

# Morphology and Pathological Characteristics of Mycobacteria

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## DESCRIPTION

### Basic microbiological characteristics of mycobacteria

Mycobacteria is the only genus in the Mycobacteriaceae family and a member of the Actinomycetales order. The genus *Mycobacterium* currently contains over 100 recognized species, including numerous pathogens and saprophytic organisms of warm-blooded animals. This genus is distinguished by its acid-fastness and the presence of mycolic acids. Mycobacteria are rod-shaped, non-spore-forming bacteria that live in soil and water. These are abundant in nature and have been isolated from wet soil, mud, compost, grasses, vegetables, raw milk, and butter, where they could easily gain access to drinking water. Because these bacteria have a 20-hour generation time, isolation and identification could take up to 6 weeks (although a few species may grow in only 5-7 days). These bacteria are acid-alcohol fast, which means they can be decolorized after staining with acidified alcohol as well as strong mineral acids. The acid-fastness of waxy materials in cell walls is critical for identifying mycobacteria. Because other Gram-positive bacteria (such as *Neisseria*, *Corynebacterium*, and *Rhodococcus*) are frequently partially acid-fast, staining procedures must be followed carefully. Certain mycobacteria, including *Mycobacterium tuberculosis*, have the ability to shed their cell walls, resulting in spheroplasts that are undetectable by the acid-fast stain test.

Mycobacteria are non-motile, Gram-positive, catalase-positive rod-shaped bacteria that do not form spores (0.2  $\mu$ -0.6  $\mu$  wide and 1.0  $\mu$ -10  $\mu$  long). The morphology of Mycobacteria colonies varies, with some species growing as rough or smooth colonies. The majority of mycobacteria are aerobic, despite the fact that some are microaerophilic. Mycobacteria are divided into two groups based on their rate of growth. Rapid growers frequently form visible colonies on solid media in seven days or less, whereas slow growers, such as MAC, take longer.

### Pathologic characteristics of the mycobacteria genus

The majority of the 140 *Mycobacterium* species are saprophytes that live as environmental opportunistic pathogens in soil and

water. NTM is commonly found in natural water, drinking water distribution systems, soils, and dust. *Mycobacterium tuberculosis*, *Mycobacterium africanum*, *Mycobacterium bovis*, *Mycobacterium bovis*, *Mycobacterium microti*, *Mycobacterium caprae*, and *Mycobacterium pinnipedii* are all members of the *Mycobacterium tuberculosis* complex. The most important clinical species is *Mycobacterium tuberculosis*, which causes tuberculosis in humans. Tuberculosis (TB) is caused by these organisms, which cause tuberculosis and caseous necrosis in tissues. Tuberculosis is the source of tubercle bacilli. Tuberculosis is caused by *Mycobacterium bovis* in both cattle and humans, whereas *Mycobacterium africanum* is a rare cause of human tuberculosis in central Africa.

Humans spread *Mycobacterium tuberculosis*; Cattle, bison, and deer spread *Mycobacterium bovis*, while chickens spread *Mycobacterium avium*. Wild mammals and birds can be infected by *Mycobacterium tuberculosis*, *Mycobacterium bovis*, and *Mycobacterium avium*, and these animals can occasionally become sources of infection for domestic animals.

While the phenotypes of these pathogenic species differ, they are genetically very similar and are frequently grouped together as the *Mycobacterium tuberculosis* complex. Other pathogenic mycobacteria include *Mycobacterium Avium* Complex (MAC) and Non-Tuberculous Mycobacteria (NTM, atypical mycobacteria, or environmental mycobacteria). Both of these groups of pathogens are common opportunistic pathogens, especially in immunocompromised people. Given the recent discovery of spore formation in a number of mycobacteria, including NTM, aerosols are the most common mode of transmission. One of the reasons that many NTM survive in the environment as well as in or on patients for extended periods of time is spore formation, which facilitates skin and pulmonary infection.

The genus *Mycobacterium* contains both pathogenic acid-fast bacteria and numerous saprophytes. Saprophytes must be distinguished from organisms that spread infectious or contagious disease. Saprophytes are opportunists because they cause disease in certain circumstances. Some saprophytic mycobacteria cause infection when they come into contact with wounds in humans or animals on immunosuppressive therapy.

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