

Proteus mirabilis

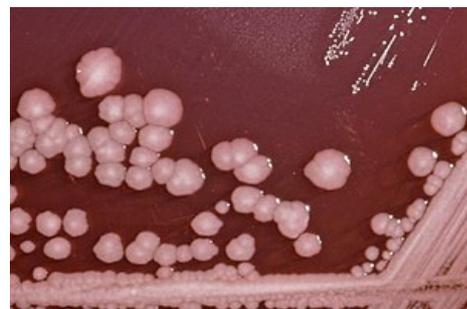
Proteus mirabilis is a **gram-negative facultatively anaerobic bacterium** characterized by swarming motility and urease activity. *Proteus mirabilis* causes 90% of infections of the genus *Proteus*, which can be considered community-acquired infections.

Occurrence

Proteus mirabilis is part of the normal gastrointestinal flora. It is also found in soil, water, plants, human and animal faeces. *Proteus* is found in many ecological habitats, including long-term health care facilities and hospitals.

Microbiological characteristics

Proteus mirabilis belongs to the group of **enterobacteria**. It is a small Gram-negative facultatively anaerobic bacillus. It is characterised by **swarming growth** on the Endo agar, the ability to ferment maltose, and the inability to ferment lactose. It has the ability to elongate, and when in contact with solid surfaces, it secretes polysaccharides, thus becoming very mobile and spreading to various surfaces, such as medical devices.



Colonies of *Proteus mirabilis*

Virulence factors

The **flagellum** of *P. mirabilis* is critical for its motility and helps the organism colonize. The flagellum is also associated with the bacterium's ability to form a biofilm, aiding in resistance to the host defense and selected antibiotics. **P. mirabilis** also relies on its **pili** for attachment to avoid flushing from the urinary tract.

Important to *P. mirabilis* is **urease**, responsible for raising the pH and subsequent thriving of the bacteria. There are **endotoxins**, responsible for the induction of inflammatory reactions, and **hemolysin**, which forms pores.

Diseases

Most often, infections occur when bacteria move into the urethra and bladder. Although the bacterium *Proteus mirabilis* is known to cause urinary tract infections, most of these infections are caused by *E. coli*. Urinary tract infections caused by *P. mirabilis* are usually found in patients with long-term catheterization. The bacteria moves around and forms encrustations on urinary catheters. The encrustations cause blockage of the catheter.

Symptoms for **urethritis** are mild, including urinary frequency and pyuria (presence of white blood cells in urine examination). Symptoms of **cystitis** (bladder infection) include back pain, urgency, hematuria (presence of red blood cells in the urine), suprapubic pain, frequent urination, and pyuria.

Pyelonephritis (infection of the renal glands) can occur when bacteria migrates from the lower urinary tract to the upper urinary tract. Not all patients have symptoms associated with urethritis and cystitis. Pyelonephritis is associated with nausea and vomiting.

The *Proteus mirabilis* bacteria can enter the bloodstream through a wound (e.g. when the wound comes into contact with an infected surface), causing inflammatory reaction, which can cause sepsis and systemic inflammatory response syndrome (SIRS). SIRS has a mortality rate of 20-50%^[1].

P. mirabilis can also, although less frequently, colonize lungs. This results from interaction with infected hospital equipment (air conditioning) and causes **pneumonia**. Symptoms of pneumonia are fever, chills, chest pain, murmurs, and cough.

Infection with *P. mirabilis* may also result in prostatitis, which is characterized by fever and chills. The bacteria may also be the cause of **neonatal sepsis** and **meningitis**.^[2]

Therapy

The antibiotics of choice for *P. mirabilis* are usually **cephalosporins** of 1st and 2nd generation. The bacteria generally manifests high sensitivity to various antibiotics, though **furantoin** and **tetracyclines** are the ones it's resistant to.^[3]

Links

Related articles

- Escherichia coli
- Klebsiella pneumoniae
- Salmonella
- Shigella
- Yersinia pestis
- Vibrio
- Haemophilus influenzae

References

1. University of Connecticut - Department of Molecular and Cell Biology. *Student presentation on Proteus mirabilis* [online]. [cit. 2013]. <<http://web.uconn.edu/mcbstaff/graf/Student%20presentations/Proteus/Proteus.html>>.
2. BENEŠ, Jiří, et al. *Infekční lékařství*. 1. edition. Galén, 2009. 651 pp. pp. 269-270. ISBN 978-80-7262-644-1.
3. HURYCH, Jakub – ŠTÍCHA, Roman, et al. *Lékařská mikrobiologie : Repetitorium*. 2. edition. Praha : Triton, 2021. 622 pp. pp. 165. ISBN 978-80-7553-900-7.

Literature

- BEDNÁŘ, M. – FRANKOVÁ, V., et al. *Lékařská Mikrobiologie*. 1. edition. Praha : Marvil, 1996. ISBN 8023802976.
- University of Michigan Medical School. *Research Proteus mirabilis* [online]. [cit. 2013]. <<https://moblely.lab.medicine.umich.edu/>>.
- University of Connecticut - Department of Molecular and Cell Biology. *Student presentation on Proteus mirabilis* [online]. [cit. 2013]. <<http://web.uconn.edu/mcbstaff/graf/Student%20presentations/Proteus/Proteus.html>>.
- Medscape Reference. *Proteus Infections* [online]. ©2011. [cit. 2013]. <<https://emedicine.medscape.com/article/226434-overview>>.
- HURYCH, Jakub – ŠTÍCHA, Roman, et al. *Lékařská mikrobiologie : Repetitorium*. 2. edition. Praha : Triton, 2021. 622 pp. pp. 165. ISBN 978-80-7553-900-7.
- BENEŠ, Jiří, et al. *Infekční lékařství*. 1. edition. Galén, 2009. 651 pp. pp. 269-270. ISBN 978-80-7262-644-1.