Anbar University

Science College

Biotechnology Department

Aerobic Non–Spore-Forming Gram-Positive Bacilli

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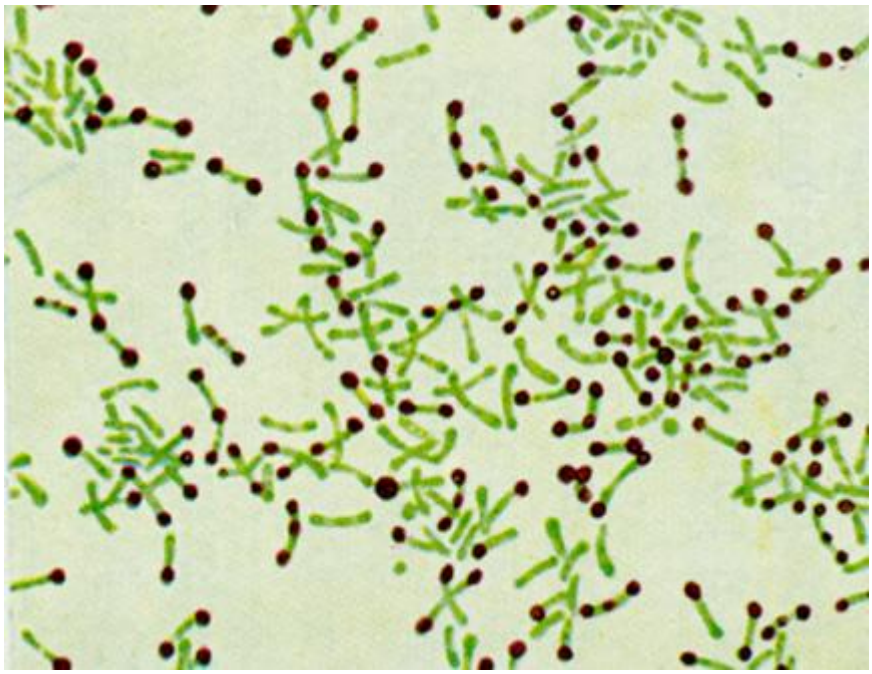
Textbook of Diagnostic Microbiology (Mahon, Textbook of Diagnostic Microbiology), Connie R. Mahon MS, Donald C. Lehman EdD MLS(ASCP)cm SM(NRCM), George Manuselis Jr. MA MT(ASCP)

Jawetz Melnick & Adelbergs Medical Microbiology, Stefan Riedel (Author), Stephen Morse (Author), Timothy Mietzner (Author), Steve Miller.

Mims' Medical Microbiology and Immunology, International Edition, Goering.

Aerobic Non–Spore-Forming Gram-Positive Bacilli:

The non–spore-forming gram-positive bacilli are a diverse group of aerobic and anaerobic bacteria. *Corynebacterium* species and related bacteria tend to be clubbed or irregularly shaped.



Corynebacterium diphtheriae

Corynebacterium diphtheriae is the bacterium that causes the disease diphtheria. *Corynebacterium diphtheriae* is a rod-shaped, Gram positive, non-spore-forming, and non-motile bacterium.

Characteristically, they possess irregular swellings at one end that give them the “club-shaped” appearance. Irregularly distributed within the rod (often near the poles) are granules staining deeply with aniline dyes (metachromatic granules) that give the rod a beaded appearance.

Pathogenicity

The pathogenicity of *Corynebacterium diphtheriae* includes two distinct phenomena:

1. **Invasion** of the local tissues of the throat, which requires colonization and subsequent bacterial proliferation. The bacteria produce several types of pili. The diphtheria toxin, as well, may be involved in colonization of the throat.

2. **Toxigenesis**: The diphtheria toxin causes the death eukaryotic cells and tissues by inhibition protein synthesis in the cells.

Toxigenicity

Two factors have great influence on the ability of *C. diphtheriae* to produce the diphtheria toxin:

1-presence of a lysogenic prophage in the bacterial chromosome.

2- low extracellular concentrations of iron. High yields of toxin are synthesized only by lysogenic bacteria under conditions of iron deficiency.

Pathogenesis

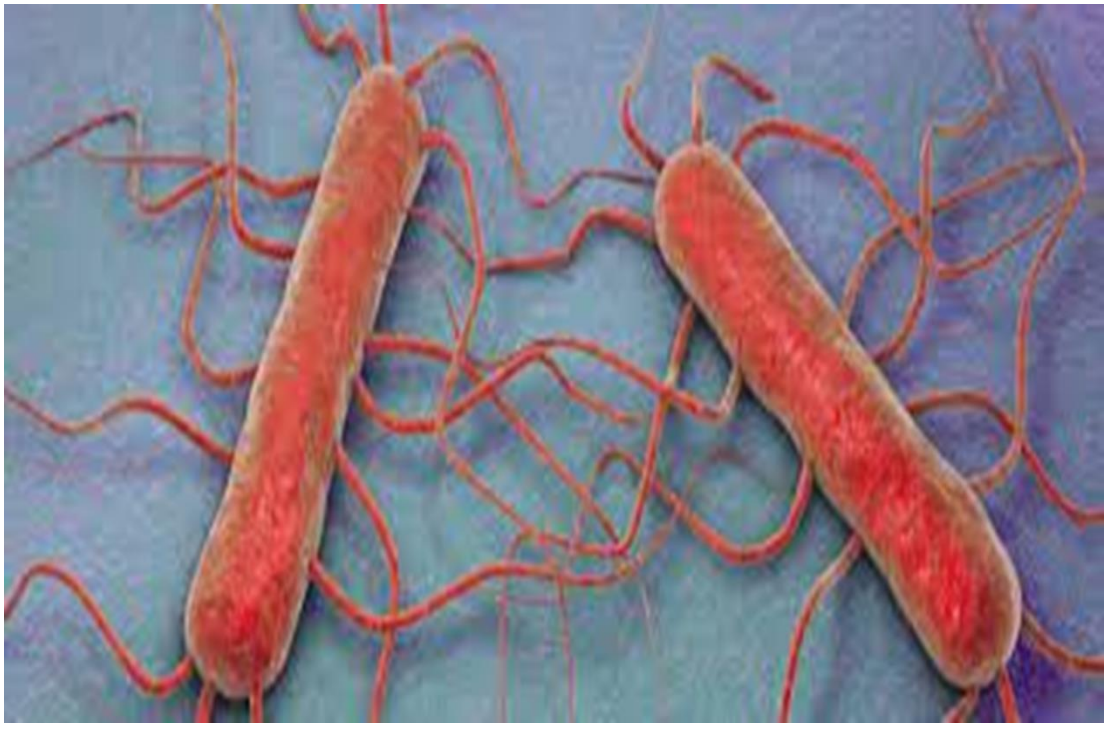
In areas where diphtheria is endemic, *C. diphtheriae* in the nasopharyngeal passageways is common. The exotoxin of *C. diphtheriae* is absorbed in the blood which in turn kills heart, kidney, and nerve cells by blocking protein synthesis. Toxigenic strains in susceptible individuals can cause disease by multiplying and secreting diphtheria toxin into either skin or nasopharyngeal lesions. The diphtheritic lesion is often covered by a

pseudomembrane composed of fibrin, bacteria, and inflammatory cells.

Diphtheria toxin

Diphtheria toxin is a heat-labile, single-chain. Diphtheria toxin can be proteolytically cleaved into two fragments: an N-terminal fragment A (catalytic domain), and fragment B (transmembrane and receptor binding domain). Fragment A catalyzes the NAD+ -dependent ADP-ribosylation of elongation factor 2, thereby inhibiting protein synthesis in eukaryotic cells. Fragment B binds to the cell surface receptor and facilitates the delivery of fragment A to the cytosol.

Listeria monocytogenes



L. monocytogenes is a short, gram-positive, non–spore-forming rod. It is catalase positive and has a tumbling end-over-end motility at 22–28°C but

not at 37°C; the motility test rapidly differentiates Listeria from diphtheroids that are members of the normal microbiota of the skin.

There are several species in the genus Listeria. Of these, *L. monocytogenes* is important as a cause of a wide spectrum of disease in animals and humans. *L. monocytogenes* is capable of growing and surviving over a wide range of environmental conditions.

Pathogenesis:

L. monocytogenes enters the body through the gastrointestinal tract after ingestion of contaminated foods such as cheese, fruit, or vegetables. The organism has several adhesion proteins (Ami, Fbp A, and flagellin proteins) that facilitate bacterial binding to the host cells and that contribute to virulence. It has cell wall surface proteins called internalins A and B that interact with epithelial cells, promoting phagocytosis into the epithelial cells. After phagocytosis, the bacterium is enclosed in a phagolysosome, the bacterium will produce listeriolysin O. This enzyme, along with two phospholipases, lyses the membrane of the phagolysosome and allows the listeriae to escape into the cytoplasm of the epithelial cell. The listeriae are released, and the cycle begins again.