THE GENERA *MYCOPLASMA* AND *UREAPLASMA*

Mollicutes

- *mollis* = soft; *cutis* = skin “soft skin”
- Bacteria lack a rigid cell wall. They only have a trilaminar outer membrane
- Small size 0.2-0.3 microns
- Small genome
- Members of the order *Mycoplasmatales*, class *Mollicutes*
- Some are free living but most are parasitic
- Only two genera, *Mycoplasma* and *Ureaplasma* are important in medicine

- *Mycoplasma pneumoniae* is a member of the class *Mollicutes*, meaning soft skin.
- Along with the other members of this class (*Acholeplasma*, *Anaeroplasma*, *Asteroleplasma*, *Spiroplasma*, and *Ureaplasma*) *Mycoplasma* are characterized by their unusually small genome as well as their complete lack of a bacterial cell wall.
- *M. pneumoniae* was first linked to respiratory infections in 1898 when Roux and Nocard isolated the organisms from bovine pleuropneumonia specimens.

- *Mycoplasma pneumoniae* lacks a cell wall which leads to osmotic instability. To create some structural support, *M. pneumoniae* utilizes sterols, like eukaryotic cells, in its triple-layered membrane.

- The bacterium may be able to survive without a cell wall because it lives in an osmotically stable environment, the animal (human) host, as well as its protein network which resembles an ancestral cytoskeleton. The combination of these unique characteristics creates a different scenario for treatment of a mycoplasmal infection than other bacteria. The lack of a cell wall prevents the utilization of a beta-lactam antibiotic, because they act specifically to disrupt the cell wall.

- The absence of a cell wall is likely to facilitate a bacterium to host interaction through which compounds can be exchanged. This transfer can include not only the nutrients and supplementary amino acids, etc. that is necessary for the support of bacterial growth, but also toxic metabolic compounds.

- It is thought that this bacterial surface parasitism causes severe damage to the host cell, however, not one toxin has been identified as the culprit.

- These groups of microorganisms, previously described under the general title of pleuropneumonia-like organisms (PPLO), are small procaryotic cells (200-250 nm in diameter).
- They resemble larger procaryotic cells (e.g. bacteria) in their ability to grow in cell-free media although some are exacting in their growth requirements and grow slowly.
- Their genome is a single circular, double stranded DNA molecule.
- They have no rigid cell wall. There is a trilaminar cytoplasmic membrane, but unlike that of bacteria, it contains cholesterol or carotenol in addition to the usual phospholipids.
- The mycoplasma cannot synthesize their own cholesterol and require it as a growth factor in the culture medium.

- The absence of a rigid cell wall is reflected in branched and other unusual morphological forms of the mycoplasma cell.
- Cells of some species have a coccobacillary morphology, other are filamentous, some have specialized processses for attachment to host cells that are probably also related to the capacity for gliding motion.
- In line with absence of a cell wall these microorganisms are not inhibited by members of the penicillin family, bacitrain, or polymyxin B.
- In general they are sensitive to tetracyclines, macrolides, fluoroquinolones and chloramphenicol that act at ribosome level, they are also sensitive to arsenical compounds.

- Mycoplasma cells stain poorly by the Gram method, but are negative.
- Consequently varios special staining techniques are used - overnight Giemsa, Dienes´ stain.
- The cells from fluid culture may also be visualized by darkground or phase-contrast methods in the light microscope, or in the electron microscope.

- Mycoplasma are grown in soft agar medium with a high (10-20%) concentration of serum or other protein such as ascitic fluid. The function of the serum or other protein is to provide a source of cholesterol, fatty acids, or urea in the case of the ureaplasmas, and to regulate their availability to the organisms.

- Some mycoplasma species are aerobes or facultative anaerobes, other grow better in hydrogen or nitrogen with 10% CO_2. The colonies looks like "fried egg" on the solid agar. Colony size varies from 200-500 µm for the large colony mycoplasmas to 15-30 µm for the ureaplasmas.

- **The established human mycoplasma flora comprises:**
  - ***M. pneumoniae***
  - *M. hominis*
  - *M. salivarium*
  - *M. orale*
  - *M. buccale*
  - *M. faucium*
  - *M. fermentans*
  - *M. genitalium*
- Of these mycoplasmas *M. pneumoniae* is the predominant pathogen.
- *M. hominis*, *M. fermentans*, *M. genitalium* have a variable importance.

Clinical associations are:

- *M. pneumoniae* with pharyngitis, sinusitis, febrile bronchitis or pneumonia.
- In recent years extrapulmonary manifestations such as arthritis, hepatitis have been reported.
- *M. hominis*, *M. fermentans* or *U. urealyticum* with some cases of salpingitis, tuboovarian abscess, pelvic abscess, septic abortion and fever.
- An association of *U. urealyticum* (and perhaps now *M. genitalium*) with non-gonococcal (NGU) or postgonococcal urethritis or cervicitis.

- The ureaplasma (*Ureaplasma urealyticum*) were previously known as T mycoplasma, T for tiny colony - a reference to the size difference of their colonies compared with those of the mycoplasmas.

- As the name implies, they have the ability to split urea to amoniac, unlike the mycoplasma. Except for the ureaplasmas and *Mycoplasma genitalium*, mycoplasma are more resistant to the inhibitory action of thallium salts than bacteria, a diference exploited in selective media.

- Despite some colonial similarities, mycoplasmas are quite distinct from L-phase variants of bacteria and do not revert to bacteria when cultured in media free of inhibitors of bacterial cell wall synthesis or other L-phase inducers.

- *Mycoplasma hominis* and *Ureaplasma urealyticum* are frequently found colonizing the genital tracts of normal, sexually active man and women. They are less common in sexually inactive populations, which supports the view that they may be sexually transmitted.

- *M. hominis* may cause pelvic inflammatory disease, post-abortal and post-partum fevers.

- *Ureaplasma urealyticum* has been associated with urethritis and prostatitis in man.

- Fortunatelly, both *M. hominis* and *U. urealyticum* are susceptible to tetracycline which is also the treatment of choice for chlamydial infections.

Infections, vhich can be caused by *Chlamydophila pneumoniae*:

pharyngitis	2 - 5 %
sinusitis	5 - 10 %
bronchitis	5 - 10 %
acute exacerbation of chronic bronchitis	4 - 5 %
community-acquired pneumonia	**6 - 25 %**

Infections, vhich can be caused by *Mycoplasma pneumoniae*:

- **pneumonia**
- pharyngitis
- tracheobronchitis
- bronchitis
- bronchiolitis
- otitis media

According the data from olomouc region it is possible to make a conclusion:

- community-acquired pneumonia
  - typical pneumonias form about 65 %
  - atypical pneumonias form about 35 %
    - *chlamydia pneumonias* *24 %*
    - *mycoplasma pneumonias* *11 %*

Etiology of pneumonia in children

- *Haemophilus influenzae*
- *Mycoplasma pneumoniae*

  (mainly in children 5 years old and older)
- *Streptococcus pneumoniae*
- *Klebsiella pneumoniae*

According the data from olomouc region it is possible to make a conclusion about etiology of community-acquired pneumonia in children:

- *Haemophilus influenzae* 36 %
- *Mycoplasma pneumoniae* 25 %
- *Klebsiella pneumoniae* 14 %
- *Streptococcus pneumoniae* 11 %
- others 14 %

Laboratory diagnosis of mycoplasma infections

- *M. pneumoniae* infection of the respiratory tract:
  - diagnosis may most easily be made by detection of specific IgM antibody.

- Serodiagnosis may be supported by demonstration of antigen or specific nucleotide sequences, or by culture of the microorganism.