



USGS NSF Internship Opportunity

Point of Contact Name:	Robin Russell
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USGS Center:	National Wildlife Health Center
Project Title:	Modeling plague transmission dynamics
Summary:	<p>Collaborators at the National Wildlife Health Center and University of Wisconsin Madison recently developed an oral plague vaccine and field tested the vaccine with a large scale experiment that included four species of prairie dog along a latitudinal gradient from Texas to Montana. This study provided information of prairie dog survival rates, population densities, and movement radii that can be used to inform plague transmission dynamic models. We have developed and published a non-spatial model of transmission dynamics and have recently extended the model to include spatial dynamics of the host species for a single population. We would like to extend this model further to explore hypotheses related to the transmission of plague between populations, overwinter conditions that exacerbate or ameliorate the effects of plague, changing climate conditions, and vaccination strategies.</p> <p>Plague dynamics in the western United States are complex. The disease occurs sporadically with often devastating effects on host populations and their predators. Sylvatic plague vaccines offer a potential tool for mitigating the effects of plague as well as an avenue to explore plague transmission dynamics. The development of a comprehensive plague transmission model that is parameterized with empirical data will provide us with a framework for hypothesis testing and exploring applied questions regarding the management of plague.</p>
Project Hypothesis or Objectives:	<p>Plague caused by the bacteria <i>Yersinia pestis</i> occurs sporadically in the western United States. Transmission dynamics of plague are complex, and potentially involve several pathways including direct contact between hosts, soil reservoirs, and non-host vertebrate species, such as small mammals. Hosts of plague including prairie dogs and other ground squirrel species are highly susceptible to plague and suffer up to 100% mortality when plague outbreaks occur</p>

in a population. Currently, there are many questions regarding how plague is maintained in the system between outbreaks, and understanding these mechanisms are essential for disease management and ecosystem protection. Our goal is to extend current spatially explicit plague transmission models that focus on a single season and single population, to include multiple years and multiple populations to explore hypotheses related to host-disease dynamics and disease management.

- Duration:** Up to 12 months
 - Internship Location:** Madison, WI
 - Field(s) of Study:** Life Science
 - Applicable NSF Division:** IOS Integrative Organismal Systems, DEB Environmental Biology
 - Intern Type Preference:** NSF Graduate Research Fellow (GRF) via the Graduate Research Intern Program (GRIP)
 - Keywords:** quantitative ecology, epidemiology, plague transmission, prairie dogs, disease, mathematical modeling
 - Expected Outcome:** Annotated computer code to generate simulated plague transmission dynamics. At least one manuscript, led by the student, detailing the models and an application to climate change or vaccination ecology.
 - Special skills/training Required:** Familiarity with basic disease ecology, statistical knowledge and/or experience modeling population dynamics using the R statistical program is required.
 - Duties/Responsibilities:** Candidate will work with USGS statisticians and wildlife disease specialists to extend single season, single population, spatially-explicit plague transmission models. This will entail writing computer code, some statistical estimation, and effective communication with project personnel. The results of this development will be annotated computer code to run the plague transmission models, and a manuscript detailing the models. Candidate will interact with scientists from USGS, and potentially USFWS and state agencies with an interest in managing plague. This project will provide the student experience working on an applied management project while developing modeling skills
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Internal Information - Not to be posted:

Center Director Name: Jonathan Sleeman

USGS Responsibilities: Equipment, Facilities, Mentoring, On-boarding, Background Check, Volunteer Agreement Management

Preliminary Approval: This opportunity has my Center's approval

I already have a student in mind: No

Comments: The staff of the USGS-National Wildlife Health Center include professional veterinarians, wildlife pathologists, quantitative disease ecologists, epidemiologists, microbiologists, and wildlife biologists. This group of dynamic, multi-disciplinary scientists work together daily to protect the nation's wildlife and ecosystem health.
