Proteus Mirabilis

Proteus mirabilis is a gram-negative, bacillus. This bacteria shows "swarming" motility on agar and produces urease. Patients can contract urinary tract infections from this bacteria, leading to alkaline urine. A complication of infection is the development of struvite kidney stones.



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Characteristics

Gram-Negative
Graham-cracker Negative-devil
Proteus mirabilis is a gram-negative bacteria, which is a part of the normal flora of the gut. It is also abundantly in soil in water. It is most associated with UTIs, but can also lead to septicemia, pneumonia and wound infections in hospitalized patients.

Bacillus
Rod
This bacterium is rod-shaped, or a bacillus. It is also notable that proteus mirabilis is facultatively anaerobic.

Oxidase Negative
Wilting Negative Ox-daisy
Proteus mirabilis is oxidase negative, meaning this bacterium does not contain cytochrome c oxidase. It cannot use oxygen for energy production, and leads to a colorless reagent when tested.

Urease-Positive
Positive U-eraser
This bacteria has the ability to produce urease, which hydrolizes urea in the body to ammonia. In a urinary tract infection, this means that the urine becomes more alkaline. In the lab, these bacteria produce a very distinct, fishy odor.

Swarming Motility
Swarm
These bacteria are able to be easily diagnosed on agar, as they show characteristic "swarming motility."

Non-lactose Fermenting
Nun Milk-carton Ferns
This bacterium cannot utilize lactose, and does not ferment when exposed to it. Rather, in the MacConkey agar in which this trait is tested for, Proteus mirabilis uses peptone instead of lactose, forming ammonia, which in turn raises the pH of the agar. This causes Proteus grow as white/colorless colonies on MacConkey agar.

Symptoms

Urinary Tract Infection
Kidneys and bladder in flames
These bacteria are a normal part of the gut's flora, but can infect the urinary tract. These urease producing bacteria, when causing a UTI, lead to alkalinized urine, which can then cause kidney stones (often staghorn calculi).

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Struvite Crystals

Stove Crystals

These bacteria can alkalinize the urine, leading to formation of crystals, such as struvite, which is also called magnesium ammonium phosphate. Struvite crystals are characteristic of this infection, and often grow into large staghorn calculi, which cause renal obstruction and renal failure.

Staghorn Kidney Stones

Stag with Staghorn Kidney Stones

Staghorn calculi are upper urinary tract stones that involve the renal pelvis and extend into at least two of the calyces. All types of urinary stones can potential form staghorn calculi, but the majority of them are composed of struvite-carbonate-apatite.

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