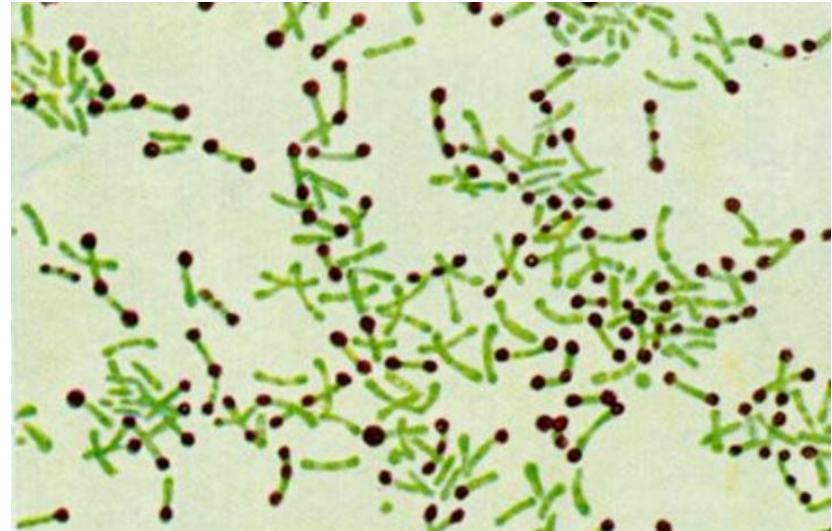


GENUS CORYNEBACTERIUM

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CLASSIFICATION



- Kingdom Bacteria
- Phylum Actinobacteria
- Order Actinomycetales
- Family Corynebacteriaceae
- Genus *Corynebacterium*
- Species *Corynebacterium bovis*



HISTORY

- Genus *Corynebacterium* was originally created by Lehmann and Neumann (1896)
- *Corynebacterium diphtheriae* (**Klebs–Löffler bacillus**)

It was discovered in 1884 by German bacteriologists **Edwin Klebs and Friedrich Löffler**

- Various selective media were formulated for *C. diphtheriae*, by the following scientist
 - Frobisher, 1937 - Cystine-tellurite blood agar
 - Hoyle, 1941 - Hoyle's lysed blood tellurite agar
 - Tinsdale, 1947 - Tinsdale agar

INTRODUCTION

- Gram positive
- Coccobacilli with some **metachromatin granules**
- Pleomorphic irregularly stained
- Stained tissue smears reveal groups of cells in parallel (Palisades) or cells at sharp angles to each other “V” or “Y” configurations (**Chinese letter or Cuneiform arrangement**).



HABITAT AND ECOLOGY

- Soil born and often found in manure.
- Survive as commensals on normal mucous membrane and skin of cattle and other domestic animals.
- Chronic cases and adult animals are the common carriers.
- Most species of *Corynebacterium* are opportunistic pathogens.
- Present in the intestines of horses and persist for long periods in the manure and litter of stables.
- As commensals, they can be found on the skin or on mucous membranes of animals



MORPHOLOGY

- Gram-positive slender rod with a tendency to clubbing at one or both ends
- Non-sporing, Non-motile, Non-capsulated , Non-acid fast.
- Palisades or Chinese letter or Cuneiform arrangement



- Small, pleomorphic (club-shaped), Gram-positive rods
- Cell size is 2 to 6 μm long and 0.5 to 1 μm in diameter.
- Modified ZN staining positive
- Straight to slightly curved, often with tapered ends
- Coryne bacterial cell walls contain thin spots which leads to some Gram variability and "ballooning" that produces a "club-shaped" cell.
- Lipid-rich cell wall contains meso-diaminopimelic acid, arabino-galactan polymers, and short-chain mycolic acids



GRANULES

- High energy phosphate granules – polymetaphosphate.
- Strongly Gram positive than the rest of the bacterial cell.
- Stained with Loeffler's methylene blue, the granules take up a reddish purple color and hence they are called metachromatic granules.
- They are called as **volutin** or Babes Ernst Granules.

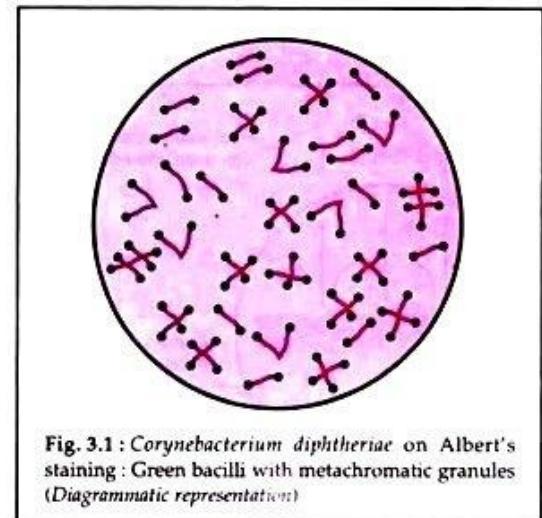


Fig. 3.1 : *Corynebacterium diphtheriae* on Albert's staining : Green bacilli with metachromatic granules (Diagrammatic representation)

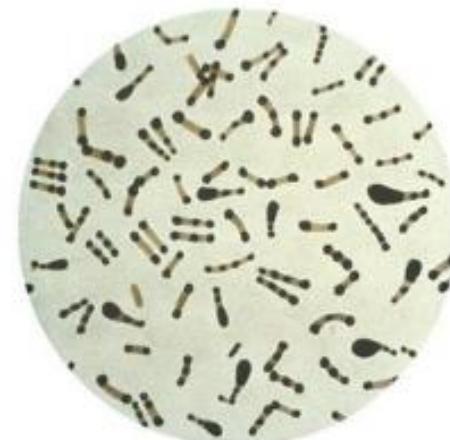
GRANULES

- They are often situated at the poles of the bacilli and are called **polar bodies**.
- Special stains, such as **Albert's**, **Neisser's** and **Ponder's** have been devised for demonstrating the granules clearly.

Neisser's technique



Albert stain



CULTURAL CHARACTERISTICS

- Growth on enriched media (Fastidious) scanty- a gray **pin point** to small colonies.
- Enrichment with blood, serum or egg is necessary for good growth.
- Optimum temperature for growth is 37°C
- Optimum pH is 7.2.
- Aerobe and facultative anaerobe.
- Some of them are beta hemolytic while renale groups are non-haemolytic

- Diptheroids are readily destroyed by heat, 60°C for one hour.
- They are highly susceptible to disinfectants.
- It is more resistant to the action of light, desiccation and freezing.
- *Corynebacterium equi* is resistant to 2.5% oxalic acid for one hour.



- *Corynebacterium bovis* is a lipophilic bacterium which produces small, white, dry, non-haemolytic colonies in the well of plates inoculated with a bovine milk sample.
- *Corynebacteriurn kutscheri* produces whitish colonies. Occasional isolates are haemolytic.
- *Corynebacteriurn pseudotuberculosis* has small, whitish colonies surrounded by a narrow zone of complete haemolysis, which may not be evident for up to 72 hours. After several days, the colonies become dry, crumbly and cream-coloured

- Members of the *C. renale* group produce small non-haemolytic colonies after incubation for 24 hours. Pigment production after incubation for 48 hours is one of the differentiating features of the three species in the group

Table 10.2 Differentiation of bacteria in the *Corynebacterium renale* group.

Feature	<i>C. renale</i> (type I)	<i>C. pilosum</i> (type II)	<i>C. cystitidis</i> (type III)
Colour of colony	Pale yellow	Yellow	White
Growth in broth at pH 5.4	+	-	-
Nitrate reduction	-	+	-
Acid from xylose	-	-	+
Acid from starch	-	+	+
Casein digestion	+	-	-
Hydrolysis of Tween 80	-	-	+

Enhancement of haemolysis test

- The haemolysis produced by *C. pseudotuberculosis* is enhanced when the organisms are inoculated across a streak of *Rhodococcus equi*

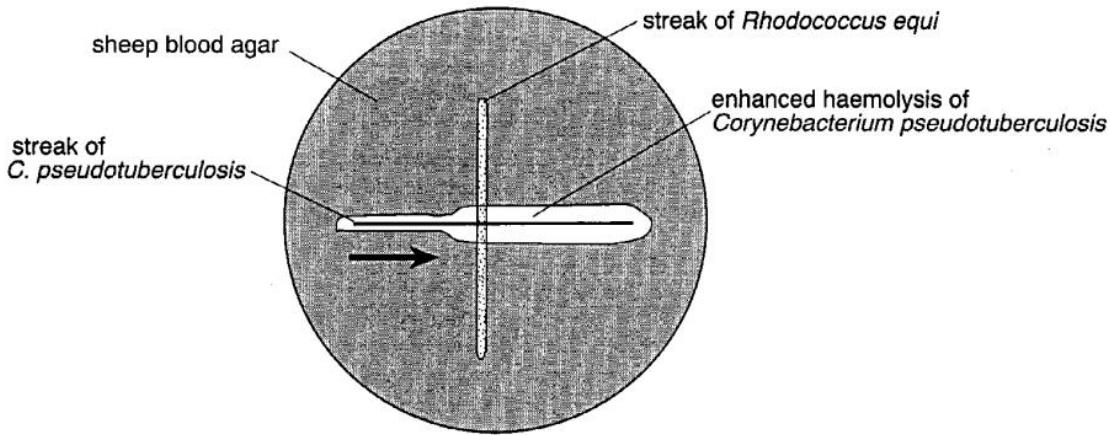


Figure 10.2 Enhancement of haemolysis test for *Corynebacterium pseudotuberculosis*. When a streak of *C. pseudotuberculosis* is drawn at right angles (arrow) across a streak of *Rhodococcus equi*, enhancement of haemolysis occurs.

BIOCHEMICAL PROPERTIES

- Catalase-positive
- Oxidase negative
- Except *Corynebacterium bovis* others are urease positive.
- Renale group is very strong urease positive (less than one hour).
- All diphtheroids ferment sugar except *Rhodococcus equi*.
- *Corynebacterium bovis* and *Corynebacterium renale* ferment both glucose and maltose.
- Two biotypes of *Corynebacterium ovis* are recognized.
- Ovine/Caprine strains lack nitrate-reducing capacity, while the equine/bovine strains usually reduce nitrate.

CORYNEBACTERIUM OF VETERINARY IMPORTANCE

- *Corynebacterium pseudotuberculosis*
(*Corynebacterium ovis* or Preisz Nocard Bacillus)
- *Corynebacterium kutscheri*
- *Corynebacterium renale*
- *Corynebacterium cystitidis*
- *Corynebacterium pilosum*
- *Corynebacterium bovis*
- *Arcanobacterium pyogenes* (*C. Pyogenes*)
- *Rhodococcus equi* (*Corynebacterium equi*)



IMPORTANT ANIMAL DISEASES

Table 10.1 The pathogenic corynebacteria, their hosts, usual habitats and the disease conditions which they produce.

Pathogen	Host	Disease condition	Usual habitat
<i>Corynebacterium bovis</i>	Cattle	Subclinical mastitis	Teat cistern
<i>C. kutscheri</i>	Laboratory rodents	Superficial abscesses, caseopurulent foci in liver, lungs and lymph nodes	Mucous membranes, environment
<i>C. pseudotuberculosis</i>			
Non-nitrate-reducing biotype	Sheep, goats	Caseous lymphadenitis	Skin, mucous membranes, environment
Nitrate-reducing biotype	Horses, cattle	Ulcerative lymphangitis, abscesses	Environment
<i>C. renale</i> group			
<i>C. renale</i> (type I)	Cattle	Cystitis, pyelonephritis	Lower urogenital tracts of cows and bulls
	Sheep and goats	Ulcerative (enzootic) balanoposthitis	Prepuce
<i>C. pilosum</i> (type II)	Cattle	Cystitis, pyelonephritis	Bovine urogenital tract
<i>C. cystitidis</i> (type III)	Cattle	Severe cystitis, rarely pyelonephritis	Bovine urogenital tract
<i>C. ulcerans</i>	Cattle	Mastitis	Human pharyngeal mucosa

IMPORTANT ANIMAL DISEASES

- Bovine pyelonephritis, ureteritis and cystitis is caused by *C. renale* group, previously designated as type I, II, and III. They have been (*C. renale Group*) classified into three species on the basis of their distinct pili and biochemical properties.
 1. *C. renale* Mostly affects cows and causes chronic cystitis, pyelonephritis (Important).
 2. *C. pilosum* <4% and rare cause of pyelonephritis in cows and causes the mildest form of cystitis.
 3. *C. cystitis*. 90% of the bulls are carriers. It can cause severe hemorrhagic cystitis in cows that may lead to chronic pyelonephritis. Transmitted by the bull to the susceptible cow during coitus.



IMPORTANT ANIMAL DISEASES

- Non-nitrate reducing biotype of *Corynebacterium pseudotuberculosis* causes Caseous lymphadenitis (CLA) in sheep and goats
- Nitrate reducing biotype of *Corynebacterium pseudotuberculosis* causes Ulcerative lymphangitis in Horses & Cattle
- *Corynebacterium bovis* causes Subclinical mastitis in cattle
- *Rhodococcus equi* (*Corynebacterium equi*) cause Suppurative bronchopneumonia in foals (2-4 months) and Cervical lymphadenitis in Pigs
- *Arcanobacterium pyogenes* (*Actinomyces pyogenes*) causes *Summer mastitis* – a mixed infection with *Peptostreptococcus indolicus*

CORYNEBACTERIUM PSEUDOTUBERCULOSIS

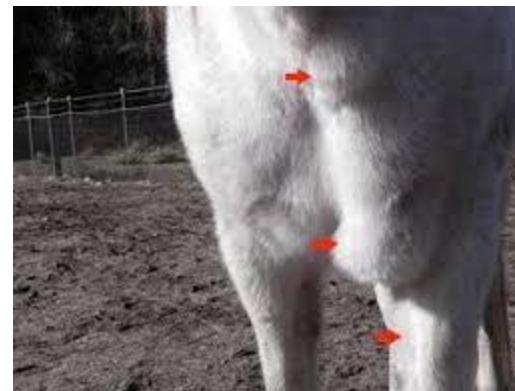
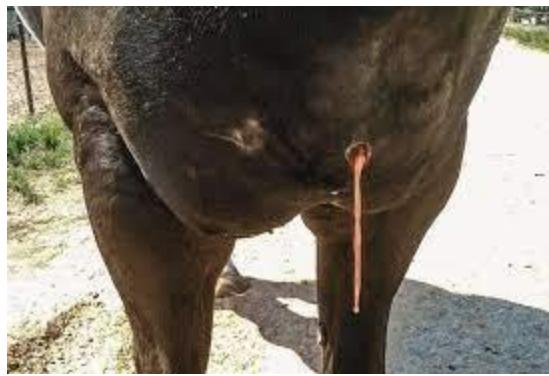
- Non-nitrate reducing biotype causes Caseous lymphadenitis (CLA) in sheep and goats
- Nitrate reducing biotype causes Ulcerative lymphangitis in Horses & Cattle
- Chronic abscessation: peripheral LN
- Thick caseous exudate, slightly greenish



Figure 1 Non-movable and solid mass at



ULCERATIVE LYMPHANGITIS/ PIGEON FEVER



ULCERATIVE BALANOPOSTHITIS

- Ulcerative (enzootic) balanoposthitis (**pizzle rot**), particularly common in Merino sheep and Angora goats, is caused by *C. Renale*
- Characterized by ulceration around the preputial orifice, with a brownish crust developing over the lesion.
- Similar lesions sometimes occur on the vulva in ewes.

