

Corynebacterium

Corynebacterium is a genus of gram positive, aerobic or facultative anaerobic, non-motile, non-sporulated, rod-shaped actinobacteria. Most do not cause disease, but are part of normal human skin flora. *Corynebacteria* are a diverse group found in a range of different ecological niches such as soil, vegetables, sewage, skin, and cheese smear. Some, such as *Corynebacterium diphtheriae*, are important pathogens while others, such as *Corynebacterium glutamicum*, are of immense industrial importance. The term diphtheroids is used to represent *Corynebacteria* that are non-pathogenic for example, excluding *Corynebacterium diphtheriae*.

Some nondiphtheria species of *Corynebacterium* produce disease in specific animal species, and some of these are also human Pathogens. Some species attack healthy hosts, and others attack immunosuppressed hosts. Some of their effects include granulomatouslymphadenities, pneumonitis, pharengitits, skin infections, andendocarditis. Endocarditis caused by *Corynebacterium* spp. is particularly seen in patients with indwelling intravascular devices.

Corynebacteria are common skin contaminants. They grow slowly, even on enriched media. The gram stain reveals irregular, rod shaped bacteria, that tend to arrange themselves in "Chinese Letter" and palisade arrangements. Metachromatic granules are usually present representing stored phosphate regions.



Gram stain of *Corynebacterium* spp. demonstrating "Chinese letters" formation

Scientific classification

Kingdo Bacteria

m:

Phylum: Actinobacteria

Order: Actinomycetales

Suborde Corynebacterinea

r: e

Family: Corynebacteriace
ae

Genus: *Corynebacterium*

Species: *Corynebacterium diphtheriae*

Corynebacterium pseudotuberculosis

Corynebacterium bovis

Corynebacterium cystitidis

Corynebacterium mastitidis

Corynebacterium renales

Corynebacterium urealyticum

Host susceptibility

- *Corynebacterium diphtheriae*: diphtheria in humans
- *Corynebacterium urealyticum*: urinary tract infections; rare but important in humans
- *Corynebacterium pseudotuberculosis*: subacute relapsing lymphadenitis and other purulent infections in sheep, goat, horse and warm blooded animals
- *Corynebacterium ulcerans*: pharyngitis
- *Corynebacterium cystitidis* causes severe haemorrhagic cystitis in cows
- *Corynebacterium camporealensis* is reported to be associated with sheep mastitis.

Corynebacterium diphtheria

History:

Corynebacterium diphtheriae is a pathogenic bacterium that causes diphtheria. It is also known as the Klebs-Löffler bacillus, because it was discovered in 1884 by German bacteriologist Edwin Klebs (1834 – 1912) and Friedrich Löffler (1852 – 1915).

Morphology & Physiology:

Small, nonmotile, irregularly staining pleomorphic Gram-positive rods with club-shaped swelled ends but no spores; may be straight or slightly curved Palisade arrangement of cells in short chains ("V" or "Y" configurations) or in clumps resembling "Chinese letters."

Cells tend to lie parallel to one another (palisades) or at acute angles (coryneforms), due to their snapping type of division. Vary greatly in dimension, from 0.3 to 1 µm in diameter and 1.0 to 8.0 µm in length. May also contain inclusion bodies, known as metachromatic granules, which are composed of inorganic polyphosphates (volutin) that serve as energy reserves and are not membrane bound. Internal metachromatic granules densely stain ruby red while the rest of the bacillus stains blue, when stained with an aniline dye such as toluidine blue O or methylene blue.

Cells appear to be banded or beaded with irregularly staining granules; may show alternate bands of stained and unstained material (giving the appearance of septa).

Aerobic or facultatively anaerobic. Fermentative metabolism (carbohydrates to lactic acid); form acid but not gas from certain carbohydrates. Fastidious and slow growth on enriched medium. Catalase positive. *Corynebacterium urealyticum* strongly urease positive

Epidemiology:

Diphtheria exists throughout the world and occasional outbreaks occur almost yearly.

The Schick test can be used to ascertain population risk. This test involves the injection of a minute amount of the diphtheria toxin under the skin. The absence of a reaction indicates immunity.

Isolation and ecology:

Diphtheria, is caused by *Corynebacterium diphtheriae*. This disease is usually contracted by exposure to aerosol droplets or through contaminated water. Humans, especially children, can die from diphtheria if the disease is not treated promptly.

Clinical syndrome:

***Corynebacterium diphtheriae*:** toxigenic strains cause diphtheria in humans in two forms

- Respiratory disease
 - Initially: sore throat, low-grade fever; followed by adherent pseudomembrane on the tonsils and pharynx
 - Later stages include localized damage, bleeding, difficulty in breathing, and myocarditis and peripheral neuritis

- Complications from systemic spread of exotoxin to other target organs in the body; eg., heart (concept of "disease at a distance")
- Most mortality from systemic toxin-mediated heart failure
- Cutaneous diphtheria (extra-respiratory disease)
 - Acquired by skin contact; organism enters through break in subcutaneous tissue
 - Chronic non-healing ulcer results
- *Corynebacterium urealyticum*: urinary tract infections (UTI's); rare but important
- *Corynebacterium pseudotuberculosis*: subacute relapsing lymphadenitis and other purulent infections in sheep, goat, horse and warm blooded animals
- *Corynebacterium ulcerans*: pharyngitis
- *Corynebacterium cystitidis* causes severe haemorrhagic cystitis in cows
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Laboratory Identification:

- Microscopy
 - Methylene blue stain shows metachromatic granules
 - Gram stain shows Gram-positive pleomorphic rods arranged in perpendicular, parallel, and palisade formations
- Culture
 - A confirmed diagnosis of diphtheria can only be made by isolating toxigenic diphtheria bacilli from the primary lesion (in the throat or elsewhere)
 - Exudate from the lesion should be inoculated onto blood agar and selective media: Cysteine-tellurite agar, serum-tellurite agar, aloeffer's slant
 - Three **varieties** of *C. diphtheriae* colonies may be recognized: gravis, intermedius, and mitis colonial morphology:

1. var. *gravis*: large, flat, rough, dark-gray colonies; not

hemolytic; very few small metachromatic granules; form a pellicle in broth

2. var. *mitis*: smooth, convex, black, shiny, entire colonies; hemolytic; prominent metachromatic granules; diffuse turbidity in broth
3. var. *intermedius*: dwarf, flat, umbilicate colony with a black center and slightly crenated periphery; not hemolytic; fine granular deposit in broth

● *C. diphtheriae* (also *Staphylococcus*) produces gray to black colonies on the tellurite media because the tellurite is reduced intracellularly to tellurium

- Any colonies which appear on the three media should be stained with toluidine blue O or
- Methylene blue

● Any typical *Corynebacterium* colonies would be subcultured on a Loeffler's slant, and tested for toxigenicity, either by the guinea pig virulence test or by the in vitro gel diffusion method of Elek

● Diphtheroids may be distinguished from *C. diphtheriae* by means of CAT sugar fermentation reactions and tests for toxigenicity

● *In vivo* test:

● Schick test

● Guinea pig virulence test

● *In vitro* test: Elek test (immunodiffusion)

Treatment, Prevention & Control:

● Antitoxin

● Used for neutralizing exotoxin

● Effective in conjunction with antibiotic therapy

● Toxoid

● Toxoid preparations are used for vaccines as active immunization for diphtheria

● Usually given in conjunction with pertussis and tetanus vaccines (DPT vaccine) or as a booster with tetanus (TD)

● Antibiotics

● Penicillin G

● Erythromycin if allergic

References

1. From Wikipedia, the free encyclopedia .
2. Hirsh, Dwight C.(1999): Veterinary Microbiology, Blackwell Science, Inc.
3. Sarma, D.K. (2008): A Text Book of Veterinary Bacteriology and bacterial Diseases.