Pseudomonas

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What are Pseudomonas

- Family Pseudomonadaceae
  - Aerobic, non-spore forming Gram negative straight or slightly curved rod (1 to 3 um in length)
  - Motile with polar flagella
  - **Non-fermenters**
  - **Catalase and oxidase positive**
  - Pigment producing bacteria.
  - Mostly causes Hospital acquired infection.
  - Opportunistic pathogens, majorly found in soil, water and sevage.
  - They are highly resistant to chemical disinfectants, antibiotics.

- The most important pseudomonad species responsible for human infections are **Pseudomonas aeruginosa, Burkholderia pseudo mallei** and members of the **Burkholderia cepacia complex**.

Pseudomonas aeruginosa

• Morphology

- They are slender gram negative bacillus, 1.5 – 3 microbes x 0.5 microns
- Actively motile by polar flagella
- some are pilated
- Non capsulated but many strains have mucoid slime layer.

Cultural Characters

- **Obligate aerobe**
- Growth occurs at wide range of temperatures 6-**42°C** the optimum being 37°C
- Growth on ordinary media producing large opaque irregular colonies with earthy smell.
- In broth forms dense turbidity with surface pellicle.

- **Nutrient agar-**

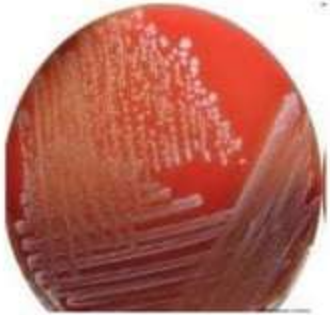
➢ Colonies are smooth, large, translucent, low convex, 2-4mm in diameter.

➢ Produce sweetish aromatic odor

➢ Greenish blue pigment diffuses

Growth on

- **Blood agar**
  - ➢ Similar to nutrient agar
  - ➢ Many are haemolytic
- **Mac conkey agar**
  - ➢ Colourless,non lactose fermenters
- **Cetrimide agar**
  - ➢ selective media



Blood agar

Non lactose fermenting colonies on MacConkey agar

Cetramide agar

P. aeruginosa

Mucoid *P. aeruginosa*

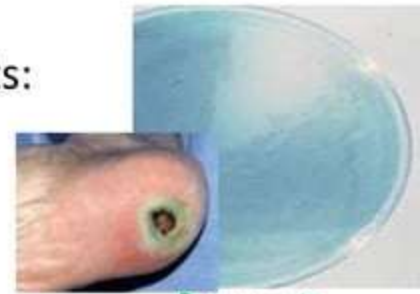
MacConkey Agar

Pigment production

Some strains produce diffusible pigments:

- **Pyocyanin**

- Bluish green phenazine pigment
- Soluble in chloroform and water
- Not produced by other species
- It is diagnostic of **Pseudomonas *aeruginosa***



Pyocyanin

- **Pyoverdin(fluorescein)**

- It is a greenish yellow pigment
- Insoluble in chloroform but soluble in water
- Produced by many other species

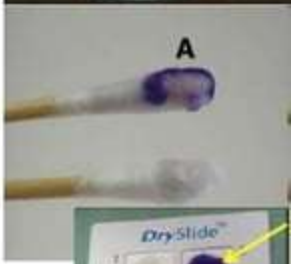
Pyoverdin

- **Pyorubin**
  - Reddish brown pigment
  - Insoluble in chloroform but soluble in water
- **Pyomelanin**
  - Brown to black pigment
  - Production is uncommon

Biochemical reactions

- O/F test-oxidative
- **Catalase-positive**
- Indole, MR and VP and H_2S tests are negative
- **Oxidase-positive**
- **Nitrate reduction-positive**
- **Citrate test-positive**

Catalase test



Oxidase test

Citrate test

Resistance

- Killed at 55°C in 1 hour
- High resistance to chemical agents
- Resistance to quaternary ammonium compounds. Chlorxylenol
- Grows also in antiseptic bottles
- Dettol and Cetrimide as selective medium**(Cetrimide agar)**
- Sensitive to acids silver salts, (Uses as tropical cream in burns.)
- Intrinsically resistant to commonly used antibiotics.

Pathogenesis and Immunity

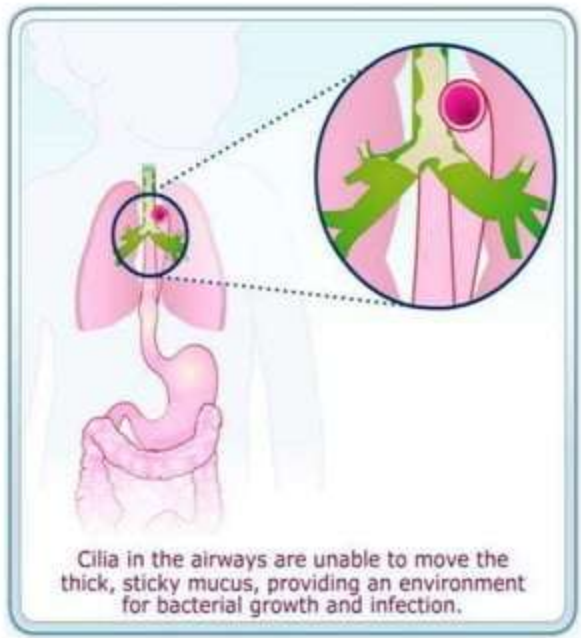
- Common cause of hospital acquired infection.
- *P. aeruginosa* can infect almost any external site or organ.
- *P. aeruginosa* is invasive and toxigenic. It attaches to and colonizes the mucous membrane or skin, invade locally, and produces systemic diseases and septicemia.
- *P. aeruginosa* is resistant to many antibiotics. It becomes dominant when more susceptible bacteria of the normal flora are suppressed.

P. aeruginosa is an opportunistic pathogen

- Extremely broad host spectrum
- Hardly any infections in the normal human host
- Severe immunodeficiencies and medical devices predispose the patients to *P. aeruginosa* infections
- Broad spectrum of clinical symptoms
  - Urinary tract infections
  - Pulmonary infections
  - Soft tissue infections
  - Sepsis
  - Bone and joint infections
  - Endocarditis

Who are more susceptible to infection

- This bacterium is of particular concern to individuals with cystic fibrosis who are highly susceptible to pseudomonas lung infections.
- Pseudomonas aeruginosa is also of grave concern to cancer and burn patients as well as those people who are immunocompromised.
- The case fatality rate for individuals infected with Pseudomonas aeruginosa approaches 50 percent.



Laboratory diagnosis

Specimens:

- Wound discharge
- sputum
- Blood
- Urine
- CSF
- Pus

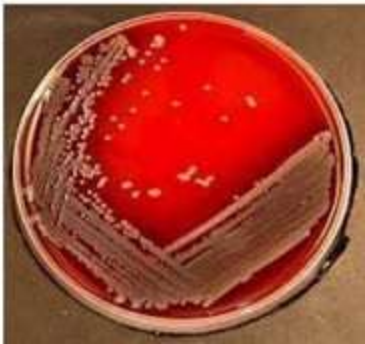
Culture

On nutrient agar

- Colonies are smooth, large, translucent
- Greenish blue diffusible pigment

On blood agar

- Grayish colonies
- Many are haemolytic (beta hemolysis).

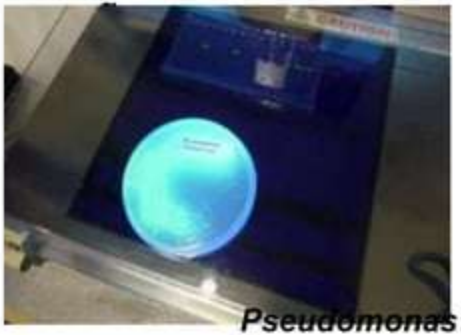


On MacConkey agar

- Non-lactose fermenting (colourless colonies)

Pigment production on **Cetrimide agar**

- is a type of agar used for the selective isolation of the gram-negative bacterium, *Pseudomonas aeruginosa*.
- As the name suggests, it contains cetrimide, which is the selective agent against alternate microbial



Pseudomonas aeruginosa
fluorescence under UV illumination

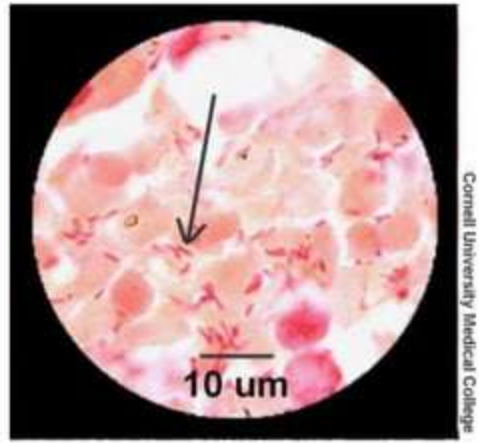
Microscopy

-Gram staining

Gram negative bacili seen.

-Hanging drop preparation:

Actively Motile



Biochemical Reactions

Oxidase test

- **Oxidase positive**

Catalase test

- Catalase positive

Automated methods

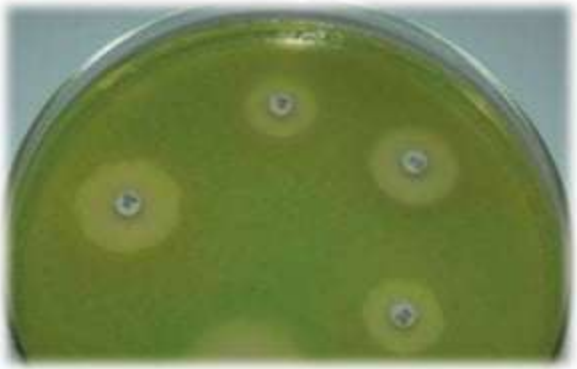
VITEK test: for identification and antibitic sensitivity of bacteria

Molecular methods

The bacterial genome can be identified by PCR.

Antibiotic senstivity testing

Helpful to select out appropriate antibiotic for treatment.



Treatment of *P. aeruginosa* infections

- *P.aeruginosa* is frequently resistant to many commonly used antibiotics.
- Although many strains are susceptible to **gentamicin, tobramycin, colistin, and amikacin**, resistant forms have developed.
- The combination of **gentamicin and carbenicillin** is frequently used to treat severe Pseudomonas infections.
- No vaccines so far

Prevention and Control

Pseudomonas spp. normally inhabit soil, water, and vegetation and can be isolated from the skin, throat, and stool of healthy persons.

Spread is mainly via contaminated sterile equipment's and cross-contamination of patients by medical personnel.

Prevention and Control

- High risk population: patients receiving broad-spectrum antibiotics, with leukaemia, burns, cystic fibrosis, and immunosuppression.
- Methods for control of infection are similar to those for other nosocomial pathogens. Special attention should be paid to sinks, water baths, showers, hot tubs, and other wet areas.

Other Pseudomonas

- Clinically relevant pseudomonas in increasing percentage are:
  - *Pseudomonas putida*
  - *Pseudomonas stutzeri*
  - *Pseudomonas flurescens*