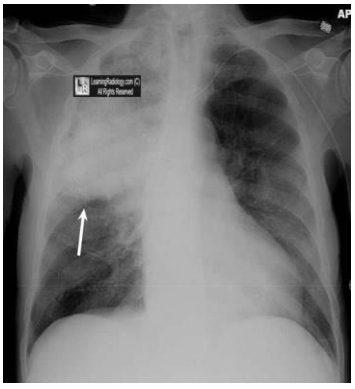
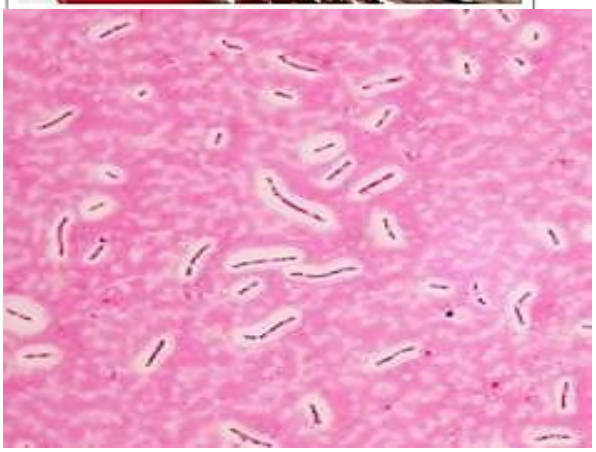
Genus Klebsiella




Introduction:

Klebsiella are ubiquitous and may colonize the skin, pharynx, or gastrointestinal tract in humans. They form large moist colonies due to large mucoid polysaccharide capsule (K antigen) that protects from phagocytosis and aids in adherence.

The two species *; Klebsiella pneumoniae* , *Klebsiella oxytoca* and recently *Klebsiella aerogenes* (*Enterobacter aerogenes*) are opportunistic pathogens found in the environment and in mammalian mucosal surfaces; they are commonly passed by hands of hospital

personel. Catheters and tools in medical procedures can transmit *K. pneumoniae* into the urinary tract, the bloodstream, and wounds.

K. pneumoniae has developed resistance to many antibiotics, However, testing the sensitivity of the bacteria in blood or tissue samples can help them identify the most effective course of treatment.

Characteristics:

- Gram negative coccobacilli
- Non-motile,
- *K. pneumoniae* is a member of the enterobacteriaciae. K. pneumoniae and *k. oxytoca* are closely related and distinguishable by indole testing *k. pnumoniae* is indole negative *k. oxytoca* is indole positive .
- Possess a prominent polysaccharide capsule. *Klebsiella* bacteria without capsules are less infectious than those with capsules.
- Facultative aerobes, capable of both fermentation and aerobic respiration.

NOTE: ***Klebsiella aerogenes***, previously known as *Enterobacter aerogenes,* is a Gram-negative, oxidase negative, catalase positive, citrate positive, indole negative, rod-shaped bacterium. The bacterium is approximately 1-3 microns in length, and is **capable of motility** via peritrichous flagella.

Specimen: urine, stool, sputum, wounds, water, food samples.

Pathogenicity:

K. pneumoniae in their digestive tracts. When the bacteria spread to other parts of the body, they can cause a variety of infections, including:

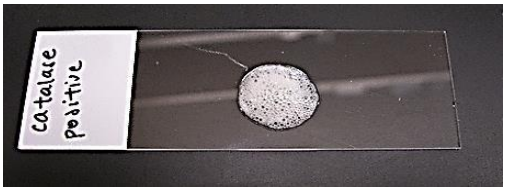
- Pneumonia.
- Urinary tract infection.
- Diarrhea.
- Upper respiratory tract infection.
- Wound infection.
- Osteomyelitis.
- Meningitis.
- Hemorrhage in the lung tissue, which produces a thick, bloody.

Lab Work:

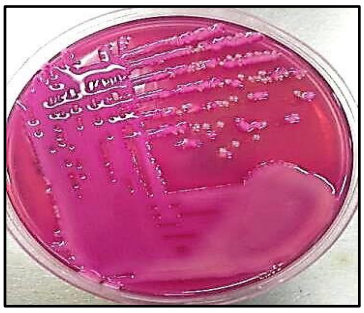
1. **Gram stain:**

Gram negative coccobacilli of Klebsiella

2. **Catalase: Positive**



3. **MacConkey agar:**



Mucoid lactose fermenter colonies of Klebsiella.

4. **TSI: A / A gas +**
5. **IMViC tests:**

Indole : -ve

MR: -ve

VP: +ve

Citrate utilization : +ve

Characteristics	*Klebsiella pneumoniae*
Capsule	+ve
Catalase	**+ve**
Citrate	+ve
Flagella	**-ve**
Gas	+ve
Gelatin Hydrolysis	**-ve**
Gram Staining	-ve
Growth in KCN	**+ve**
H_2S	-ve
Indole	**-ve**
Motility	-ve
MR (Methyl Red)	**-ve**
MUG Test	+ve
Nitrate Reduction	**+ve**
OF (Oxidative-Fermentative)	Fermentative
Oxidase	**-ve**
Pigment	-ve
Shape	**Rod**
Spore	-ve
TSIA (Triple Sugar Iron Agar)	**A/A**
Urease	+ve
VP (Voges Proskauer)	**+ve**

Fermentation of	
Adonitol	+ve
Arabinose	**+ve**
Arabitol	+ve
Cellobiose	**+ve**
Dnase	-ve
Erythritol	**-ve**
Esculin Hydrolysis	+ve

Glucose	**+ve**
Glycerol	+ve
Inositol	**+ve**
Lactose	+ve
Maltose	**+ve**
Mannitol	+ve
Mannose	**+ve**
Melibiose	+ve
Mucate	**+ve**
MyoInositol	+ve
Raffinose	**+ve**
Rhamnose	+ve
Salicin	**+ve**
Sorbitol	+ve
Sucrose	**+ve**
Tartrate	+ve
Trehalose	**+ve**
Xylose	+ve
Enzymatic Reactions	
Acetoin Production	Variable

Arginine Dehydrolase	**-ve**
Esculin Hydrolysis	+ve
Lipase	**-ve**
Lysine	+ve
ONPG (β-galactosidase)	**+ve**
Ornithine Decarboxylase	-ve
Phenylalanine Deaminase	**-ve**
Tryptophan Deaminase	**-ve**
Tyrosine Hydrolysis	**-ve**
Motility	Positive

Indole	**Negative**
Methyl Red	Negative
VP	**Positive**
Citrate (Simmons)	Positive
Nitrate Reduction	**Positive**
Hydrogen Sulfide (TSI)	Negative
Urea Hydrolysis	**Negative**
Oxidase	Negative
Phenylalanine Deaminase	**Negative**
Eosin-methylene blue	Positive
Glucose Fermentation	**Acid/Gas**
Lactose Fermentation	Acid/Gas
Sucrose Fermentation	**Acid/Gas**
Mannitol Fermentation	Acid/Gas
Motility	**Positive**
Indole	Negative
Methyl Red	**Negative**
VP	Positive

Citrate (Simmons)	**Positive**
Nitrate Reduction	Positive
Hydrogen Sulfide (TSI)	**Negative**
Urea Hydrolysis	Negative
Oxidase	**Negative**
Phenylalanine Deaminase	Negative
Eosin-methylene blue	**Positive**
Glucose Fermentation	Acid/Gas
Lactose Fermentation	**Acid/Gas**
Sucrose Fermentation	Acid/Gas
Mannitol Fermentation	**Acid/Gas**
Growth in KCN	Positive
Ornithinine Decarboxylase	**Positive**
Gelatin Hydrolysis (22 °C)	Negative
Growth in KCN	**Positive**
Motility	Positive
Indole	**Negative**
Methyl Red	Negative
VP	**Positive**
Citrate (Simmons)	Positive
Nitrate Reduction	**Positive**
Hydrogen Sulfide (TSI)	Negative
Urea Hydrolysis	**Negative**
Oxidase	Negative
Phenylalanine Deaminase	**Negative**
Eosin-methylene blue	Positive
Glucose Fermentation	**Acid/Gas**
Lactose Fermentation	Acid/Gas
Sucrose Fermentation	**Acid/Gas**
Mannitol Fermentation	Acid/Gas
Growth in KCN	**Positive**
Ornithinine Decarboxylase	Positive
Gelatin Hydrolysis (22 °C)	**Negative**
Ornithinine Decarboxylase	Positive
Gelatin Hydrolysis (22 °C)	**Negative**

Klebsiella aerogenes (formerly *Enterobacter aerogenes*):

Basic Characteristics	Properties (*Enterobacter aerogenes*)
Capsule	**Positive (+ve)**
Catalase	Positive (+ve)
Citrate	Positive (+ve)
Flagella	**Positive (+ve)**
Gas	Positive (+ve)
Gelatin Hydrolysis	**Negative (-ve)**
Gram Staining	Gram-negative
H2S	**Negative (-ve)**
Indole	Negative (-ve)
Motility	**Positive (+ve)**
MR (Methyl Red)	Negative (-ve)
Nitrate Reduction	**Positive (+ve)**
OF (Oxidative-Fermentative)	Fermentative
Oxidase	**Negative (-ve)**
Shape	Rod-shaped
Spore	**Negative (-ve)**
TSIA (Triple Sugar Iron Agar)	Acid/ Acid Gas
Urease	**Negative (-ve)**
VP (Voges Proskauer)	Positive (+ve)
Fermentation of	
Arabinose	Positive (+ve)
Arabitol	**Negative (-ve)**
Cellobiose	Positive (+ve)
Dnase	**Negative (-ve)**
Fructose	Positive (+ve)

Galactose	**Positive (+ve)**
Glucose	Positive (+ve)
Glycerol	**Positive (+ve)**
Lactose	Positive (+ve)
Mannitol	**Positive (+ve)**
Mannose	Positive (+ve)
Rhamnose	**Positive (+ve)**
Starch	Negative (-ve)
Trehalose	**Positive (+ve)**
Xylose	Positive (+ve)
Enzymatic Reactions	
Arginine Dehydrolase	Negative (-ve)
Esculin Hydrolysis	**Positive (+ve)**
Gamma-Glutamyl transferase	Positive (+ve)
ONPG (β-galactosidase)	**Positive (+ve)**
Ornithine Decarboxylase	Positive (+ve)
Phenylalanine Deaminase	**Negative (-ve)**
Tetrathionate reductase	Negative (-ve)

Basic Characteristics	Properties *(Enterobacter cloacae)*
Capsule	Negative (-ve)
Catalase	Positive (+ve)
Citrate	Positive (+ve)
Flagella	Positive (+ve)
Gas from glucose	Positive (+ve)
Gelatin Hydrolysis	Negative (-ve)
Gram Staining	Negative (-ve)
Growth in KCN	Positive (+ve)
H2S	Negative (-ve)
Indole	Negative (-ve)
Motility	Motile
MR (Methyl Red)	Negative (-ve)
Nitrate Reduction	Positive (+ve)
OF (Oxidative-Fermentative)	Facultative Anaerobes
Oxidase	Negative (-ve)
Pigment	Negative (-ve)
Shape	Rods
Spore	Negative (-ve)
Urease	Negative (-ve)
VP (Voges Proskauer)	Positive (+ve)

Adonitol	Negative (-ve)
Arabinose	**Positive (+ve)**
D-Arabitol	Variable
Cellobiose	**Positive (+ve)**
Dnase	Negative (-ve)
Dulcitol	**Negative (-ve)**
Meso-Erythritol	Negative (-ve)
Glucose	**Positive (+ve)**
Glycerol	Variable
Lactose	**Negative (-ve)**
Maltose	Positive (+ve)
D-Mannitol	**Positive (+ve)**
D-Mannose	Positive (+ve)
Melibiose	**Positive (+ve)**
Mucate	Positive (+ve)
MyoInositol	**Negative (-ve)**
Raffinose	Positive (+ve)
Rhamnose	**Positive (+ve)**
Salicin	Positive (+ve)
D-Sorbitol	**Positive (+ve)**
Sucrose	Positive (+ve)
Tartrate	**Variable**
Trehalose	Positive (+ve)
Xylose	**Positive (+ve)**
Enzymatic Reactions	
Acetate Utilization	Positive (+ve)
Aesculine Hydrolysis	**Variable**
Arginine decarboxylase	Positive (+ve)
Esculin Hydrolysis	**Variable**
Lipase	Negative (-ve)
Lysine decarboxylases	**Negative (-ve)**
ONPG (β-galactosidase)	Positive (+ve)
Ornithine Decarboxylase	**Positive (+ve)**