Brucellosis History Summary

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Brucellosis is a sexually transmissible as well as contact-transmitted infection of livestock that can have adverse effects on the fetus and newborn. It occasionally transmits to humans in roles of animal handlers, raw milk consumers, and packing plant workers. In humans, the disease is infectious with long term chronic but distressing febrile episodes rarely fatal with modern clinical management; treatment remains in the domain of infectious disease physicians and should not be attempted by family doctors. The causative organism is *Brucella melitensis* [from sheep/goats], *Brucella bovis* [from cattle], *Brucella suis* [from swine] and *Brucella canis* [from dogs].

Historically, the disease was recognized in the Mediterranean region, particularly in goats and sheep, dating back to antiquity. Brucellosis-type illnesses were recognized by Hippocrates in his *Epidemics* writings; the Apostle Paul is considered to have been infected following his being shipwrecked on the Island of Malta and suffered from a recurrent illness or "thorn in my flesh" afterward. Britain maintained a military base on this island during the 18th and 19th centuries. During this period, several British physicians provided vivid descriptions of illness in garrisoned troops and physician David Bruce was dispatched to investigate; he isolated the causative organism from four fatal cases in 1887 and named it *Micrococcus melitensis*. A Greek physician working with Bruce, Themistokles Zammit, demonstrated in 1905 that the Maltese goat – often with no clinical signs of illness – carried the organism and served as the source of infection through consumption of unpasteurized milk by military personnel. Goat's milk was banned and the troubling episode ended in 1906.

Concomitantly in 1897, Bernard Bang, a physician-veterinarian, studied a disease of cattle in Denmark referred to as "contagious abortion" and isolated an organism that he named *Bacillus abortus*. Later an American microbiologist, Alice Evans, showed in 1918 that it caused human brucellosis and was closely related both morphologically and biochemically to Bruce's organism. Karl Meyer, a veterinary scientist at the Hooper Foundation in San Francisco, proposed to group these organisms under the genus "Brucella" in honor of Dr. Bruce to settle the nomenclature issues. Alice Evans continued to develop improved techniques of recovering the organism and diagnosing the disease resulting in becoming infected herself in 1925 incidental to laboratory exposure. During this period "Bang's Disease" became the standard term for livestock; human disease was also termed Bang's as well as "Malta or Undulant Fever" for many years.

With brucellosis now recognized and amenable to laboratory diagnosis, the USDA's Bureau of Animal Industry in the 1920-40 period standardized procedures of management and conducted research on an effective vaccine that remained elusive, especially killed bacterins. Through a

serendipitous sequence of events, Dr. John M. Buck, of the Bureau had maintained a group of brucellosis cultures for "well over a year" on his desk at room temperature and decided to evaluate them for immunogenicity and stability. It was determined that the 19th culture evaluated was significantly less pathogenic and remained stable through numerous transmissions in testing protocols. This became the optimal vaccine strain, first licensed in 1941 as a live attenuated "Strain 19 vaccine", and used for decades to eliminate the infection from U.S. cattle in calf-hood vaccination programs. Of side interest, the source cow for Strain 19 was a registered Jersey named 'Matilda' that after having three calves, did not abort but could not be bred again, and was infected as evidenced by serological testing plus Dr. Buck's recovery of the organism from her milk.

After WW II, more funds were appropriated for research and expanded programs to test cattle and conduct surveillance. Human disease, while reduced from these efforts along with expanded pasteurization of milk, continued to occur primarily among herdsmen, veterinarians, and packing plant workers. Finally, almost all cases were primarily in abattoir workers involved in swine slaughter with airborne transmission a risk factor. A final push to eliminate *B. suis* from swine ensued and human cases were finally eliminated by 1985. Currently, human brucellosis is diagnosed almost exclusively in immigrants and persons traveling overseas who consume raw dairy produce; U.S. case counts are reduced to about 150 annually.

In summary, while brucellosis was eliminated in humans after widespread pasteurization of milk, it remained for eradication of livestock reservoirs to assure elimination of all human risk. As such it is a "legacy zoonosis" that helped shape the role of One Health – interdisciplinary efforts by human health workers, animal health staff, and environmental health personnel – to improve human well-being. It remains an awesome story of human achievement where 'chance favors the prepared mind' as duly noted by Louis Pasteur.