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Proteus



Classification

❖ **Family: Enterobacteriace.**

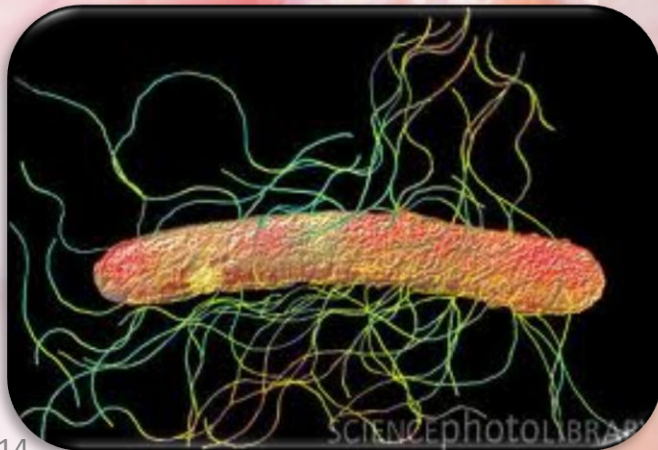
❖ **Genus: *Proteus*.**

Species of proteus:

- 1) Proteus vulgaris.
- 2) Proteus mirabilis.
- 3) Proteus myxofaciens.
- 4) Proteus penneri.
- 5) Proteus hauseri.
- 6) Genomospecies 4, 5, and 6.

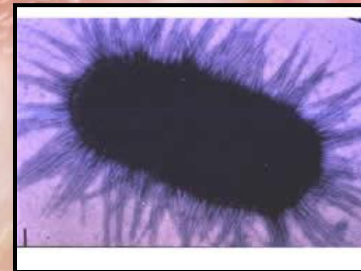
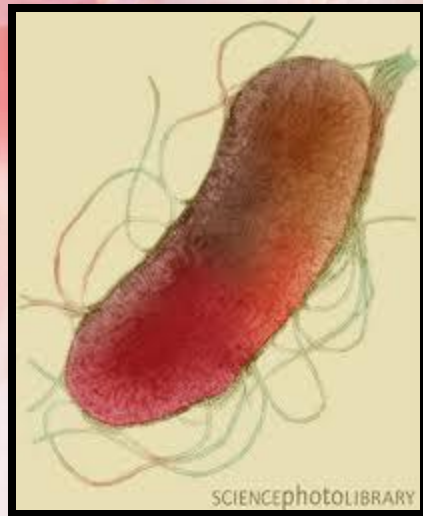
Morphology

- ✓ Gram negative bacilli, (1–3X 0.5 μ m).
- ✓ In young cultures, cells are long, curved, and filamentous, arranged concentrically.
- ✓ In older cultures, no characteristic arrangement.
- ✓ Non-capsulated, non-sporing & actively motile.



Cont..

- ✓ Possess peritrichate flagella & many strains possess fimbriae.
- ✓ Flagella are more variable in shape.



Cultural characteristics:

- **They are aerobic & facultatively anaerobic.**
- **In nutrient broth uniform turbidity with powdery deposit and a faint ammoniacal odor.**
- **A thin, fragile pellicle in old cultures.**

Cont...

- **Grow on ordinary media.**
- **When grown on nutrient agar or blood agar *Pr.vulgaris* & *Pr.mirabilis* exhibit swarming (spreading growth).**
- **Emits a putrefactive (fishy or seminal) odor.**



Culture on MacConkey agar

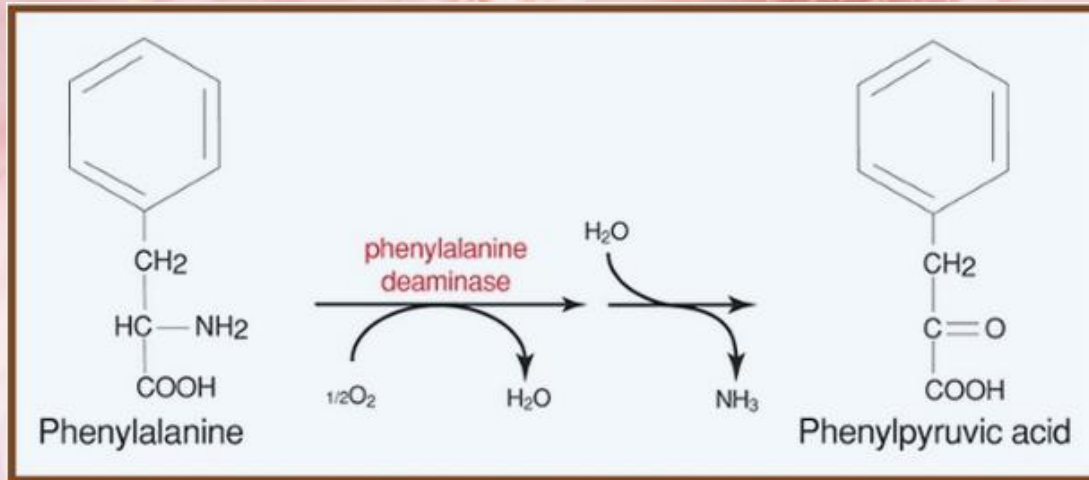
❖ *Proteus* strains form several sorts of discrete colony on MacConkey agar.



Phenylalanine Agar (PPA)

Principle:

- Organism that produce phenylalanine deaminase can be identified by their ability to remove the amine group (NH₂) from the amino acid phenylalanine.
- The reaction requires oxygen & produce ammonia (NH₃) & phenylpyruvic acid.
- Deaminase activity is evidenced by the presence of phenylpyruvic acid.



Phenylpyruvic Acid + FeCl₃ → Green Color



Biochemical reactions

All strains are:

- 1) catalase-positive and oxidase negative.**
- 2) Ferments glucose with small amounts of gas.**
- 3) Lactose fermentation is rare.**
- 4) Sucrose fermented by most strains except *P. mirabilis* (only 15–20% are positive).**

Sp.	swarming	gas	ure	ind	orn	H ₂ S	gel	man	adon	malt	tre	xyl
P.mirabilis	+	+	+	-	+	+	+	-	-	-	+	+
P.Penneri	+	+/-	+	-	-	+/-	+/-	-	-	+	+/-	+
P.vulgaris	+	+	+	+	-	+	+	-	-	+	+/-	+
M.morganii	-	+	+	+	+	+/-	-	+	-	-	-	-
Prov.alcalifaciens	-	+	-	+	-	-	-	+	+	-	-	-
Prov.rettgeri	-	-	+	+	-	-	-	+	+	-	-	-
Prov.rustigianii	-	+/-	-	+	-	-	-	+	-	-	-	-
Prov.stuartii	-	-	+/-	+	-	-	-	+	-	-	+	-

cont...

5) All species produce an inducible urease; which differentiate it from shigella and salmonella.

6) All species within the tribe also have the ability to degrade indole on prolonged incubation.

7) Regarding **Triple Sugar Iron** agar, Proteus are:
K/A/G+ \backslash H₂S.

✓ Proteus produce H₂S gas during fermentation, this gas will reduce the ferrous sulphate in the medium causing a black precipitate to form in the butt of the tube at 16-24 hours of incubation.



IMVIC phenomena

- ✓ Growth on Simmons's citrate medium is variable in some species.
- ✓ But does not occur with *P. penneri* and *P. hauseri* strains.
- ✓ Most strains of *Proteus* are **MR positive & VP negative.**

cont...

- ✓ Among the indole-positive strains of *Proteus*.
- ✓ Those that also acidify salicin and degrade aesculin are strains of *P. vulgaris*.
- ✓ Whereas those that do not acidify salicin or degrade aesculin are either strains of *P. hauseri* or strains of genomospecies 4, 5, and 6.

Disease caused by proteus:

☐ Strains of *Pr. mirabilis* are a prominent cause of:

- 1. Urinary tract infection.**
- 2. Septicaemia.**
- 3. Infections, usually of surgical wounds or bedsores.**

Sample Collection

❖ Sample from:

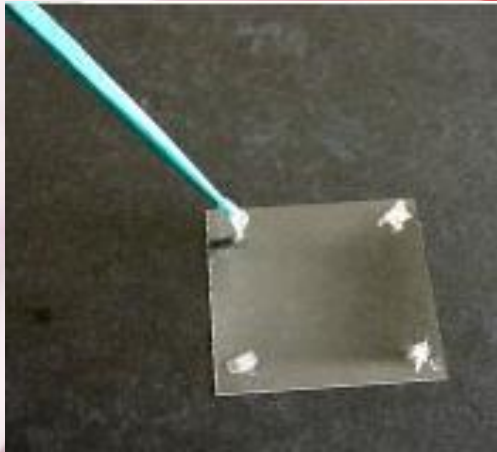
- 1) Urinary tract.**
- 2) Wounds.**
- 3) Blood samples.**

Laboratory diagnosis

- 1) Gram staining: Gram negative bacilli, non-capsulated & non-spore forming.**
- 2) Hanging drop preparation.**
- 3) Biochemical reactions (PPA & Urease tests).**

Hanging drop preparation

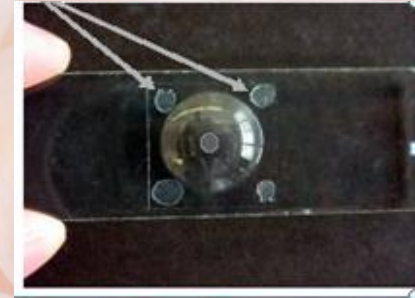
Step 1: Preparing Cover Glass:



✓ Using a toothpick, place a small dab of Vaseline in each corner of a clean cover glass.

- ✓ Aseptically transfer a loopful of a liquid bacterial culture into the center of the cover glass. Do not spread the drop!
- ✓ Alternatively, if you have a solid culture.

Step 2: Attaching Depression Slide:

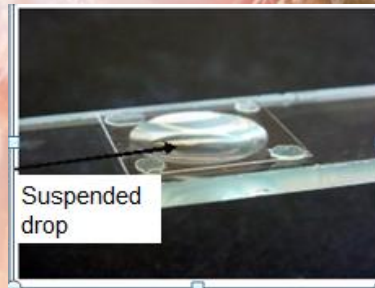


Carefully lower depression slide with depression facing down.

Vaseline attaching cover glass to depression slide

Step 3: Invert Depression Slide:

Quickly invert depression slide.



Step 4: Examine under Microscope:

With 10x objective and using course adjustment knob, focus on the edge of the hanging drop.





Urease Test

❖ **The test used particularly to distinguish genus proteus from other enteric bacteria.**

❖ **How to Perform Test:**

Inoculate urea broth or urea slant agar with inoculating loop.

❖ **Property it tests for:**

This test is done to determine a bacteria's ability to hydrolyze urea to make ammonia using the enzyme urease.

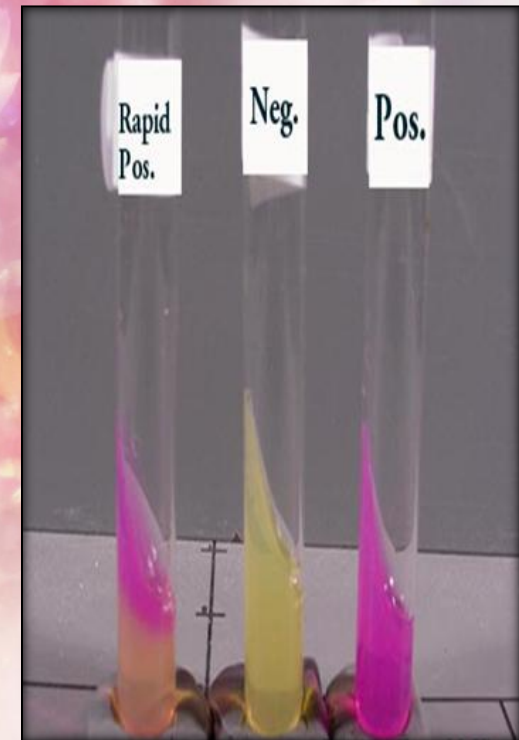
❖ **Media and Reagents Used: Urea Disks or Tablets, Urea broth or Urea slants contains: a yeast extract, monopotassium phosphate, disodium phosphate, urea, and phenol red indicator.**

❑ **Reading Results: Urea slant is a yellow color.**

The enzyme urease will be used to hydrolyze urea to make ammonia.

A) If test is positive, ammonia is made & the broth turns a bright pink color.

B) If test is negative, broth has no color change and no ammonia is made.



PSEUDOMONAS



PSEUDOMONAS

- ❑ It is an important genus in the family pseudomonaceae.

- ❑ These M.O are:
 - 1) Oxidase ve+ (opposite to Enterobacteriaceae).

 - 2) Non-fermentative for CHO, **but oxidative; so the require O2.**

Introduction:

➤ **Large group of :**

- 1.aerobic.
- 2.non sporing.
- 3.gram negative.
- 4.motile by polar flagella.

➤ **Ubiquitous.**

- **oppurtunistic infections** like UTI, wound infection and severe infection in hospitalized and compromised persons.



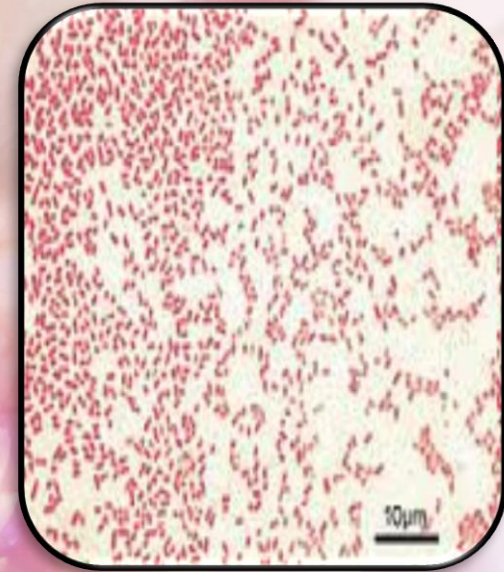
Species

- *P.aeruginosa* (the most important one).
- *P.fluorescenes*.
- *P.putida*.
- *P.stutzeri*.

Pseudomonas aeruginosa

Morphology:

- slender, Gram negative bacillus.
- size-1.5 microns-3*1.5microns.
- motile by polar flagella.
- non capsulated though some mucoid strains may sometimes occur.
- some are pilated.



Cultural characteristics

- ✓ Obligate aerobe.
- ✓ Wide range of temperature $5^{\circ}\text{C}-42^{\circ}\text{C}$

1) On ordinary media :

Large, opaque, irregular, with distinctive musty, mawkish, earthy smell.

Cont...

2) *On nutrient agar:*

- ✓ Colonies are smooth, large, translucent, low convex, 2-4mm in diameter.
- ✓ Produce sweetish aromatic odor.
- ✓ Greenish blue pigment diffuses.



Pigment production on nutrient agar

1) *Pyocyanin*:

- ✓ Bluish green phenazine pigment.
- ✓ Soluble in chloroform and water.
- ✓ Produced by *P.aeruginosa*.



2) *Pyoverdín (fluorescín)*:

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



Cont..

3) Pyorubin:

- ✓ Reddish brown pigment.
- ✓ Insoluble in chloroform but soluble in water.

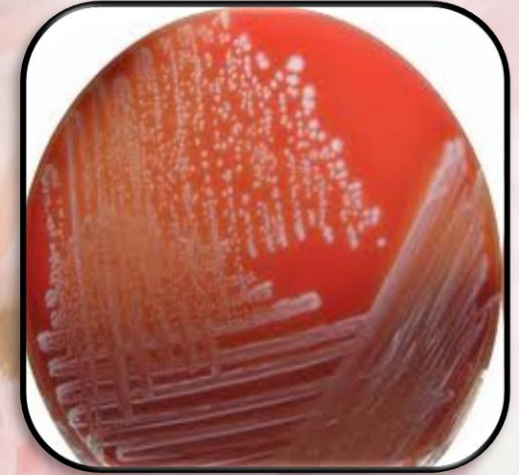
4) Pyomelanin:

- ✓ Brown to black pigment.
- ✓ Production is uncommon.

Cont..

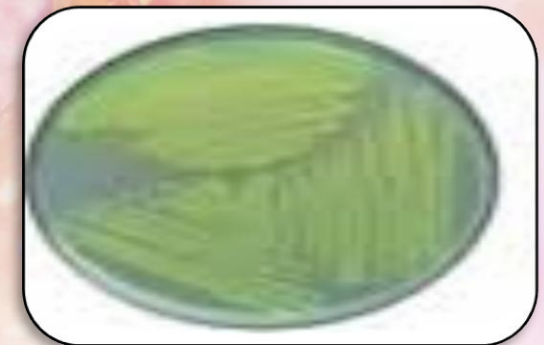
3) *On blood agar:*

- Similar to nutrient agar.
- Many are haemolytic.



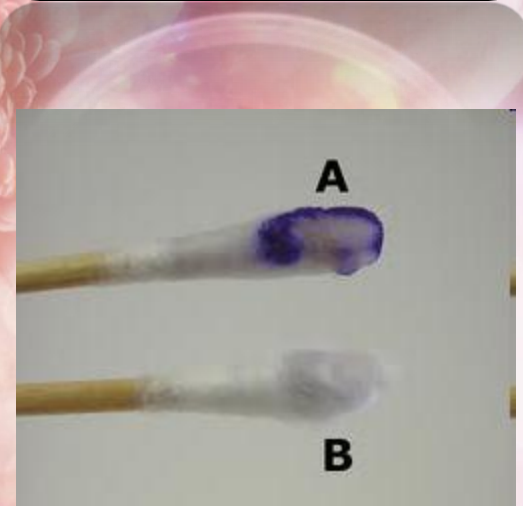
4) *On MacConkey agar:*

- Colourless, non lactose fermenters.



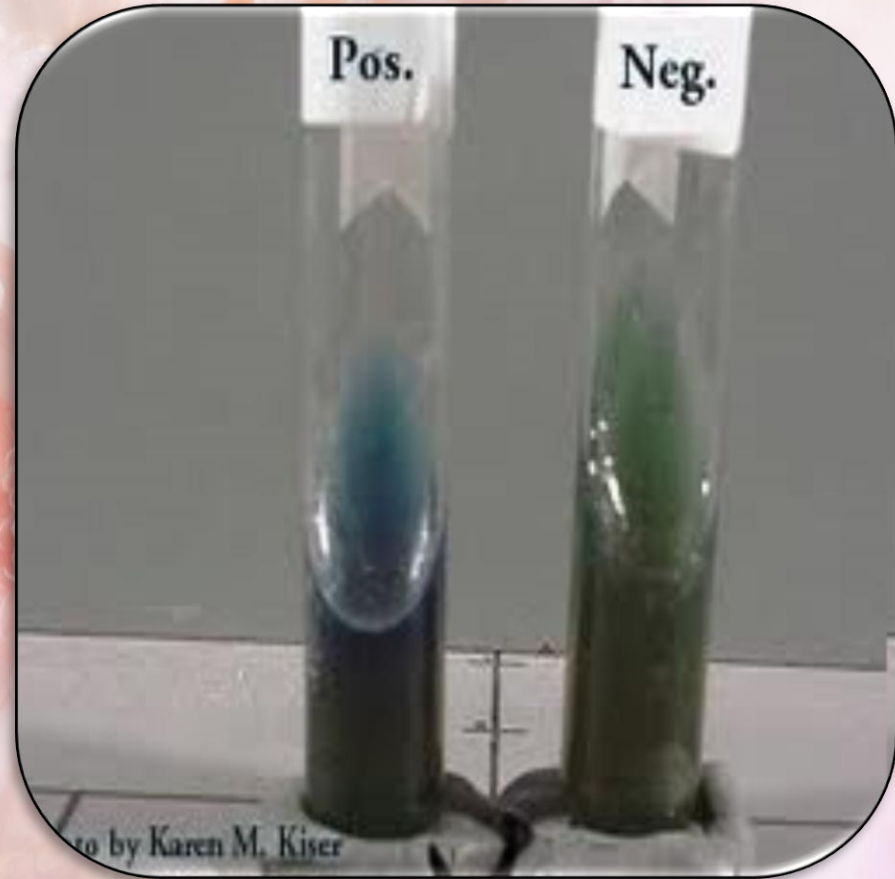
Biochemical reactions

- O/F test-oxidative.
- Catalase-positive.
- Oxidase-positive.
- Nitrate reduction-positive.



Cont...

- Citrate test-positive.
- Urease test-negative.



Cont...

➤ *Sugar utilization tests:*

Glucose-only acid.

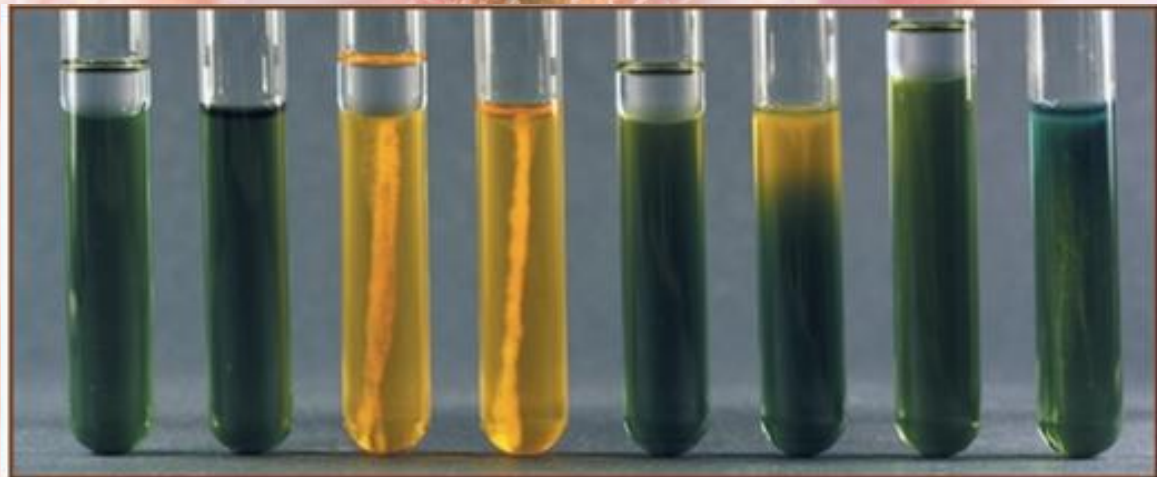
Lactose-negative.

Sucrose-negative.

Mannitol-negative.

Oxidative-Fermentative Test (OF):

- Two tubes of semisolid media are used (which have low concentration agar, high CHO content & an indicator called bromothymol blue) They are inoculated with the M.O; one is covered by mineral oil and the other is left opened.
- After 24-48 hours the covered tube remains **green**, while the opened becomes **yellow**.
- Also, in this test, the motility could be seen, which have tree-like appearance mainly toward the top of the tube (aerobic M.O).



Disease caused by pseudomonas:

- ❖ Important agent in causing nosocomial infections.
- ❖ **Most common infections are:**
 - 1) Urinary tract infections following catheterization.
 - 2) Acute purulent meningitis following lumbar puncture.
 - 3) Post-tracheostomy pulmonary infection.
 - 4) Septicaemia in debilitated patients.

cont..

5) Chronic otitis media and otitis externa.

6) Eye infections.



7) Acute necrotizing vasculitis.



9) Infantile diarrhea.

8) Wound and burn infections.



A white rectangular card is centered on a background of numerous pink rose petals. The petals are scattered and overlap, creating a soft, textured surface. The card is slightly tilted. The text 'Thank You' is written in a black, elegant cursive font on the card.

Thank You