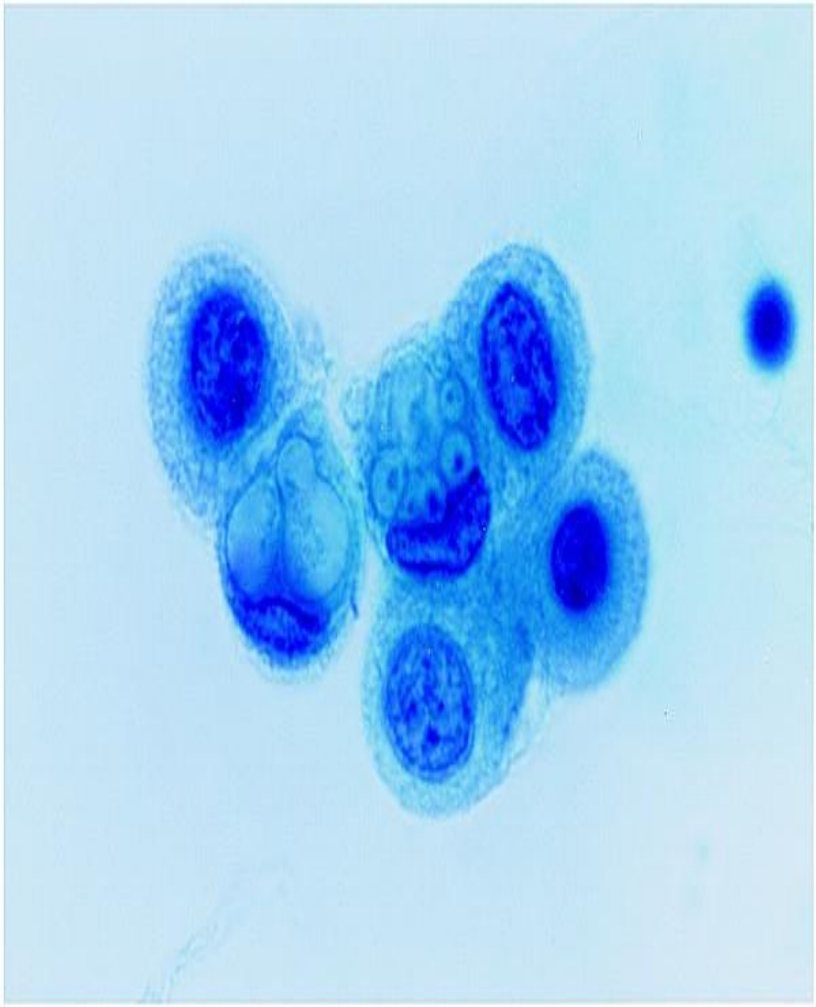

Chlamydia

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Chlamydiae that infect humans are divided into three species,

Chlamydia trachomatis,

Chlamydia (Chlamydophila)pneumoniae, and

Chlamydia (Chlamydophila) psittaci **,**

on the basis of antigenic composition, intracellular inclusions, sulfonamide susceptibility, and disease production.

Classification:

Three that infect humans

C. trachomatis: This species produces compact intracytoplasmic inclusions that contain glycogen; it is usually inhibited by sulfonamides. It includes agents of human disorders such as trachoma, inclusion conjunctivitis, nongonococcal urethritis, salpingitis, cervicitis, pneumonitis of infants,and lymphogranuloma venereum (LGV).

C. psittaci: This species produces diffuse intracytoplasmic inclusions that lack glycogen; it is usually resistant to sulfonamides. It includes agents of psittacosis in humans, and other animal diseases.

C. pneumoniae: This species produces intracytoplasmic inclusions that lack glycogen; it is usually resistant to sulfonamides. It causes respiratory tract infections in humans.

Th e chlamydiae can be viewed as **gram-negative bacteria**
that lack mechanisms for the production of metabolic energy and
cannot synthesize adenosine triphosphate (**ATP**).
Thus, chlamydiae are **obligate intracellular parasites**

Developmental Cycle

All chlamydiae have unique biphasic developmental cycle. The environmentally stable infectious particle is a small cell called the elementary body (EB).
These are about 0.3 µm in diameter.
The EBs have a high affinity for host epithelial cells and rapidly enter them. **There appear to be multiple adhesins, receptors, and mechanisms of entry.**
Heparan sulfate–like proteoglycans on the surface of *C trachomatis* are likely possibilities for mediating at least the initial interaction between EBs and host cells.

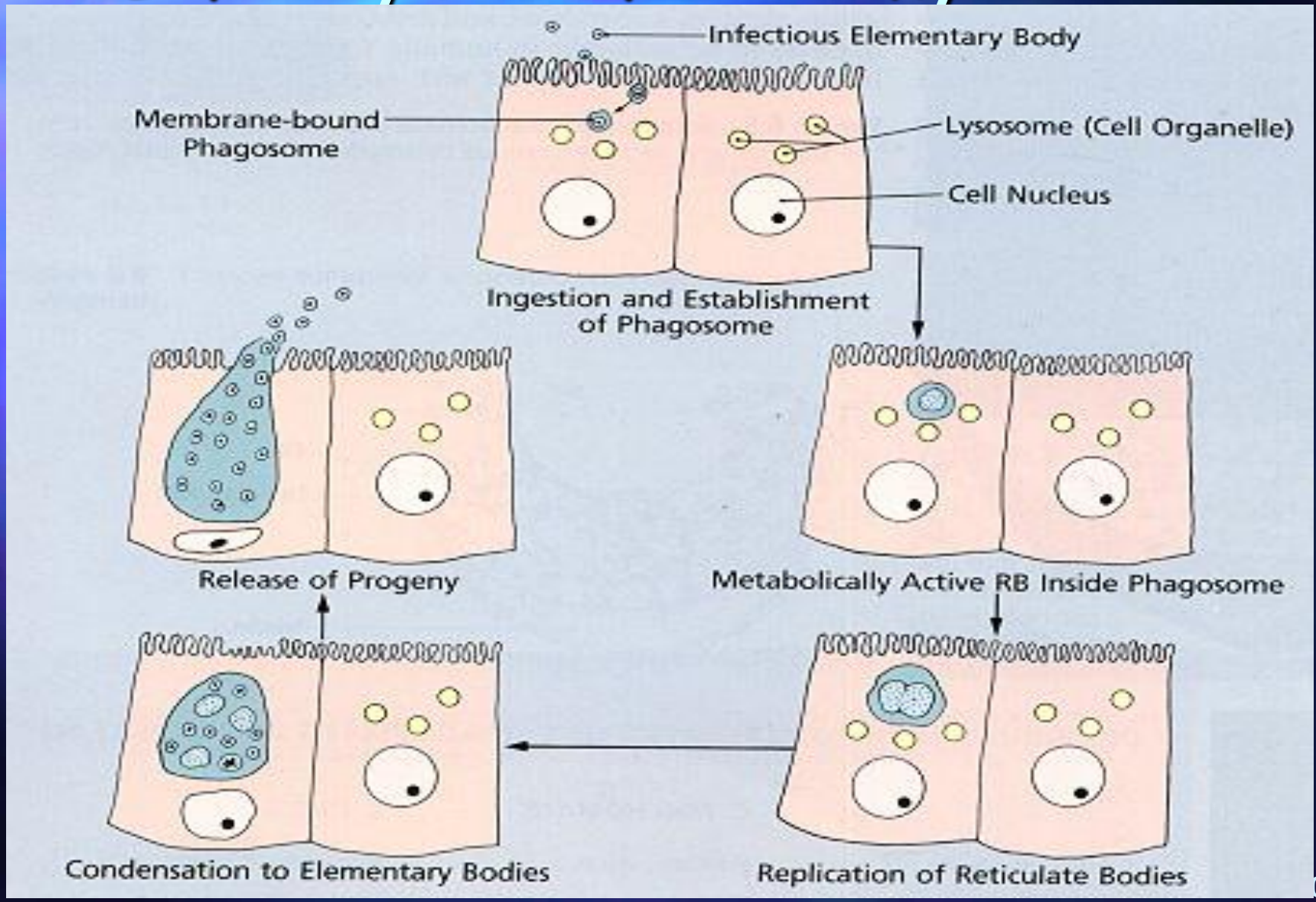
Other potential adhesins include the major outer membrane protein (MOMP) , glycosylated MOMP, and other surface proteins.

The mechanisms thought to mediate entry into the host cell also varied. **EBs are usually seen attached near the base of microvilli,** where they are subsequently engulfed by the host cell

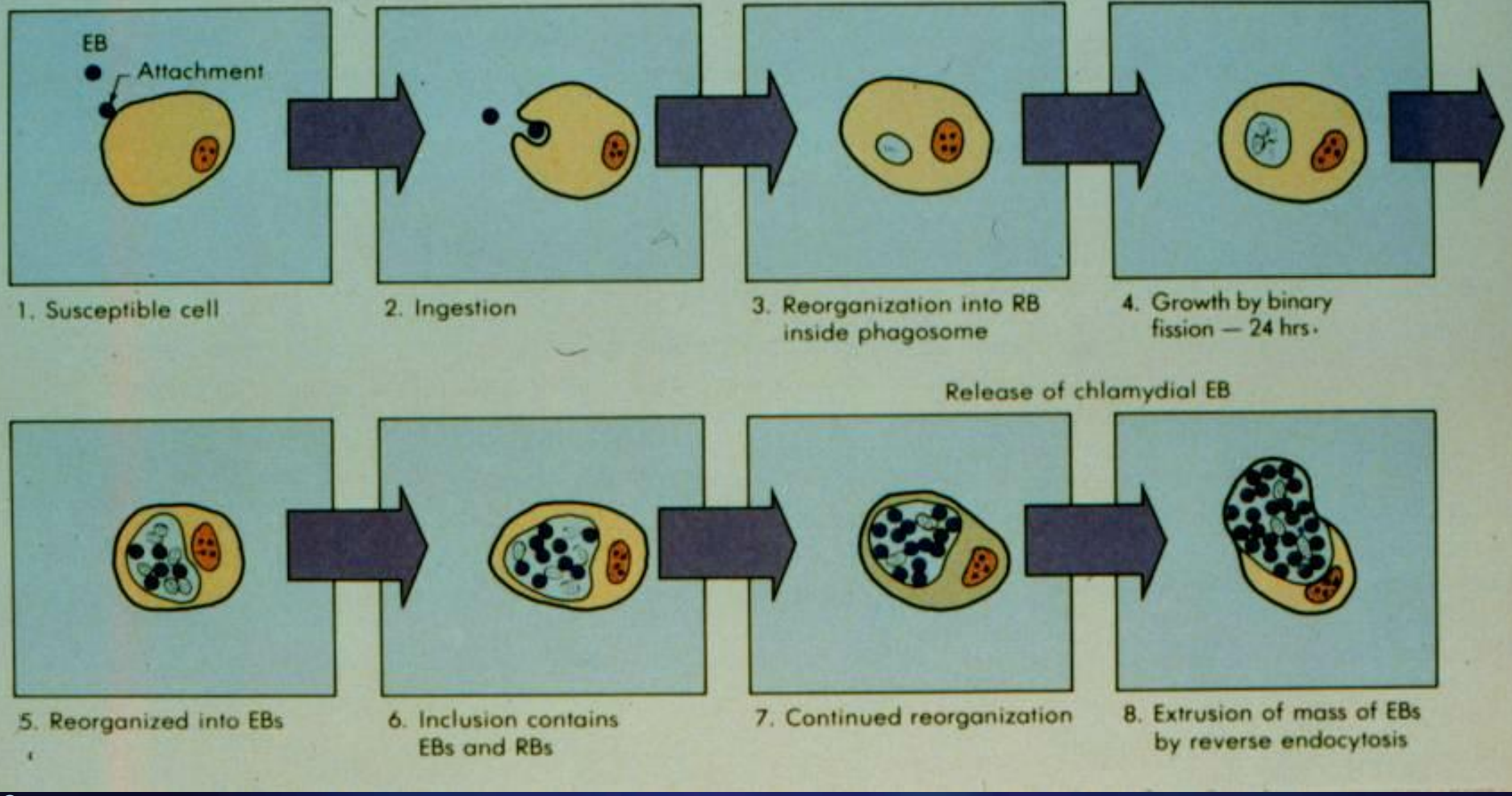
Lysosomal fusion is inhibited, creating a protected membrane-bound environment around the chlamydiae. Shortly after entry Into the host cell

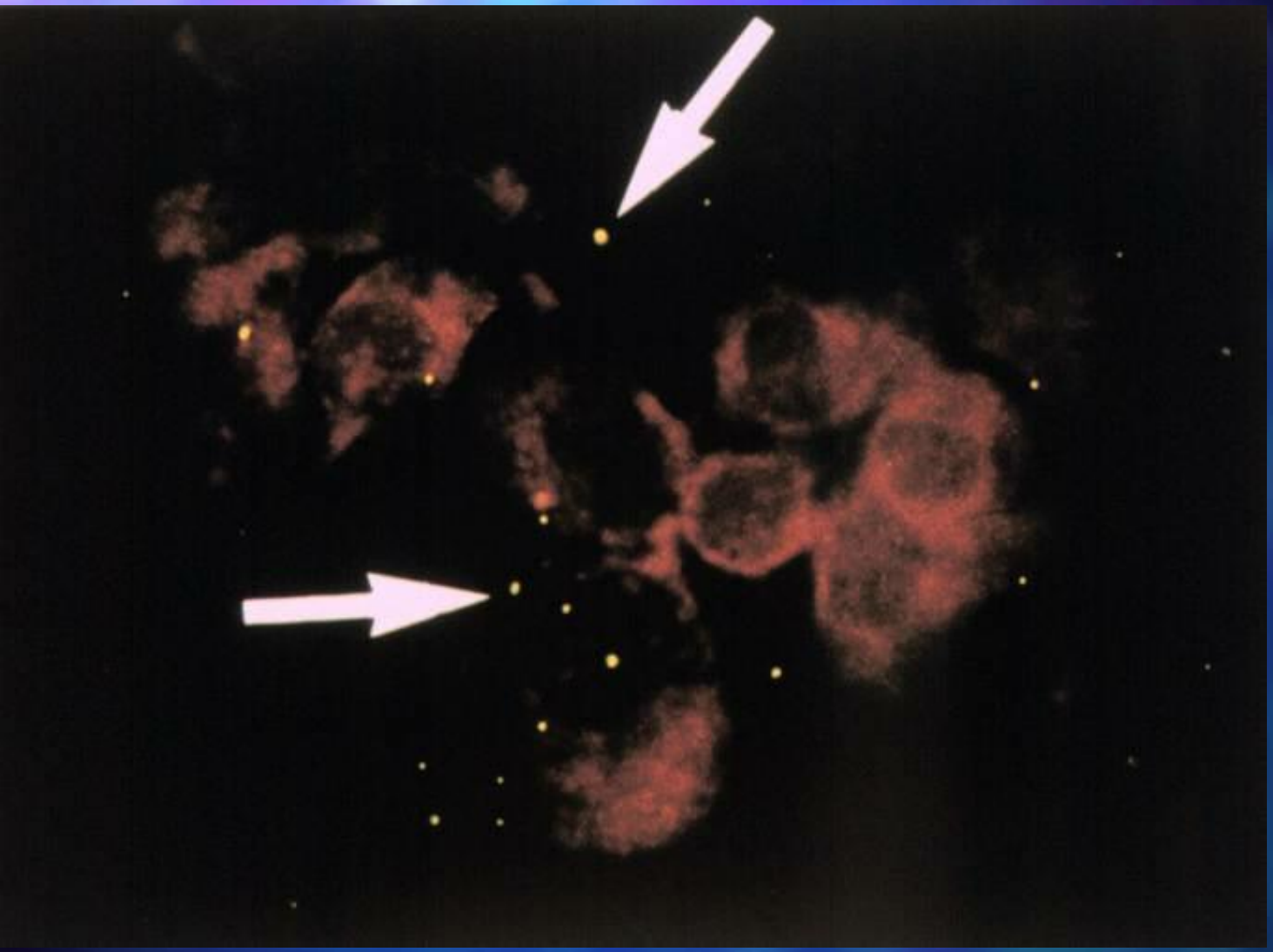
the disulfide bonds of the EB membrane proteins are no longer cross-linked, and the EB is reorganized into a larger structure called a reticulate body (RB) measuring about 0.5–1 μm
the RB grows in size and divides repeatedly by binary fission. Eventually, the entire vacuole becomes filled with EBs derived from the
RBs to form a cytoplasmic inclusion . The newly formed EBs may be liberated from the host cell to infect new cells. The developmental cycle takes 24–48 hours.

Life Cycle of Chlamydia



Developmental Cycle of Chlamydia





C trachomatis elementary bodies

Growth and Metabolism

- Chlamydiae require an intracellular habitat because they are unable to synthesize ATP and depend on the host cell for energy requirements.

- The replication of chlamydiae can be inhibited by many antibacterial drugs. Cell wall inhibitors such as **penicillins and cephalosporins**
- Inhibitors of protein synthesis (**tetracyclines,erythromycins)** are effective

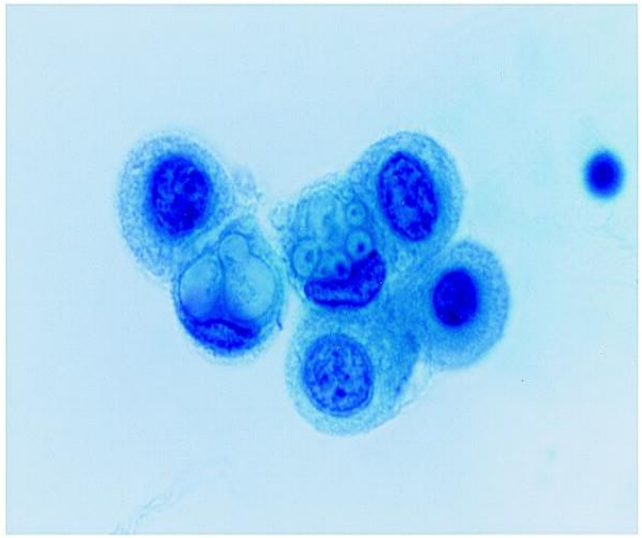
What is chlamydia?

- **Chlamydia is a common STD that can infect both men and women. It can cause serious, permanent damage to a woman's reproductive system.**

This can make it difficult or impossible for her to get pregnant later on.

Chlamydia can also cause a potentially fatal ectopic pregnancy (pregnancy that occurs outside the womb).

STI caused by bacterium
Chlamydia trachomatis
primarily targets cells of mucous membranes including urethra, vagina, cervix and endometrium (mouth and throat)
one of most commonly reported bacterial STDs



Chlamydia

- Obligate intracellular coccoid parasites
- contain DNA and RNA, and ribosomes
- lack ATP, biosynthetic pathways
- cell wall but peptidoglycan absent -
  - use disulfide bonds
- non motile

Chlamydia Characteristics

- Unique growth cycle because they are deficient in independent energy metabolism; therefore they are obligate intracellular parasites
- Replication involves **elementary body (EB)** and **reticulate body (RB)**

Symptoms and signs

- appear between 1 and 3 weeks after exposure (may not emerge until much later)

-“silent disease”

- 70-75% asymptomatic women

Women

Complications

- **Pelvic Inflammatory Disease (PID)**
  - higher risk of ectopic pregnancy, premature birth, infertility
- **Mother-to-child-transmission (MTCT)**
  - eye or lung infection
- **Cerviciti**

- yellowish vaginal discharge and pain during sex
- deep pelvic pain and backache

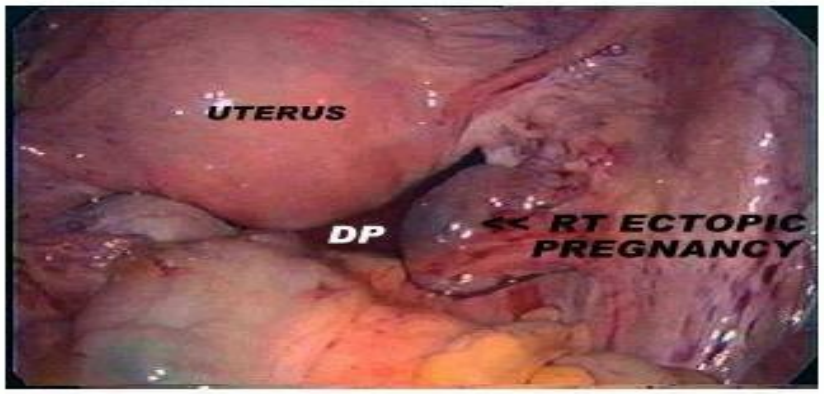


Figure 15:
Right Ectopic Pregnancy (DP= Douglas Pouch)

Men & Women

- **Reiter´s syndrome**

  - inflammation of eyes and joints, rash on genitals and soles

- **Appendicitis**

Chlamydia trachomatis

- Most commonly sexually transmitted bacterial pathogen in U.S.
  - Only HPV is a more commonly sexually transmitted disease
  - Adult males
    - Non-gonococcal urethritis (NGU)
    - Epididymitis and prostatitis

Chlamydia trachomatis (cont'd)

- Adult females
  - Urethritis, follicular cervicitis, endometritis, proctitis, salpingitis, PID and perihepatitis
- Major cause of sterility in U.S.
- May be transmitted to newborns during delivery

Chlamydia trachomatis (cont'd)

- **Laboratory Diagnosis**
  - Direct microscopic examination to find EBs
  - Cell culture
  - Enzyme immunoassay
  - Nucleic acid probes with and without amplification (PCR)
  - Serologic (antibody) assay

Ecology

- Chlamydia form two main ecological groups.
- **Infect only humans**
  - **Subgroup A**
  - **trachoma, inclusion conjunctivitis, and lymphogranuloma venereum**
- Zoonotic Infections
  - Subgroup B
  - Respiratory tract infections

C trachomatis

Trachoma

conjunctivitis

proctitis

urethritis

salpingitis

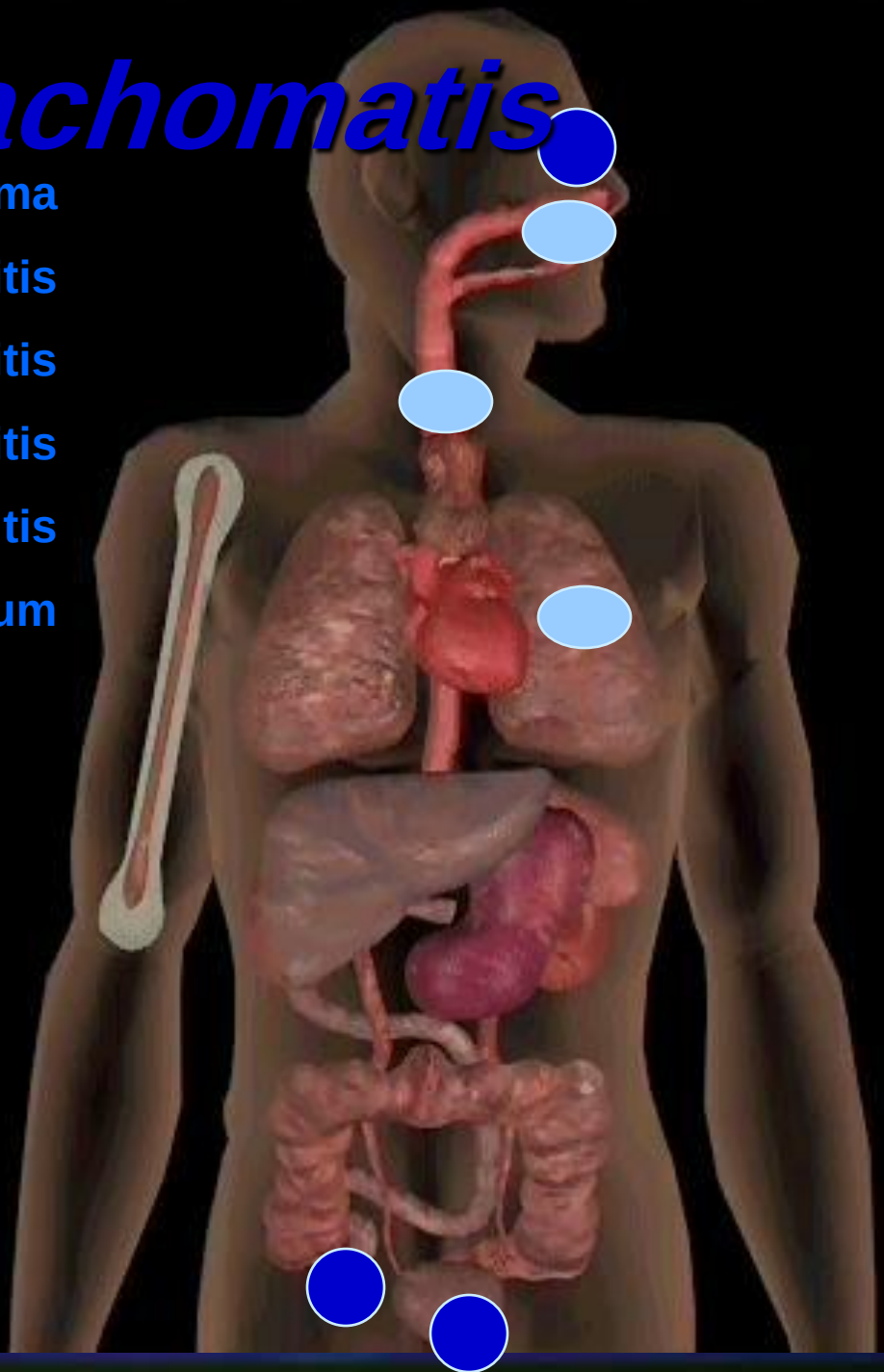
Lymphogranuloma venereum

C psittaci & C pneumoniae

Upper respiratory infection

Bronchitis

Pneumonia



Chlamydial Morphologies

- Elementary body
  - 0.25 - 0.3 um diameter
  - electron-dense nucleoid
  - Released from ruptured infected cells. Human to human
  - & bird to human.
- Reticulate Body
  - Intracytoplasmic form 0.5 - 1.0 um
  - Replication and growth. (Inclusion body)
  - without a dense center.

C trachomatis inclusions

Conjunctivitis

- Inclusion conjunctivitis:
  - Transmitted by infectious secretions of the genitourinary tract
  - autoinoculation
- Infantile conjunctivitis:
  - Acquired in the birth canal -- 5-12 days after birth
  - most common type of conjunctivitis
- Antibiotic prophylaxis: erythromycin, tetracycline.

Chlamydial Infection of Ocular Conjunctiva

Chlamydia trachomatis
Clinical disease

- lymphogranuloma venereum
- nongonoccal urethritis (NGU)
- epididymitis
- salpingitis
- mucopurulent cervicitis
- pelvic inflammatory disease (PID)
- Reiter's syndrome
- neonatal chlamydia

Chlamydia Symptoms In Men

- Symptoms usually appear between 7 and 28 days after infection, usually with mild burning when urinating, a more frequent need to urinate, and a white discharge from the penis. Occasionally, blood may appear in the urine. The symptoms occur most frequently in the morning.

Nongonococcal urethritis (NGU) - Reiter's syndrome

- Swollen, painful right knee in which needle aspiration for synovial fluid was performed (yellow discoloration from the betadine prep)

Hyperlink to original site

Lymphogranuloma venereum LGV

- 200 reported cases per year.
- Incubation period is 5 to 20 days.
- Lesion: Transient vesicles on penis or vagina that are often unnoticed and patients do not usually seek medical advice.

Chlamydia pneumoniae

- This bacterium was first recognized in 1983 as a respiratory pathogen, after isolation from a college student with pharyngitis.
- Pneumonia or bronchitis, gradual onset of cough with little or no fever. Less common presentations are pharyngitis, laryngitis, and sinusitis.

Incidence

- Each year an estimated 50,000 adults are hospitalized with pneumonia in the United States. The overall incidence is unknown.

Diagnosis of chlamydia

- urine sample
- swab taken from vagina
- swab taken from opening of the urethra at the tip of the penis

Transmission

- Person-to-person transmission by respiratory secretions.
- Risk Groups
- All ages at risk but most common in school-age children. By age 20 years, 50% of population have evidence of past infection. Reinfection throughout life appears to be common.

Treatment

- short course of antibiotics: azithromycin, doxycycline or erythromycin
- one-time dose taken daily or multiple times a day for 5-10 days
- resolves within one to two weeks
- sexual abstinence during that period

Can chlamydia be cured?

Yes, chlamydia can be cured with the right treatment. It is important that you take all of the medication your doctor prescribes to cure your infection. When taken properly it will stop the infection and could decrease your chances of having complications later on.

Repeat infection with chlamydia is common. You should be tested again about three months after you are treated, even if your sex partner(s) was treated.

- **What happens if I don't get treated?**
- If you are a woman, untreated chlamydia can spread to your uterus and fallopian tubes (tubes that carry fertilized eggs from the ovaries to the uterus). This can cause pelvic inflammatory disease (PID). PID often has no symptoms, however some women may have abdominal and pelvic pain. Even if it doesn't cause symptoms initially, PID can cause permanent damage to your reproductive system.
-
- PID can lead to long-term pelvic pain, inability to get pregnant, and potentially deadly ectopic pregnancy(pregnancy outside the uterus).

- Men rarely have health problems linked to chlamydia. Infection sometimes spreads to the tube that carries sperm from the
- testicles, causing pain and fever.
- Rarely, chlamydia can prevent a man from being able to have children.
- Untreated chlamydia may also increase your chances of getting or giving HIV – the virus that causes AIDS.

Laboratory Diagnosis

- Isolate the organism from infected tissue.
  - Inoculate the yolk sac of seven-day chick embryos
  - Inoculate McCoy human cells.
- Characteristic cytoplasmic inclusion bodies in infected cells.

Immunofluorecent tests

- Microimmunofluorescent tests
  - patients with eye infections
  - Check tears for the presence of anti-chlamydia antibody.
- Direct immunofluorescence
  - of conjunctive cells with fluorescein - conjugated monoclonal antibody is sensitive and specific.
  - In neonatal conjunctivitis and early trachoma

Summery

- Chlamydiae are small organisms that multiply in the cytoplasm of their host cells using unique biphasic developmental cycles.
- The EB is the infectious particle that is environmentally Stable.
- The RB is the metabolically Active Form that Divides by binary fission within a membrane-bound vacuole.
- There are three species of Chlamydia that cause disease in humans: *C trachomatis, C pneumoniae*, and *C psittaci*.
- C trachomatis is responsible for sexually transmitted diseases that include cervicitis, pelvic inflammatory disease, urethritis, epididymitis, LGV, and proctitis, and when transmitted to infants of infected pregnant women, infant inclusion conjunctivitis and eosinophilic pneumonia.

- Treatment of infections caused by *C trachomatis* requires doxycycline or azithromycin.
- *C pneumoniae* causes a variety of upper and lower respiratory infections. Pharyngitis is common, and atypical pneumonia resembling that of M pneumoniae is responsible for 5–15% cases of community-acquired pneumonia.