The dilemma of the *Mycobacterium avium* subspecies paratuberculosis infection: In pursue for effective vaccine

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*Mycobacterium avium* subspecies *paratuberculosis* (MAP) causes Johne's disease in domestic and wild ruminant like, cattle, sheep, goats, deer, antelope and bison worldwide. In Saudi Arabia, Johne's disease was reported in sheep, goat, dairy cattle, and camel. Long incubation period is the main characteristic feature of MAP infection. Ingestion of fecal material, milk, or colostrum is the main route of infection. The major symptoms of infection are chronic diarrhea, emaciation, decrease milk production, and infertility. The annual economical losses that John's disease causes to the American dairy industry were estimated over $200 million. It is becoming clearly evident that MAP has important role in the pathogenesis of Crohn's disease. These accumulated evidence definitely exert public health concern about consumption of the dairy and meat products. The host adaptive immune response to MAP infection is somewhat paradoxical. Despite the overwhelming research on the pathogenesis of MAP infection, the detailed mechanism by which MAP maintains its persistence and mediates the immunosuppressive status of the host is still daunting. It was noticed that the multitude of the immune responses to the MAP infection are of steady state progression. The MAP maintains the host immune responses through the regulation of overwhelming numbers of genes in wide range of pathways to secure its survival without the full impairment of the immune system. Control of John's disease is hampered by the incompetent diagnostic tests. Different versions of ELISA and molecular based techniques were introduced in the last decades to overcome the impediments of detecting the subclinical MAP infection. Nevertheless, the newly advanced techniques remained insensitive enough. The current available vaccines to control the Johne's disease suffer from major set backs in preventing the infection. The current live and killed vaccines appeared incapable of preventing the infection, though they reduce its severity and decrease the bacterial shedding. In addition, vaccination causes major interference with the bovine tuberculosis screening program due to the cross reaction of the tuberculosis skin test antigen with the MAP immune responses. Furthermore, the conventional vaccines have shown to create major diagnostic difficulties in differentiating the infected from the vaccinated animals. Hence, the current research strategies have taken in consideration all of the above concerns for developing new effective MAP vaccines. Lately, several new subunit MAP vaccines were developed that were characterized with the DIVA properties and antigens that induce potent CD4+ and CD8+ responses without interference with the bovine tuberculosis screening test. For instance oral vaccine was developed using *Listeria monocytogenes* as platform to deliver the MAP DNA antigens. Another important subunit MAP vaccine consisted of poly MAP antigens that are produced at different stages of the bacterial infection. The multi-stage subunit vaccine comprise of four early expressed MAP antigens, which are combined with the proteins that are expressed at the late stage of the infection. The most important immunological responses induced by the newly developed vaccines and their efficacy in providing durable protection will be discussed in this overview.

**Biography**
Ahmed M Alluwaimi completed MSc from Cornell University, USA in 1986 in field of Immunology and PhD from University of Birmingham, UK in 1994 in Immunology. He completed Postdoctoral studies at University of California, Davis working on the role of cytokines in mastitis. Currently, he is a Professor of Immunology at College of Veterinary Medicine, King Faisal University, Saudi Arabia. He is the Director of the Saudi Veterinary Medical Society.

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