

Lecturer 20: Francisella

Francisella is a genus of pathogenic, Gram-negative bacteria. They are small coccobacillary or rod-shaped, nonmotile organisms, which are also facultative intracellular parasites of macrophages. Strict aerobes, *Francisella* colonies bear a morphological resemblance to those of the genus *Brucella*. The genus was named in honor of American bacteriologist Edward Francis, who, in 1922, first recognized *F. tularensis* (then named *Bacterium tularensis*) as the causative agent of tularemia.

Kingdom:	Bacteria
Phylum:	Proteobacteria
Class:	Gammaproteobacteria
Order:	Thiotrichales
Family:	Francisellaceae
Genus:	<i>Francisella</i>

Pathogenesis

The type species, *F. tularensis*, causes the disease tularemia or rabbit fever. They are associated with septicemia and invasive systemic infections.

Laboratory characteristics

Francisella species can survive for several weeks in the environment; paradoxically, they can be difficult to culture and maintain in the laboratory. Growth is slow (though increased by CO₂ supplementation) and the organisms are fastidious, with most *Francisella* strains requiring cystine and cysteine media supplementation for growth. Growth has been successful on several media types, including chocolate agar and Thayer-Martin medium with appropriate additives as noted above. After 24 hours of incubation on appropriate solid

media, *Francisella* colonies are generally small (1 to 2 mm), opaque, and white-gray to bluish-gray in color. Colonies are smooth, with clean edges and, after a 48 hours of growth, tend to have a shiny surface.

Treatment

streptomycin, gentamicin, doxycycline, and ciprofloxacin

Nocardia

Nocardia is a genus of weakly staining Gram-positive, catalase-positive, rod-shaped bacteria. It forms partially acid-fast beaded branching filaments (acting as fungi, but being truly bacteria). It contains a total of 85 species. Some species are nonpathogenic, while others are responsible for nocardiosis. *Nocardia* species are found worldwide in soil rich in organic matter. In addition, they are oral microflora found in healthy gingiva, as well as periodontal pockets. The genus was named for Edmond Nocard, a 19th-century veterinarian and biologist.

Kingdom: Bacteria

Phylum: Actinobacteria

Class: Actinobacteria

Order: Actinomycetales

Suborder: Corynebacterineae

Family: Nocardiaceae

Genus: *Nocardia*

Culture and staining

Nocardia colonies have a variable appearance, but most species appear to have aerial hyphae when viewed with a dissecting microscope,. *Nocardia* grow slowly on nonselective culture media, and are strict aerobes with the ability to grow in a wide temperature range. They are catalase positive and can grow easily on the most commonly used media with colonies becoming evident in 3–5 days. However, prolonged incubation periods (2–3 weeks) are sometimes needed.

Virulence

Nocardial virulence factors are the enzymes catalase and superoxide dismutase *Nocardia asteroides* is most frequently found species infecting humans, patients. The most common form of human nocardial disease is a slowly progressive pneumonia, the common symptoms of which include cough, dyspnea (shortness of breath), and fever. *Nocardia* isolation from biological specimens can be performed using an agar medium enriched with yeast extract and activated charcoal(BCYE), the same used for *Legionella* species. Selective media for mycobacteria or fungi can also be inoculated.

Treatment

Antibiotic therapy with a sulfonamide, most commonly trimethoprim-sulfamethoxazole, is the treatment of choice. People who take trimethoprim-sulfamethoxazole .

Mycoplasma

Mycoplasma is a genus of bacteria that lack a cell wall around their cell membrane. Without a cell wall, they are unaffected by many common antibiotics such as penicillin or other beta-lactam antibiotics that target cell wall synthesis. They can be parasitic or saprotrophic. Several species are pathogenic in humans, including *M. pneumoniae*, which is an important cause of atypical pneumonia and other respiratory disorders, and *M. genitalium*, which is believed to be involved in pelvic inflammatory diseases. *Mycoplasma* species are the smallest bacterial cells yet discovered, can survive without oxygen, and come in various shapes

Scientific classification

Domain: Bacteria

Phylum: Tenericutes

Class: Mollicutes

Order: Mycoplasmatales

Family: Mycoplasmataceae

Genus: *Mycoplasma*

Pathophysiology

Mycoplasma species have been isolated from women with bacterial vaginosis. *M. genitalium* is found in women with pelvic inflammatory disease. *Mycoplasma genitalium* has developed resistance to some antibiotics.

Laboratory contaminant

Mycoplasma species are often found in research laboratories as contaminants in cell culture. Mycoplasmal cell culture contamination occurs due to contamination from individuals or contaminated cell culture medium ingredients. *Mycoplasma* cells are physically small – less than 1 μm , so are difficult to detect with a conventional microscope.

Mycoplasmae may induce cellular changes, including chromosome aberrations, changes in metabolism and cell growth. Severe *Mycoplasma* infections may destroy a cell line Sexually transmitted infections, Infertility, Infant mortality

Mycoplasma infection and host cell transformation

The presence of *Mycoplasma* was first reported in samples of cancer tissue in the 1960s.^[26] Since then, several studies tried to find and prove the connection between *Mycoplasma* and cancer, as well as how the bacterium might be involved in the formation of cancer. Several studies have shown that cells that are chronically infected with the bacteria go through a multistep transformation. The changes caused by chronic mycoplasmal infections occur gradually and are both morphological and genetic. The first visual sign of infection is when the cells gradually shift from their normal form to sickle-shaped. They also become hyperchromatic due to an increase of DNA in the nucleus of the cells. In later stages, the cells lose the need for a solid support to grow and proliferate, as well as the normal contact-dependent inhibition cells.

Types of cancer associated with *Mycoplasma*

Colon cancer, Gastric cancer, Lung cancer, Prostate cancer, Renal cancer

Treatment

Antibiotics such as erythromycin, clarithromycin or azithromycin are effective treatment. However, because mycoplasma infection usually resolves on its own, antibiotic treatment of mild symptoms is not always necessary.