

## Pseudomonas and other non fermentative Gram-negative bacilli

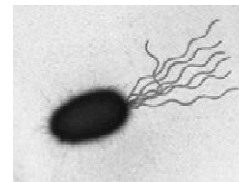
Judit Szabó

### PSEUDOMONAS

- Gram - rod with flagellae (motile)
- strict aerobic
- ubiquitous, widely distributed in soil and water

#### Pathogenesis, clinical findings:

- normal flora bacterium in the intestinal tract, on the skin
- opportunistic, nosocomial pathogen



### Specieses

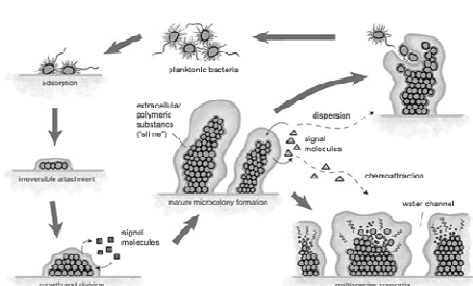
- P. aeruginosa*
- P. fluorescens*
- P. stutzeri*
- P. putida*

- Burkholderia mallei* (earlier *P. mallei*)
- Burkholderia pseudomallei* (earlier *P. pseudomallei*)
- Burkholderia cepacia* (earlier *P. cepacia*)

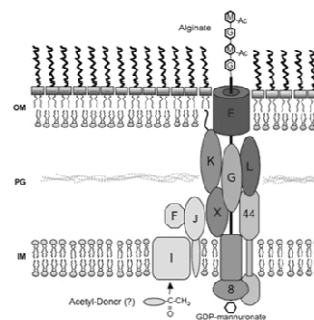
### *Pseudomonas aeruginosa*

- widely distributed in nature, common in moist environments in hospitals
- risk factors: catheters, neutropenia
- colonisation, biofilm production

### Biofilm production

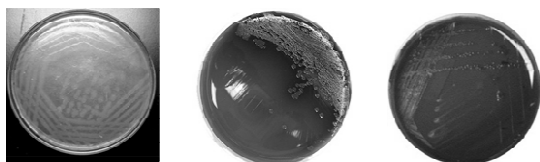


### Biofilm production



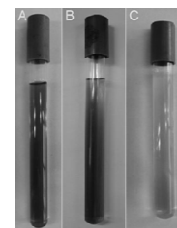
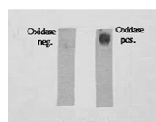
### Culture

- on nutrient agar: green pigment (fluorescein and pyocyanin)
- on blood agar: beta-haemolysis
- on EMB: lactose negative



### Biochemical reactions

oxidase positive

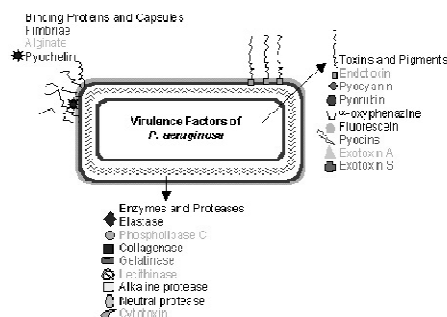


oxidative and/or fermentative sugar utilisation  
OF: +/-

### Antigenic structure

O and H antigens

### Virulence factors



### Pathogenesis, clinical symptoms

colonizes mucous membranes or skin, wound, burn infection, otitis externa, ecthyma gangreosum, invades locally, causes systemic infection, pneumonia, meningitis, sepsis

urinary tract infection (catheter associated)



### Treatment

- carbapenems (imipenem, meropenem, doripenem)
- piperacillin+tazobactam (Tazocin)
- 3. and 4. generation cephalosporins (ceftazidime, cefepime)
- aminoglycosides (amikacin)
- fluoroquinolones (ciprofloxacin)
- polymyxin (colistin)
- acquired carbapenem resistance is increasing (efflux, or metallo-beta lactamase production)

## Prevention

- frequent disinfection of ventilation machines (ICU, hematological departments)
- changes of eye drops, contact lenses solutions
- hygiene (hand washing)
- infection control

## *Burkholderia mallei*

Gram-negative rods, no flagellum  
 malleus (glanders) disease of horses, transmissible to humans  
 zoonotic  
 Asia, Africa, Near-East  
 begins with ulcer, then lymphangitis and sepsis occurs  
 inhalation leads to pneumonia  
 diagnosis: culture, biochemical reactions  
 treatment: tetracycline, aminoglycosides

## *Burkholderia pseudomallei*

Gram-negative, with flagellae (motile)  
 saprophytic: soil, water, rice, vegetables or zoonotic: rodents  
 South-East Asia, Australia  
 More frequent during the monsoon period  
 melioidosis  
 skin infection, ingestion, inhalation  
 primary pneumonia, suppurative infection, abscess, bacteremia  
 high mortality rate without treatment  
 diagnosis: microscopic (bipolar staining), culture  
 treatment: tetracycline, chloramphenicol

## *Burkholderia cepacia*

opportunistic, nosocomial pathogene

- UTI
- pneumonia (cystic fibrosis)
- wound infections
- sepsis

diagnosis: culture, biochemical reactions  
 treatment: tetracycline, tigecycline

## *Stenotrophomonas maltophilia*

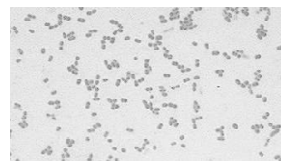
- Gram-negative rods
- oxidase negative

- Nosocomial and opportunistic infections
- pneumonia, UTI, skin and wound infections, sepsis

diagnosis: culture, biochemical reactions, automatic identifications (VITEK2, ID32GN)  
 treatment: ciprofloxacin, Sumetrolim (carbapenem R!)

## *Acinetobacter*

- Akinetos, Greek adjective, unable to move
- Gram-negative coccobacilli ubiquiter in water, soil
- can be a transient member of the normal flora
- may occur in hospital environment
- nosocomial infections
- *A. baumannii*, *A. lwoffii*, *A. johnsonii*, *A. haemolyticus*



## Culture

- obligate aerobic
- on EMB lactose negative, oxidase negative

## Antigenic structure

genotypisations only by molecular techniques  
in outbreaks: PFGE analysis (clonality)

## Clinical symptoms

Colonisation of hospitalised patients  
Risk factors: ventillation, catheters

UTI  
pneumonia  
wound infections ( soldiers from Iraq and Afghanistan)  
sepsis



## Nosocomial Bloodstream Infections

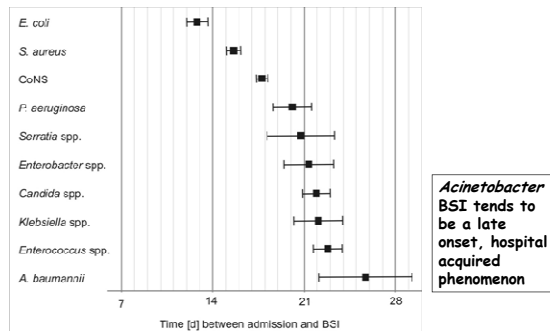


Rank	Pathogen	BSI/10,000 admissions	Percent
1	Coagulase-negative Staph	15.8	31%
2	<i>S. aureus</i>	10.3	17%
3	Enterococci	4.8	12%
4	<i>Candida</i> spp	4.6	8%
5	<i>E. coli</i>	2.8	6%
6	<i>Klebsiella</i>	2.4	5%
7	<i>Ps. aeruginosa</i>	2.1	4%
7	<i>Enterobacter</i>	1.9	4%
8	<i>Serratia</i>	1.7	2%
9	<i>Acinetobacter baumannii</i>	0.6	1%

49 US centers  
1995-2002  
N= 24,179

Wisplinghoff H, Edmond MB et al. Clin Infect Dis. 2004 Aug 1;39(3):309-17

## Time to Nosocomial BSI



**Acinetobacter BSI tends to be a late onset, hospital acquired phenomenon**

Wisplinghoff H, Edmond MB et al. Clin Infect Dis. 2004 Aug 1;39(3):309-17

## Laboratory diagnosis

culture  
biochemical reactions (lactose negative, oxidase negative)  
automatic identification (VITEK2, ID32GN)

## Treatment

multiresistant (genetic R: penicillin, ampicillin, 1. generation cephalosporins, chloramphenicol)  
 acquired resistance to carbapenems is increasing  
 can be sensitive to Unasyn (ampicillin+sulbactam)  
 Treatment options: colistin, tigecycline, aminoglycosides

## Control

hand washing  
 hygiene  
 infection control  
 prudent use of antibiotics



## Alcaligenes spp.

- *A. faecalis*
- *A. xylosoxidans*
- *A. denitrificans*
- *A. piechaudii*

Gram-negative, no capsule, no spore, oxidase positive, but OF: -,-

## Alcaligenes spp.

- opportunistic pathogens, nosocomial infections
- Pneumonia (cystic fibrosis), sepsis, peritonitis
- *A. piechaudii*: chronic otitis
- diagnosis: culture, biochemical reaction, automatic ID.
- treatment: piperacillin, Tazocin, ciprofloxacin

## Other rarely isolated non fermentative bacteria

- Agrobacterium
- Flavobacterium
- Chryseobacterium
- Empedobacter
- Weeksella
- Bergeyella
- Sphingobacterium
- Chromobacterium