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Tuberculosis

WebMD: Tuberculosis is a contagious infection that usually attacks the lungs, but can also spread to other parts of the body such as the brain and spine. The bacteria *Mycobacterium tuberculosis* causes TB. It is spread through aerosol droplets released through coughing, sneezing, or speaking.
**Mycobacterium tuberculosis complex**

- Mycobacterium tuberculosis complex has many members. They are categorized separately based on what animal/s they infect, phenotype- such as growth and motility properties, and pathogenicity- their ability to cause disease.

- The focus of my work is on *Mycobacterium bovis* (or *Mycobacterium tuberculosis variant bovis*).
Mycobacterium bovis

• Bovine TB is a zoonotic infection of cattle caused by *M. bovis*. It can be shed not only in respiratory secretions, but through feces, milk, urine, or vaginal secretions and semen.

• Although bovine TB is limited to 0.01% of dairy herds in the U.S., it is highly prevalent worldwide, with the majority affecting third-world countries.

• Bovine TB does not only affect cattle, but can be found in many spillover species such as sheep, goats, horses, pigs, dogs, cats, ferrets, camels, llamas, deer (especially here in MI), elk, elephants, rhinos, foxes, coyotes, mink, primates, opossums, otters, seals, sea lions, hares, raccoons, bears, warthogs, large cats, several rodent species, and humans. Most mammals may be susceptible.
Detection

• The caudal fold (bovine tuberculin) skin test is the preliminary screening test for cattle. Tuberculin is injected intradermally; a positive test is a delay in swelling. (Much like human TB tests.)

• Additional tests include gamma-interferon assay that measures cellular immunity and ELISAs (enzyme-linked immunosorbent assay) that measure antibody titers to *M. bovis*.

• For elephants, tests include a trunk wash (similar to that of a human sputum sample) that is submitted for culture, MAPIA (multi-antigen print immunoassay) and ElephantTB-Stat-Pak Assay which both detect the hosts antibodies to the bacteria. DPP (Dual Path Platform) is a field test much like MAPIA.
Downfalls

• There are multiple reasons these tests are not completely reliable. In the case of elephants, the trunk wash does not enter deep enough in the respiratory tract, MAPIA and Stat-Pak rely only on the host’s response to the infection. Elephants do not start developing detectable levels of antibodies to this disease until 6 months to a year after exposure.

• The false negatives of the only available testing of MAPIA and Stat-Pak allow the perpetuation of *M. Bovis* in our captive herds by allowing more time and opportunity for shedding of the bacteria.

• In the case of cattle and those animals not protected due to their endangered species status, they are culled. Elephants and other endangered species are instead treated in the same manner as humans, through a series of medications over many months. The more progressed the disease, the less likely a full recovery.
My project, my lab

- Over the past 15 years, my lab has identified 3 *M. bovis* peptides that circulate in the infected host’s blood at higher concentrations than the other bacterial peptides.
- They have validated these pathogen-specific “biomarkers” in goats, deer, primates, and cattle.
- The detection of these peptides leads to an earlier and more specific diagnosis of *M. bovis* in relation to other complex members and does not rely on the hosts ability to respond to the antigens.
- My labs’ goal is to develop a bTB-specific field diagnostic tool using these biomarkers that works in any environment.
- My project involves 26 Asian Elephant Serum samples (2006) and validating our biomarkers in their serum.