

## A Brief review on Ecology and Evolution of Mycobacteria

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### DESCRIPTION

Tuberculosis, a grand old disease, maintains even today, its rank as one among the top burdened diseases in the world, whether infectious or non-infectious. Others are Malaria, HIV, HBV, HCV, Leprosy, Diabetes, Hypertension, Cancer, Arboviral diseases etc. Mycobacteria are basically environmental saprophytes and their pathogenic capabilities were selected by environmental challenges. They were thoroughly studied from sources like soil, animals, human beings, marshland, water, vegetation etc. Distribution of saprophytic Mycobacteria is dependent on environmental conditions including soil pH. Although rarely causing overt infection, these environmental organisms are able to elicit an immune response in man, as it certainly modifies the host response to the subsequent contact with pathogenic mycobacteria and also influences the protective effect of BCG. Except *Mycobacterium tuberculosis* and *Mycobacterium leprae* all other species of Mycobacteria are environmental saprophytes. *Mycobacterium tuberculosis* is unique in being obligate pathogen contains no environmental saprophytic strains. Though Infectivity and pathogenicity have developed in this species a long time ago in the history of life on earth after which marked fluctuations in the earth's climate could have eliminated the environmental strains. Gutierrez and her colleagues concluded that an early progenitor of *M. tuberculosis* was present in East Africa as early as 3 million years ago, and they suggested that it might have infected early hominids at that time. According to a study, modern strains of *M. tuberculosis* have originated from a common ancestor about 20,000-15,000 years ago. Tuberculosis in Egypt was documented more than 5000 years ago. Typical skeletal abnormalities of tuberculosis, including characteristic Pott's deformities, were identified in Egyptian mummies and were clearly depicted in the

early Egyptian art. It is interesting to note that how the environmental Mycobacterial species have shifted from environment to take up an existence as an obligate pathogen. Evolution is defined as the adaptation of an organism to a new or changing environment. Evolution is therefore a dynamic process which generates diversity during the process of adaptation. For example, resistance to environmental toxins might also confer protection from the killing effects of antibiotics and host immune cells. Alternatively, the bacteria may routinely encounter and defend themselves against the phagocytic cells of animal hosts. These variations occurred due to mutations, which lead to loss of various properties. Generally the process of random mutation is known to cause many more deletions than acquisitions of new features. Most of the environmental Mycobacteria are genetically complete forms and certain type of deletional mutations render the strains difficult to survive in the environment and more adaptable to parasitize a man when there is an opportunity. Fortunately a very few saprophytic Mycobacteria are established as human pathogens. Virulence tends to increase as the bacterial strains adapt to the new environment. According to Darwinian Theory, development of virulence is a random event due to genetic variations. In this process, due to numerous deletional mutations, most of them lose the ecological battle for survival and disappear from the environment. This is due to the fact that *M.tuberculosis* is a strict mesophile, which has a narrow temperature range in which it will grow. Various genetic events involving deletion mutations over several years have resulted in the development of virulent strains of *M.tuberculosis* from a non-virulent progenitor.

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