

**Collaborative Research: Transmissibility of infections caused by intermittently shed pathogens capable of environmental persistence. Relating theory and empirical data**

**ABSTRACT**

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The transmission cycle of many important infectious agents includes not only the hosts but also their environments. After infection of a host with a pathogen like *Escherichia coli*, *Listeria monocytogenes*, or *Salmonella* spp, large numbers of the pathogen may be intermittently shed into the environment where they may survive, multiply, and infect new hosts. These pathogens have thus retained a combination of two traits: 1) intermittent shedding and 2) environmental persistence. The widespread occurrence of this combination of traits indicates that they optimize pathogen transmissibility, i.e., their ability to spread infection. There is a critical need to understand the evolution and ecology of the two traits, their effects on pathogen transmissibility, and their implications for the control of pathogens that carry this combination of traits. The current project will address this need by providing mechanistic insight into the tradeoff between intermittent shedding and environmental persistence traits through strategic pairing of mathematical modeling and empirical studies, using *E. coli* transmission among cattle hosts and their environment as a theoretical and empirical model system. Furthermore, the project will establish a general organizing principle for the systematic characterization of all infectious agents in terms of their aptitude for within-host replication and survival, and between-host replication and survival, all of which jointly define pathogen transmissibility.

**Broader Impacts:** The educational impact of this project arises from extensive involvement and interdisciplinary training of undergraduate and graduate students in experimental, epidemiological, molecular, microbiological and mathematical modeling efforts as part of the multidisciplinary project. The anticipated benefits of this project include the advancement of animal and public health through a better understanding of the intermittent shedding and environmental persistence traits that characterize many infectious agents.

This is a collaborative research with Dr. D. Dopfer and C. Kaspar from the University of Wisconsin-Madison.