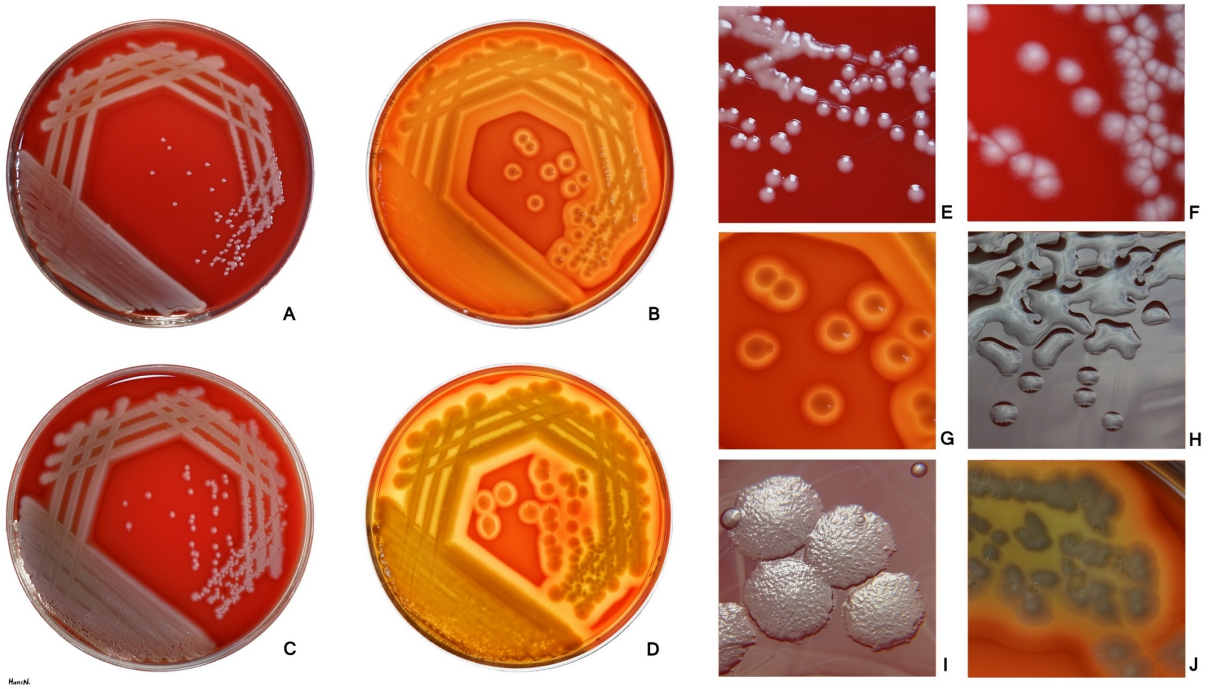
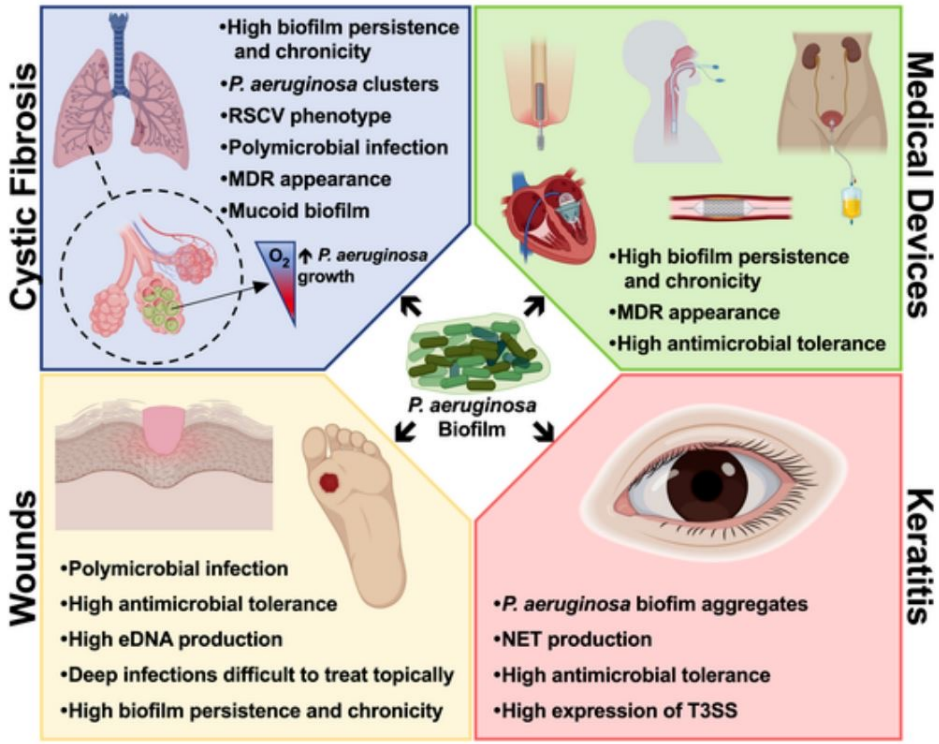
Pseudomonas aeruginosa

- ***Pseudomonas aeruginosa*** is a common encapsulated, Gram-negative, strict aerobic (although can grow anaerobically in the presence of nitrate), Rod-shaped bacterium that can cause disease in plants and animals, including humans.



Its medical importance is attributed to:

- *P. aeruginosa* is a multidrug resistant pathogen due to its advanced antibiotic resistance mechanisms.
- its association with serious illnesses – hospital-acquired infections such as ventilator-associated pneumonia and various sepsis syndromes.
- Infections are Nosocomial catheterized patients, respiratory tract infections (cystic fibrosis), urinary tract infections, wound infections, and eye infection (keratitis).



- The organism is considered opportunistic as serious infection often occurs during existing diseases
- It generally affects the immunocompromised but can also infect the immunocompetent. The symptoms of such infections are generalized inflammation and sepsis.
- If such colonizations occur in critical body organs, such as the lungs, the urinary tract, and kidneys, the results could be fatal.
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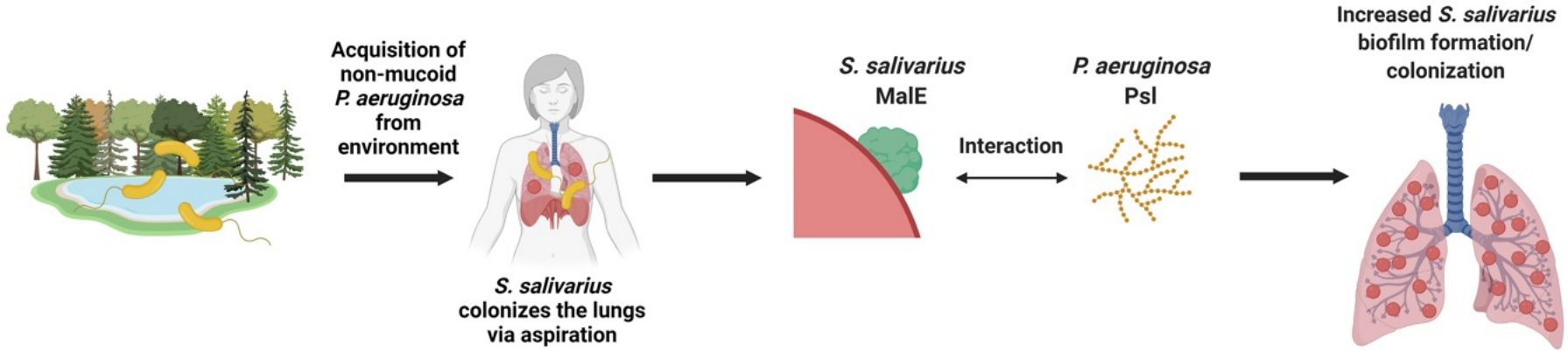
- *However, P. aeruginosa* is not extremely virulent in comparison with other major pathogenic bacterial species – for example the Gram-positive *Staphylococcus aureus* and *Streptococcus pyogenes*
- *P. aeruginosa* is capable of extensive colonization, and can aggregate into enduring biofilms.

- It is citrate, catalase, and oxidase positive. It is found in soil, water, skin flora, and most man-made environments throughout the world.
- It thrives not only in normal atmospheres, but also in low-oxygen atmospheres, thus has colonized many natural and artificial environments.



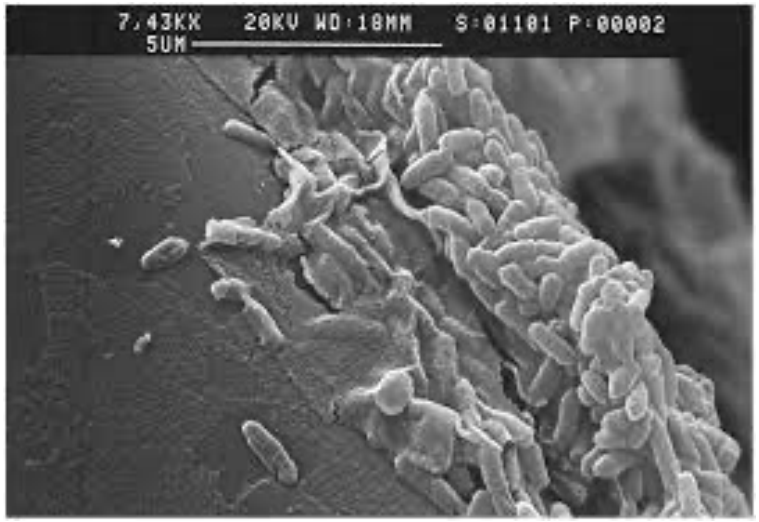
Toxins

- *P. aeruginosa* uses the virulence factor exotoxin A to inactivate eukaryotic elongation factor 2 in the host cell, much as the diphtheria toxin does. Without elongation factor 2, eukaryotic cells cannot synthesize proteins and necrotise.

- *P. aeruginosa* uses an exoenzyme U (ExoU), which degrades the plasma membrane of eukaryotic cells, leading to lysis.

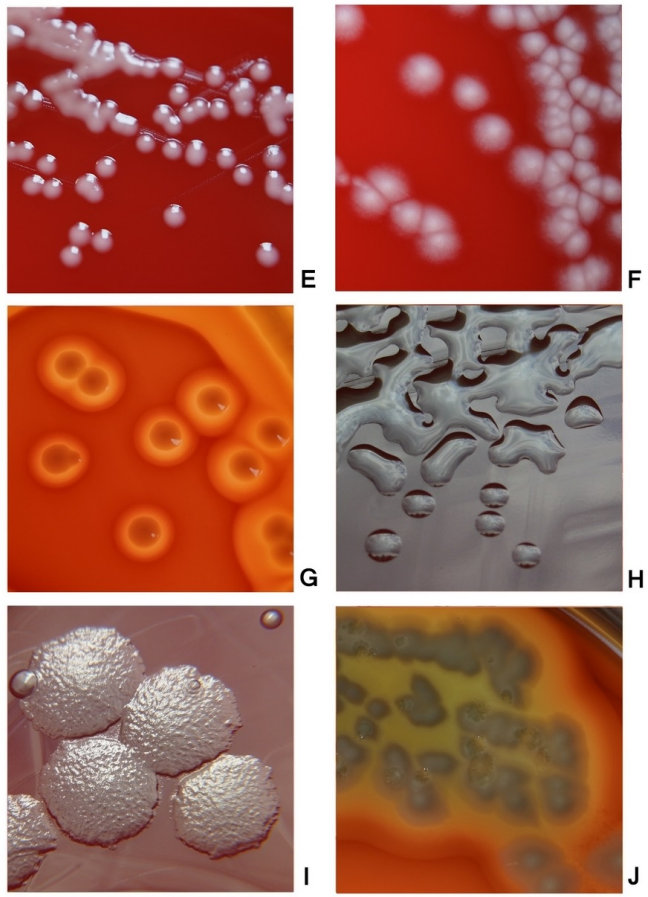
Biofilms formation

- Biofilms of *P. aeruginosa* can cause chronic opportunistic infections, which are a serious problem for medical care especially for immunocompromised patients and the elderly. They often cannot be treated effectively with traditional antibiotic therapy.
- Biofilms seem to protect these bacteria from adverse environmental factors.
- Researchers consider it important to learn more about the molecular mechanisms that cause the switch from planktonic growth to a biofilm phenotype.



Diagnosis

- Depending on the nature of infection, an appropriate specimen is collected and sent to a bacteriology laboratory for identification.
- As with most bacteriological specimens, a Gram stain is performed, which may show Gram-negative rods and/or white blood cells.
- *P. aeruginosa* produces colonies with a characteristic "grape-like" on bacteriological media. In mixed cultures, it can be isolated as clear colonies on MacConkey agar, it does not ferment lactose, which will test positive for oxidase.



- Confirmatory tests include production of the blue-green pigment pyocyanin on cetrimide agar .
- A Trible sugar iron slant is often used to distinguish nonfermenting *Pseudomonas* species from enteric pathogens in faecal specimens.
- When *P. aeruginosa* is isolated from a normally sterile site (blood, bone, deep collections), it is generally considered dangerous and almost always requires treatment.

Treatment

- Many *P. aeruginosa* isolates are resistant to a large range of antibiotics and may demonstrate additional resistance after unsuccessful treatment.
- It should usually be possible to guide treatment according to laboratory sensitivities, rather than choosing an antibiotic empirically.

- Due to widespread resistance to many common first-line antibiotics, carbapenems, polymyxins, and more recently tigecycline were considered to be the drugs of choice.
- however, resistance to these drugs has also been reported. Despite this, they are still being used in areas where resistance has not yet been reported.
- Use of β-lactamase inhibitors such as **sulbactam (** beta-lactamase inhibitors) has been advised in combination with antibiotics to enhance antimicrobial action even in the presence of a certain level of resistance.

- *P. aeruginosa* low antibiotic susceptibility is attributable to a concerted action of multidrug efflux pumps with chromosomally encoded antibiotic resistance genes
- Efflux pumps are capable of moving a variety of different toxic compounds out of cells, such as antibiotics,
- Moreover, *P. aeruginosa* have low permeability of the bacterial cellular envelopes
- In addition to this intrinsic resistance, *P. aeruginosa* easily develops acquired resistance either by mutation in chromosomally encoded genes or by the horizontal gene transfer of antibiotic resistance determinants.
- Hypermutation favours the selection of mutation-driven antibiotic resistance in *P. aeruginosa* strains producing chronic infections.

Prevention

- Probiotic prophylaxis may prevent colonization and delay onset of *Pseudomonas* infection in an ICU setting. Immunoprophylaxis against *Pseudomonas* is being investigated. The risk of contracting *P. aeruginosa* can be reduced by avoiding pools, hot tubs, and other bodies of standing water, as well as individual hygiene.