

Pseudomonas species

Pseudomonas species are medium-sized (0.5–1.0 × 1.5–5.0 μm) Gram-negative rods. They are strict aerobes, oxidative, catalase-positive, oxidase-positive and most are motile by one or several polar flagella, an exception being *P. mallei* which is non-motile. Some species produce soluble pigments and most will grow on MacConkey agar.

Natural Habitat

The numerous species in the genus are almost exclusively saprophytes including two of the species of importance in animals, *P. aeruginosa* and *P. pseudomallei*. Infected equidae are the reservoir for *P. mallei*. *P. aeruginosa* and *P. pseudomallei* are present in soil and water, *P. aeruginosa* is found worldwide and *P. pseudomallei* mainly in tropical regions. *P. aeruginosa* can be found on skin, mucous membranes and in the faeces of animals. *P. fluorescens*, present in soil and water, is associated with food spoilage and can cause lesions in reptiles and fish.

Pathogenesis

Species	Host(s)	Disease
<i>P. aeruginosa</i>	Cattle	Mastitis, uterine infections, skin infections, abscesses, enteritis and arthritis
	Sheep and goats	Mastitis, pneumonia, lung abscesses and 'green wool' (a skin infection in sheep)
	Pigs	Enteritis, respiratory infections and otitis
	Horses	Metritis, lung abscesses and eye infections

P. pseudomallei

Many animal species

Melioidosis (pseudoglanders):

Horses

The disease can mimic glanders

Cattle

Acute and chronic forms with localisation of lesions in lungs, joints and uterus

Sheep

Arthritis and lymphangitis predominate

Goats

Loss of condition, respiratory and central nervous disturbances, arthritis and mastitis

P. mallei

Horses and other equids

Glanders: acute form with high fever, mucopurulent nasal discharge, respiratory signs, septicaemia and death within 2 weeks

Chronic forms of glanders

- Pulmonary: small nodules in lungs that break down and discharge *P. mallei* into the bronchioles
- Cutaneous form: Farcy, which is a lymphangitis with ulcers along lymphatic vessels of the limbs and chest. The ulcers eventually heal leaving 'star-shaped' scars

Humans, cats and other animals

Acute, septicaemic disease

Laboratory Diagnosis

P. mallei and *P. pseudomallei* are among the most dangerous bacteria to work with in a laboratory. A biohazard cabinet must be used and all necessary safety procedures taken.

Specimens

These will be varied and depend on the clinical signs and site of lesions.

Direct microscopy

Direct microscopy from specimens is of little diagnostic use as the pseudomonads are medium-sized, Gram-negative rods with no other distinctive characteristics. A fluorescent antibody technique can be useful for *P. mallei* and *P. pseudomallei*.




Isolation

The *Pseudomonas* species are non-fastidious and will grow on trypticase soy agar, blood agar and on less complex media. The growth of *P. mallei* is enhanced by 1 per cent glycerol. A selective medium for *P. mallei* can be made by adding 1000 units polymyxin E, 1250 units bacitracin and 0.25 mg actidione to 100 ml of trypticase soy agar. Commercial selective media are available for *P. aeruginosa* and usually contain 0.03 per cent cefrimide (cetyl trimethyl ammonium bromide). *P. aeruginosa* will also grow on many of the selective media intended for the *Enterobacteriaceae* such as MacConkey, brilliant green and XLD agars



Identification

Colonial morphology

- *P. aeruginosa*: the colonies are large (3–4 mm), flat, greyish-blue with a characteristic fruity, grape-like odour of aminoacetophenone. Most strains give a clear zone of haemolysis on blood agar .
- *P. pseudomallei*: colonial growth varies from smooth and mucoid to rough with a dull, wrinkled, corrugated surface. In the smooth form the colonies are round, low-convex, entire, shiny and greyish-yellow. After several days the colonies become opaque, yellowish-brown and umbonate  .

- *P. mallei*: growth is slower than that of *P. aeruginosa* and *P. pseudomallei* but in 24–48 hours the colonies are 1–2 mm in diameter, smooth and white to cream. As they age, they become granular and yellowish or brown in colour. *P. mallei* is unable to grow on MacConkey agar.

The pigments of *P. aeruginosa*

Strains of *P. aeruginosa* produce the diffusible pigments pyocyanin (blue), pyoverdinin (yellow), pyorubin (red) and pyomelanin (dark brown)




Microscopic appearance

All the pseudomonads are medium-sized Gram-negative rods.

Biochemical characteristics

The characteristic colonial appearance, including pyocyanin production and odour, and a strong oxidase reaction (the members of the *Enterobacteriaceae* are oxidase-negative), will give a presumptive identification of *P. aeruginosa*.



Immunological tests

- Melioidosis: complement-fixing and indirect haemagglutinating antibodies are produced after infection with *P. pseudomallei*. However, the diagnosis of melioidosis depends more on the isolation and identification of the bacterium than on clinical findings and serological tests.
- Glanders: both cell-mediated and antibody-mediated responses are elicited by infection with *P. mallei*. Complement fixation, agglutination, indirect haemagglutination and counter-immunoelectrophoresis tests are used in the diagnosis of glanders. False-positive reactions may occur in areas where melioidosis is endemic as the serological tests may detect antibodies that cross-react with those of *P. pseudomallei*.

Animal inoculation

The Straus reaction is seen in male guinea-pigs inoculated intraperitoneally with infective material containing either *P. pseudomallei* or *P. mallei*. A localised peritonitis and a purulent inflammation of the testicular tunica vaginalis develops in 2–3 days.

Prevention and Treatment:

Prevention and control depend on early detection and elimination of affected animals, as well as complete quarantine and rigorous disinfection of the area involved.

Treatment is given only in endemic areas but does not reliably produce a bacteriologic cure

. Doxycycline , ceftrazidime , gentamicin , streptomycin, and combinations of sulfazine or sulfamonomethoxine with trimethoprim were effective in the prevention glanders and treatment of experimental



Thank you