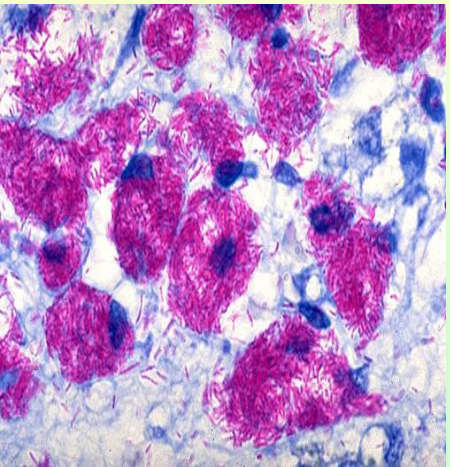
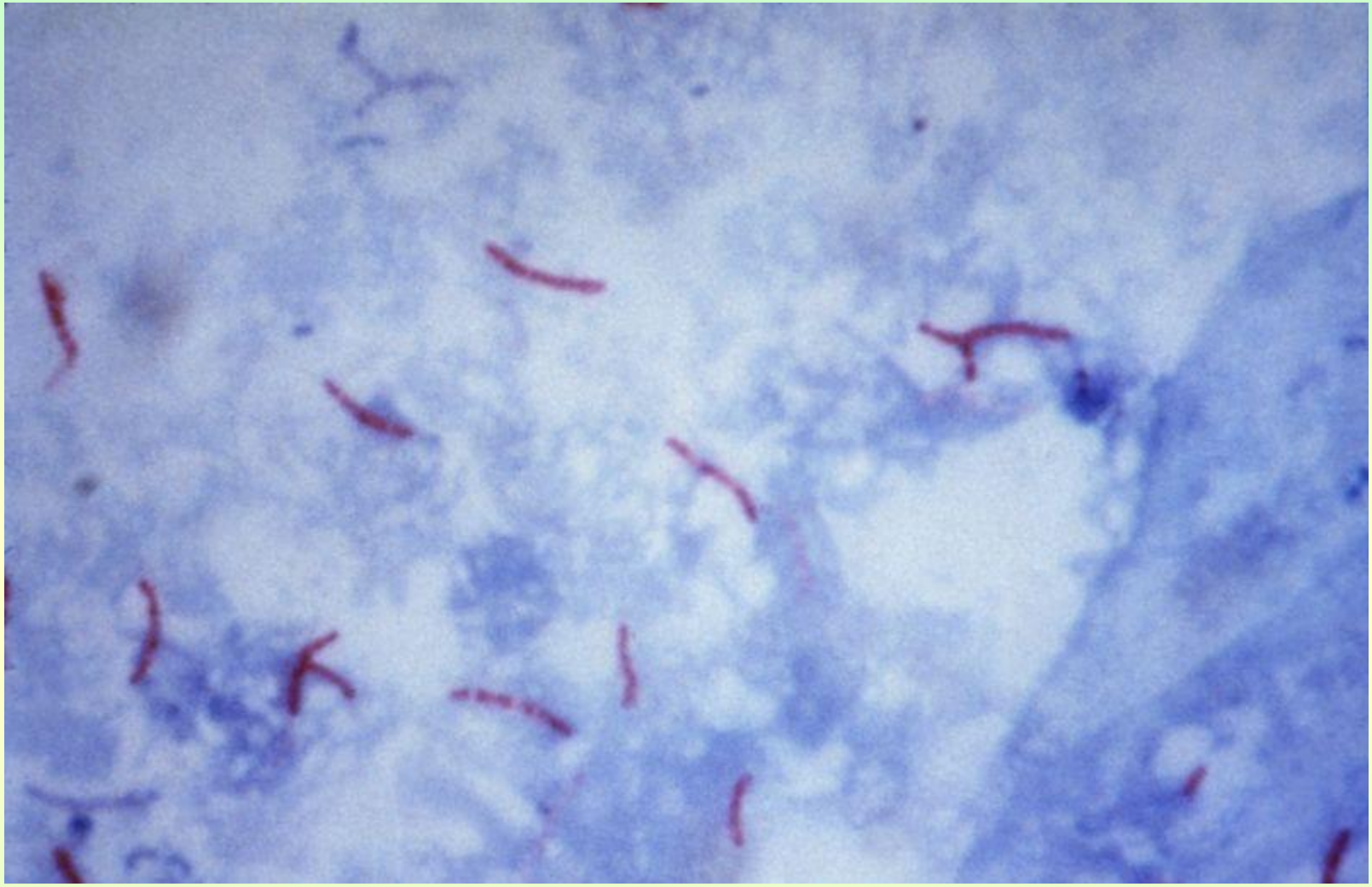
# Mycobacteria



# *Mycobacteria*

- Causative agents of tuberculosis and leprosy
- Waxy coat ⇒ NO Gram stain
  ⇒ Resistant to disinfectants
- Acid-fast bacilli ⇒ Resist decolorisation
- Use Ziehl-Neelsen staining technique



1. Ziehl-Neelsen carbol fuchsin to the slide for five minutes while applying heat.
2. Follow with a gentle wash with water to cool the slide.
3. Acid alcohol is now added to decolorize the slide.
4. Wash the slide in water again and counterstain with methylene blue for 1-2 minutes.

# *Mycobacterium tuberculosis*

- Chronic slow-progressing pulmonary infection; transmission by aerosol droplets
- Obligate aerobe, facultative intracellular parasite
- 4-6 WEEKS to see colonies on a plate
  - Lowenstein-Jensen medium
  - Use microscopy of sputum smears as first line of diagnosis
- Leading cause of death world-wide form a single infection (Bacteriology, Kenneth Todar, 2005)
  - Affects 1.7billion/year
  - Declining in US
- Infection develops in stages

*M.tuberculosis colonies*

# Primary Tuberculosis

Aerosol inhalation

Bacteria multiplication in alveoli

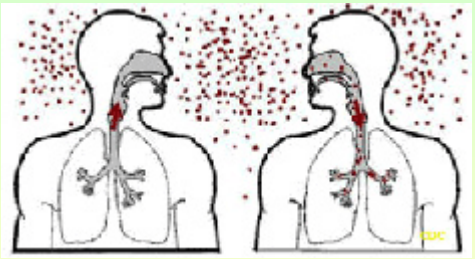
Macrophage ingestion of bacilli and formation of 1º complex

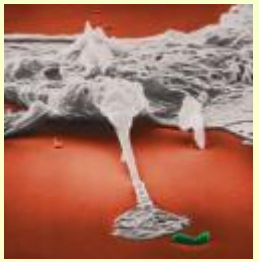
Foci of infection in lungs (may be spread to kidneys, bones, meninges)

**~ 6 weeks**

CMI is fully active, infection is stopped (majority of cases)

Some bacilli survive, reactivation several years later





**Positive tuberculin test**

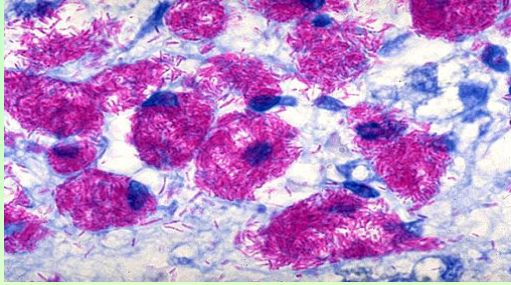
# *Mycobacterium tuberculosis*

- Post-primary tuberculosis
  - Late reactivation of lesions in lungs, kidneys, bones etc
  - 5% of cases; higher in patients with AIDS
  - Chronic infection

# Immunity in Tuberculosis

- Cell mediated immunity is most important (T-cells)
- Mantoux test
  - Tuberculin solution is injected INTRADERMALLY, wait 48-72 hrs, check for induration
  - Record diameter of induration
    - >10mm POSITIVE
    - 5-9 mm Doubtful, maybe cross reaction with other *Mycobacteria*
    - <4mm NEGATIVE
    - **A positive test does not necessarily mean there is currently an active infection**

# Atypical *Mycobacteria*



- Occasionally isolated from patients with chronic
- pulmonary disease ➡ indistinguishable from TB
    - *M. kansassi, M. avium, M. intracellulare*
    - Higher resistance to anti-TB drugs
    - Give “doubtful” Mantoux test (5-9 mm)

- *M. marinum*: skin infections

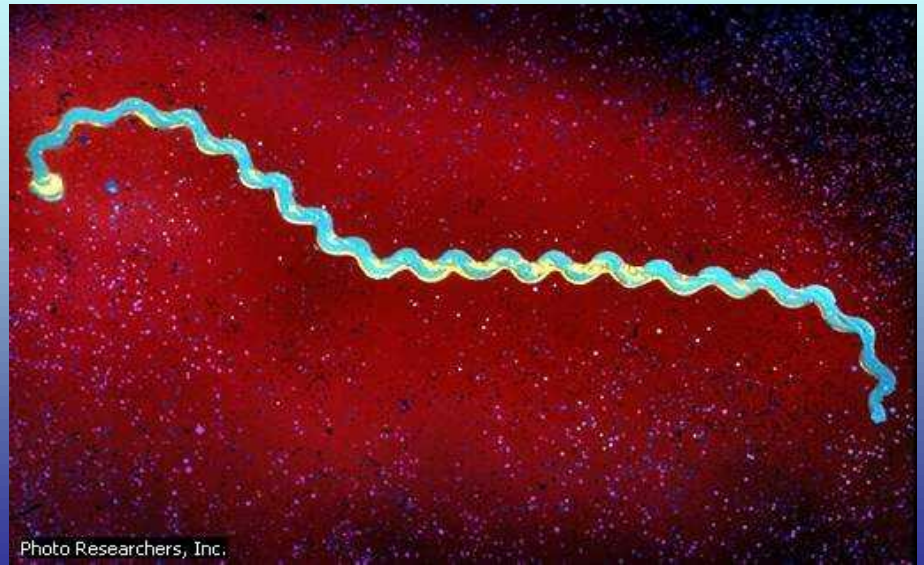
- *M. fortuitum*: soft tissue abscesses

- All these infections are most typically seen in the immune-compromised

# *Mycobacterium leprae*

- Causes leprosy
- 2 kinds
  - Tuberculoid leprosy: visible nerve enlargement, few erythmatous plaques, few bacilli in infected tissues, but many lymphocytes and granulomas; low infectivity
  - Lepromatous leprosy: no visible nerve enlargement, many erythromatous nodules, many bacilli in infected tissue; high infectivity
- Rarely found in developed countries

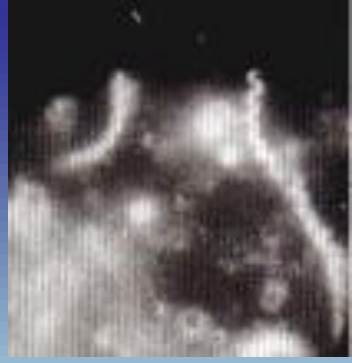
# Spirochetes



# *Treponema pallidum*


- Syphilis
- Gram negative, helical bacteria
- Unculturable *in vivo*
- Use dark field microscopy; almost invisible under Gram stain, Geimsa stain and Ziehl-Neelsen

# Syphilis

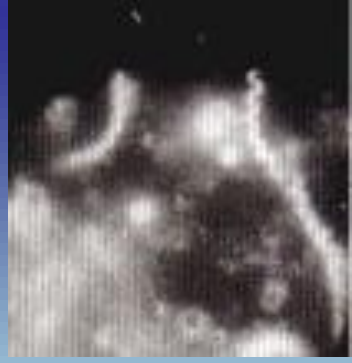


- Primary syphilis
  - Appearance of chancre 3-4 weeks after infection
  - Fluid from lesion contains bacteria ➡ seen under dark-field microscopy

- Secondary syphilis
  - 6 weeks after appearance of chancre
  - Generalized or local rash
  - Mucosal lesions with many treponemes

- Spontaneous remission may occur after 1 or 2 phase

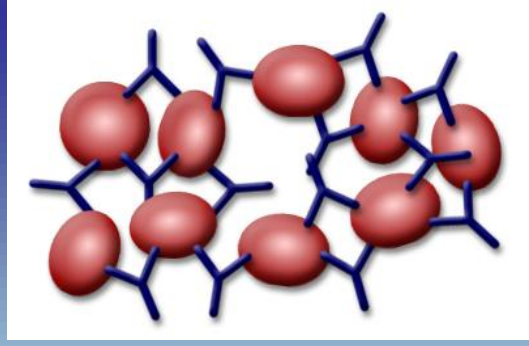
# Syphilis



- Latent syphilis
  - No symptoms of infection
  - Non-transmittable after 4 years
  - BUT congenital infection may occur

- Late syphilis
  - Obliterative endarteritis
  - Can involve skin, mucosae, nervous system, cardiovascular system and tissues

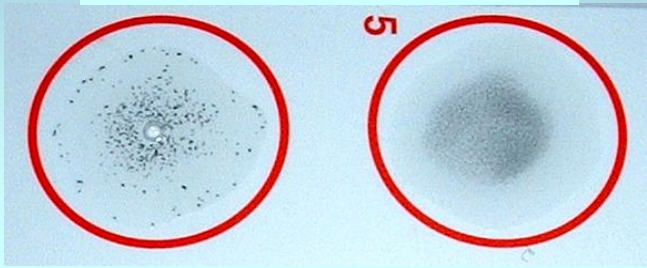
# Serology Testing



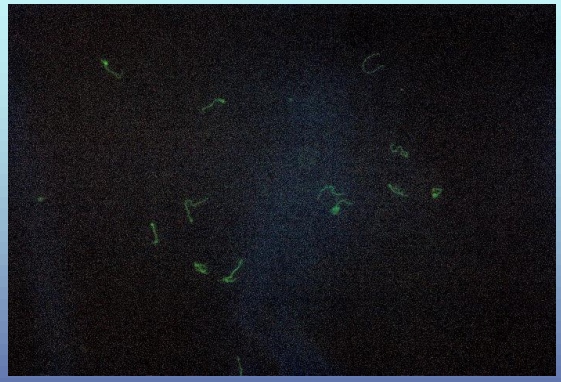
- **Non-treponemal tests** (VDRL, RPR, Wassermann)
  - Non-specific: use cardiolipin as antigen
  - Screening
  - Positive in early stages
- **Treponemal tests**
  - Specific: Use treponemal extracts
  - FTA-ABS: Flourescent Treponemal Antibody Absorption
  - MHA-TP: Microhemagglutination of *T.pallidum*

  Used to confirm positive VDRL

VDRL



+ve -ve

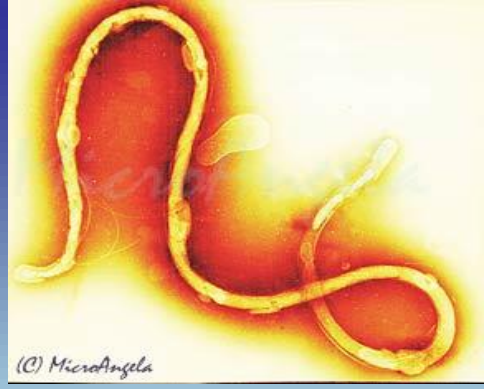


Positive FTA-ABS

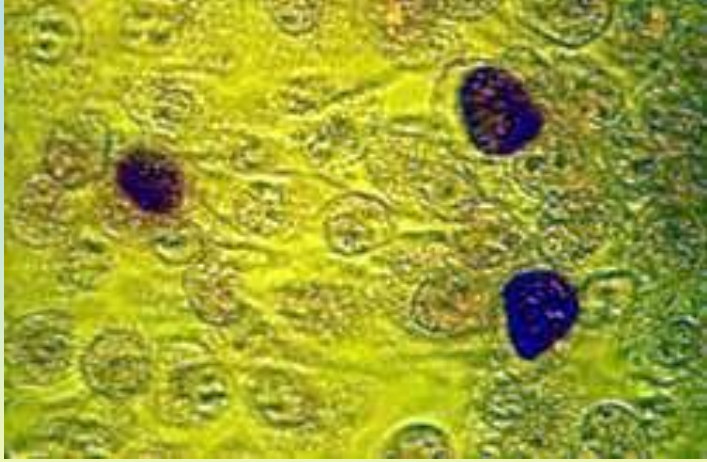
# *Borrelia burgdorferi*

- Lyme disease
- Tick bites
- Affects skin, joints, nervous system and heart
- Common in US, rare in Canada
- Use serology for diagnosis (ELISA)
    - organism is very difficult to see under microscope
    - difficult to culture
    - Serology does not give +ve result in first 2-4 weeks of infection

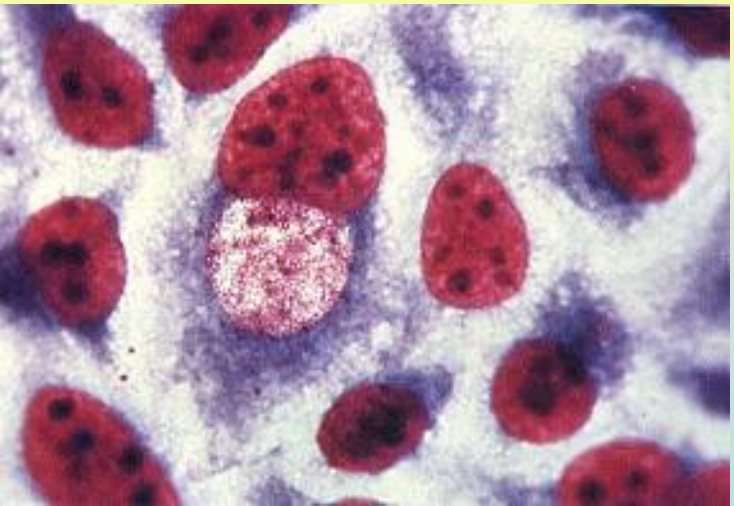
# Lyme Disease




- Treatment
  - Doxycycline, amoxicillin, cefuroxime for early disease
  - For neurological and musculoskeletal manifestations, undergo prolonged treatment
- Prevention
  - Avoid ticks and wear protective clothing in woods (long sleeves and pants)
  - Vaccine available: ospA antigen of organism



# Chlamydiae



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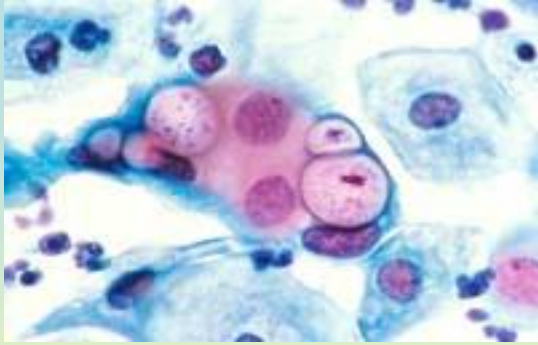
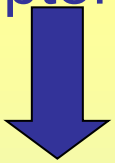


- Obligate intracellular energy parasites; cocci
  - Can NOT make their own ATP or other energy intermediates
  - Can NOT be grown on artificial media
- Life cycle has 2 forms:
  - Elementary body (300-400 nm)
    - Infectious form
    - No growth or replication
  - Reticulate body (800-1000 nm)
    - Replication and growth

# *Chlamydia trachomatis*

- STD chlamydia
- Most common STD in Canada and US
- Males: urethritis

  Females: cervicitis
- Many patients are asymptomatic and untreated

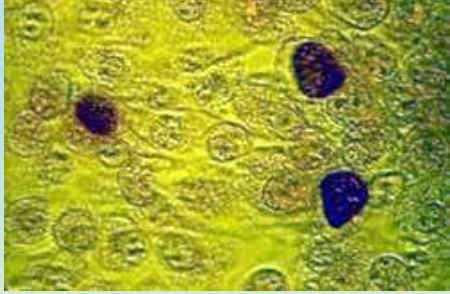


Limited diagnostic tools

**Untreated male**: prostatitis,epididymitis

**Untreated female**: PID, tubal infertility, ectopic pregnancy, chronic pelvic pain

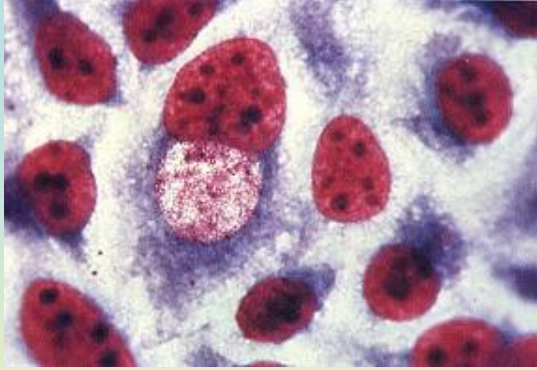
# *Chlamydia trachomatis*



- 2 biovars: Trachoma and LGV
- Trachoma:15 serovars; LGV: 4 serovars

- Other infections
  - Trachoma: chronic ocular infection; leading cause of blindness in Middle East, North Africa and South East Asia
  - Conjunctivitis in newborns ➡ perinatal transmission
  - Lymphogranuloma venereum: STD from some serotypes of *C. trachomatis;* endemic in tropical and subtropical countries

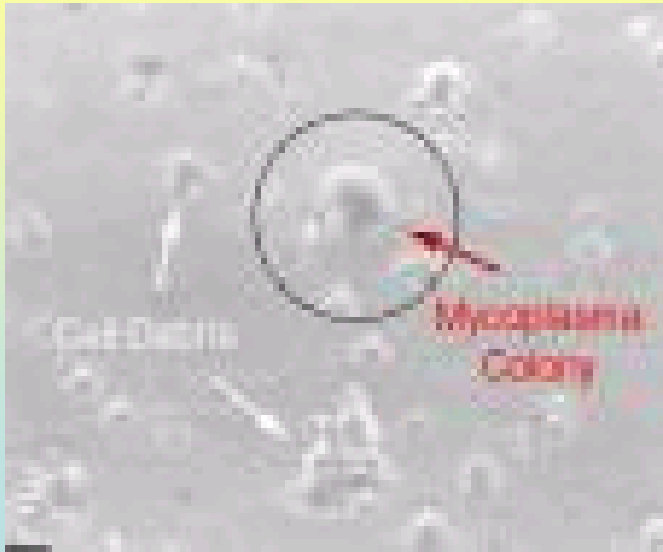
# Other Chlamydiae



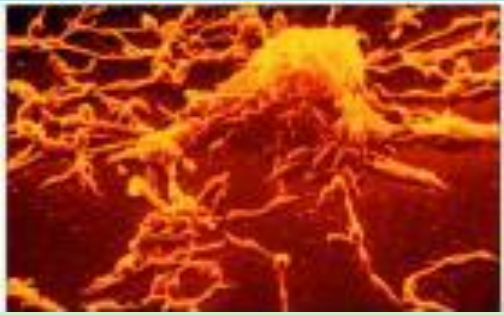
- *CHLAMYDIA PNEUMONIAE*
  - Respiratory tract infections, mild pneumonia
  - Usually sub-clinical infections

- *CHLAMYDIA PSITTACI*
  - Bird pathogen
  - Can transmit to humans
  - Pneumonia or endocarditis


# Mycoplasmas



# Mycoplasma



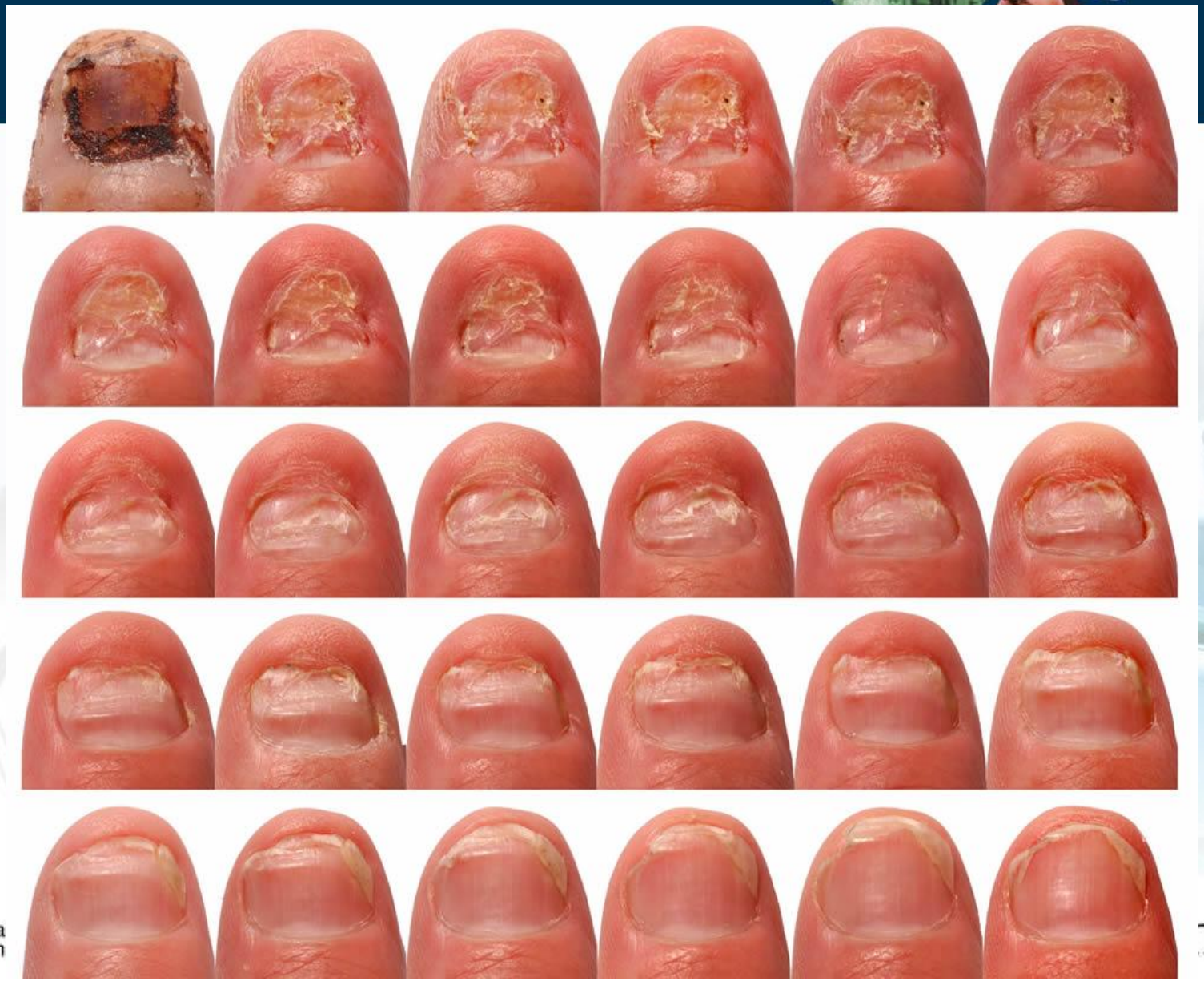
- Smallest free-living bacterium (100-300 nm)
- Saprophytes, part of normal flora of oropharynx and genital tract of humans and animals
- Lack true cell wall
- Some species are pathogenic

# Mycoplasma

- ***MYCOPLASMA PNEUMONIAE***
  - PRIMARY cause of atypical pneumonia
  - More common in younger individuals (15-35 years)
  - RARELY complications lead to meningoencephalitis, myocarditis
  - Diagnosis is usually clinical, no lab confirmation
  - Treatment: erythromycin or tetracycline

- **GENITAL MYCOPLASMA (***MYCOPLASMA HOMINIS***,** *UREAPLASMA UREALYTICUM)*
  - Part of normal genital flora
  - Rate of colonization increases with number of sexual partners
  - May cause urethritis, epididymitis, pelvic inflammatory disease and postpartum fever
  - ?? Infertility and premature birth ??

# Fungal (mycotic) Infections



# Levels (depth) of infection by fungal pathogens

Superficial

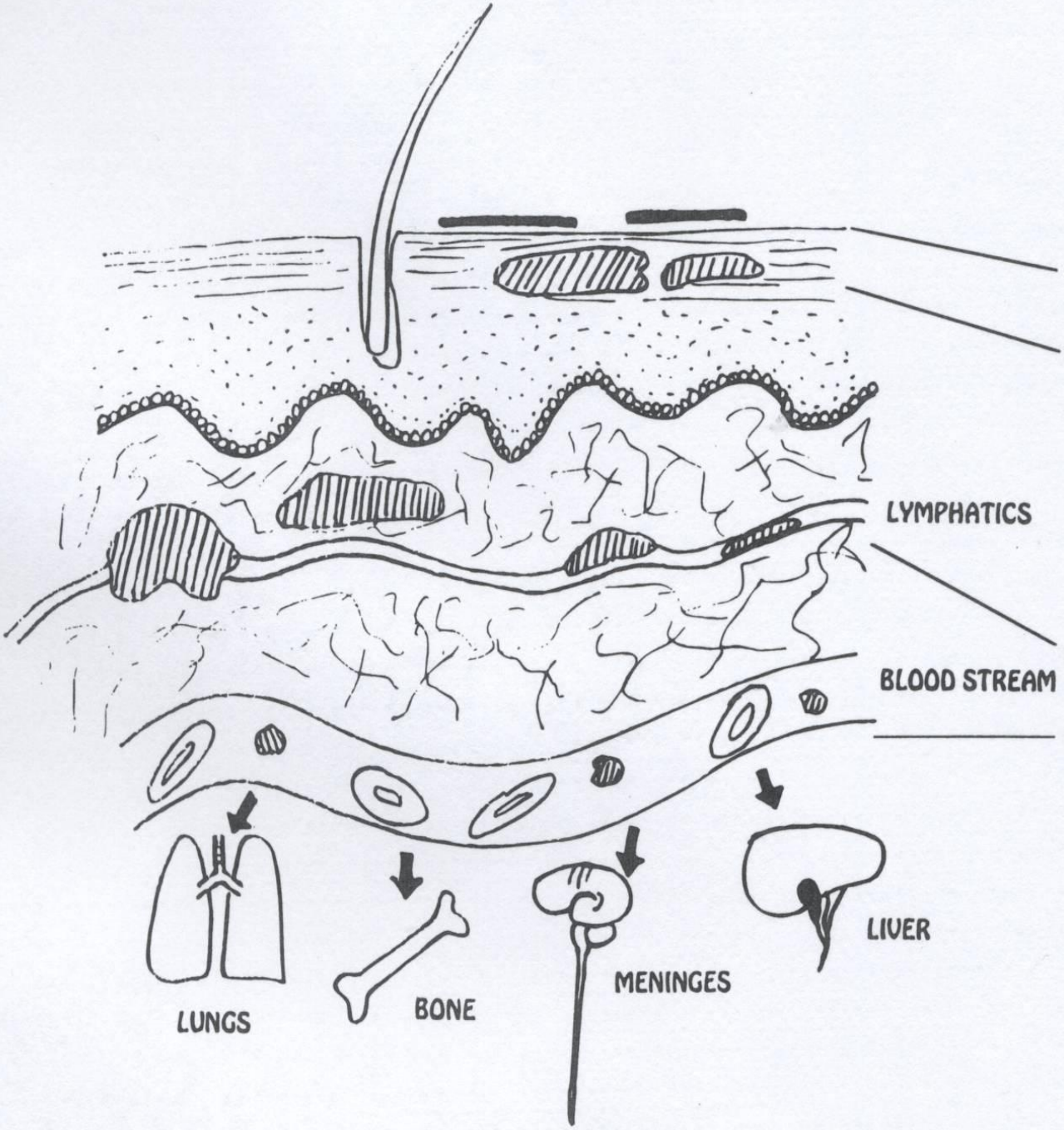
Cutaneous

Subcutaneous

Systemic

skin

bloodstream




**Superficial** :
1. Pityriasis versicolor
2. Tinea nigra

**Cutaneous** :
1. Dermatophytosis: Infections of the skin, hair and nail
   - A. Infection of the skin
     - i. Tinea corporis (body)
     - ii. Tinea cruris (groin)
     - iii. Tinea pedis (feet)
   - B. Infection of the hair: tinea capitis (scalp)
   - C. Infection of the nail: tinea unguium
2. Candidiasis of the skin

**Subcutaneous** :
1. Sporotrichosis
2. Chromomycosis

**Systemic**:
1. Coccidioidomycosis
2. Histoplasmosis
3. Blastomycosis
4. Cryptococcosis ←
5. Systemic Candidiasis
6. Aspergillosis

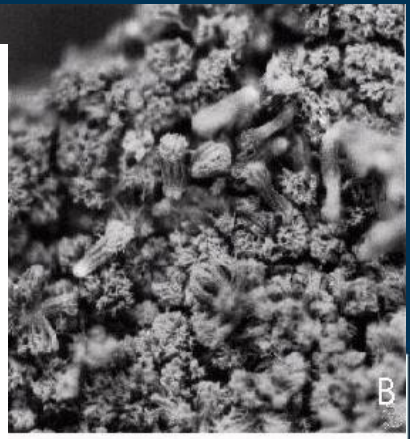
**Aspergillus**

Mycotoxin p

## 黃曲霉毒素的平均含量
## Average Levels of Aflatoxin

| 食物組別 Food Group | 樣本數目 No. of Sample | 驗出黃曲霉毒素的樣本數目 No. of Sample Detected with Aflatoxin | 最高含量（微克/公斤） Max.(μg/kg) | 平均含量（微克/公斤） Average Level (μg/kg) |
|---|---|---|---|---|
| 花生及花生食品* Peanuts & Peanut Products* | 115 | 27 | 26.0 | 1.45 |
| 植物油及脂肪食品 Vegetable Oil & Fat | 245 | 9 | 5.8 | 0.20 |
| 穀類及穀類食品 Cereals & Cereal Products | 92 | 4 | 5.8 | 0.27 |

*包括花生油 Including Peanut Oil





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