A STOCHASTIC MULTI-SCALE MODEL OF FRANCISELLA TULARENSIS INFECTION TO PREDICT RISK OF INFECTION IN A LABORATORY

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ABSTRACT: In this talk, I will present a multi-scale model of the within-phagocyte, within-host and population-level infection dynamics of Francisella tularensis, which extends the mechanistic one proposed by Wood et al. (2014). Our multi-scale model incorporates key aspects of the interaction between host phagocytes and extracellular bacteria, accounts for inter-phagocyte variability in the number of bacteria released upon phagocyte rupture, and allows one to compute the probability of response, and mean time until response, of an infected individual as a function of the initial infection dose. A Bayesian approach is applied to parameterize both the within-phagocyte and within-host models using infection data. Finally, we show how dose response probabilities at the individual level can be used to estimate the airborne propagation of Francisella tularensis in indoor settings (such as a microbiology laboratory) at the population level, by means of a deterministic zonal ventilation model.