Statement of Interest and Commitment

My present desire to engage in disease modeling research derives naturally from the raw interests I had as a college freshman. Although I wasn't sure what my major would be or what I would end up doing after graduation, there were three things of which I was certain: I was good at math, I had a passion for the life sciences, and I wanted to pursue a career that would allow me to apply my academic talents to real world problems. Under the guidance of my faculty co-mentors, Drs. Louis Gross and Susan Riechert, those interests transformed themselves into a rigorous, self-designed major in Computational Ecology. This unique course of study emphasized coursework in ecology, evolution, mathematics, and computer science, and it gave me the opportunity to become involved in independent research as early as my freshman year. Those research experiences culminated in the publication of two manuscripts and another that is currently in preparation.

As a first-year graduate student, my research interests are considerably clearer than when I began college. I want my research to focus on mathematical models that 1) relate behavioral variation among individuals to population dynamics, 2) have a spatial component, and 3) have bearing on societal problems. One topic that satisfies these criteria is spatial population spread, which could benefit from a behavioral perspective and has relevance to environmental crises like biological invasions and geographic range shifts under climate change.

In my perusal of the literature on spatial population spread, I kept noticing parallels to models in epidemiology. This makes sense, as a pathogen spreading through a host population is conceptually analogous to an invasive species moving from one habitat patch to another. This realization sparked my interest in disease ecology and motivated me to enroll in a seminar on the subject this quarter. The seminar has been a fantastic introduction to disease ecology, in large part because of the diversity of backgrounds of its participants, which range from herpetologists to veterinarians to mathematicians. While it will leave me with a basic competence of the most general principles in this broad field of study, I very much wish to delve deeper into the mathematics of disease spread. Hence, a desire for a more formal introduction is what lead me to apply for this workshop.

With a sound background in both mathematics and biology, as well as a recently kindled fascination with disease ecology, I see no better way to facilitate my entry into this field than learning from some of its greatest minds. I also look forward to the aspect of establishing contacts with like-minded students from both the US and Africa. Although abstract modeling has its merits, I am hungry to work on a real-world system, and indeed what better a system to work on than one where so much is at stake! At this point in my academic career, I realize that my growth as a researcher will be optimized by pursuing only those opportunities which appear to have fruitful outcomes. As such, my interest in this workshop stems not only from a desire to gain training in mathematical epidemiology, but also to provide the basis for much of the research I will conduct for my dissertation and beyond.

While I only recently became acquainted with the disease ecology literature, I already see potential for several problems I could work on. Because of my interest in behavior and my training in evolutionary biology, one question that interests me is explaining why some pathogens induce host behaviors that increase transmission probability (e.g., rabies) whereas others have the opposite effect (e.g., phocine distemper virus in seals [Swinton et al. 1998. J. Anim. Ecol. 67:54-68]) and still others have no effect on host behavior. Another topic of interest has to do with the behavioral responses of individuals to conspecifics who are infectious. There

are a number of potential costs (e.g., contracting the disease) and benefits (e.g., allowing a weakened conspecific to be eaten by a predator instead of oneself) and it is my understanding that their relative importance in shaping disease dynamics is not well understood (J. Saltz & A. Sih, personal communication). It is my hope that exploring topics like these and their dynamical consequences from a mathematical perspective can increase our general understanding of how behavior, ecology, and evolution shape the transmission of infectious diseases.

In summary, this workshop promises to be a pivotal experience in my scientific training and is what I hope will be the beginning of my engagement in a sustained program of research centered on an important problem with societal implications.

Curriculum Vitae

EDUCATION

University of California, Davis, CA. 2006-present. Ph.D. in Population Biology. GPA: 4.00/4.00

University of Tennessee, Knoxville, TN. 2002-2006. B.A. in Computational Ecology. GPA: 3.91/4.00

Elizabethton High School, Elizabethton, TN. 1998-2002. Valedictorian. GPA: 4.00/4.00

RESEARCH EXPERIENCE

Rocky Mountain Biological Laboratory. Gothic, CO. 2006.
Mentor: Dr. John Harte (UC Berkeley)
Research Assistant. Analyzed carbon and nitrogen content of soil, performed vegetation surveys in a montane meadow, and examined conifer sapling growth over an elevational range.

Rocky Mountain Biological Laboratory. Gothic, CO. 2005.
Mentor: Dr. John Harte (UC Berkeley)
Research Experiences for Undergraduates, funded by NSF. Investigated the effects of a period of warming that occurred in 1999-2003 on the growth rates and germination success of young lodgepole pine trees. Scouted for and selected field sites, measured age and growth of trees, analyzed data, and wrote up research proposal and results in a scientific format.

University of Tennessee. Knoxville, TN. 2003-2006.
Mentors: Dr. Louis Gross, Dr. Suzanne Lenhart, Dr. Jake Weltzin
Undergraduates in Biology and Mathematics, funded by NSF. Worked on several projects including: (1) Examined biological invasion with particular reference to interspecific competition in protists. Performed laboratory work on protists, modeled competition using Lotka-Volterra ordinary differential equations, and estimated parameters based on laboratory data. (2) Tested competitive hierarchy theory using a combination of greenhouse experimentation and a newly-developed technique inspired by mathematical partial ordering theory.

University of Tennessee. Knoxville, TN. 2003-2006.
Mentor: Dr. Susan Riechert
Independent Research. Investigated the interactions between the semisocial spider *Anelosimus studiosus* and other spiders that commonly inhabit its nests. Performed a variety of field experiments to determine the specific interactions taking place between those spiders. Subsequently performed a set of experiments to determine how the composition of *A. studiosus* nests with regard to number and age of individuals affects its ability to defend against predation.

University of Tennessee. Knoxville, TN. 2003.
Laboratory and Field Assistant to Dr. Susan Riechert. Cared for spiders in laboratory and collected data along transects at sites ranging from Big Cypress National Preserve, FL, to Melton Hill Lake, TN.

TEACHING EXPERIENCE

University of California, Davis. Winter Quarter 2007. Teaching Assistant. Taught laboratory component of Bioscience 1B, an introductory course on animal diversity and evolutionary biology.

University of Tennessee, Division of Biology. Knoxville, TN. 2004-2005.
Teaching Assistant. Taught laboratory component of two freshman biology courses: Biology 102, Humankind in the Biotic World ; Biology 130, Biodiversity.

HONORS AND AWARDS

Outstanding Graduate in Ecology and Evolutionary Biology. 2006. Awarded to the top graduate in EEB at the University of Tennessee as decided by faculty in the department.

Chancellor's Citation for Academic Achievement. 2006. Awarded to top academic graduating seniors at the University of Tennessee.

Chancellor's Citation for Professional Promise. 2006. Awarded to graduating seniors at the University of Tennessee who exhibit professional promise in their fields.

Barry Goldwater Scholarship. 2005. Awarded to promising undergraduate students who plan to enter a career in scientific research.

Phi Beta Kappa. 2004. National honor society for scholars in the liberal arts and sciences.

Morris Udall Scholarship. 2004. Awarded to undergraduate students who have the potential to have a positive influence on national environmental and Native American public policy.

Chancellor's Summer Research Internship. 2004. Provides financial support for 15 undergraduates at the University of Tennessee to conduct original research with a faculty member.

Undergraduate Research Award for Students in Ecology and Evolutionary Biology. 2003. Awarded by the Department of Ecology and Evolutionary Biology at the University of Tennessee. Provides a stipend for summer research.

Tennessee Scholarship. 2002. Four-year merit-based scholarship awarded to 20 outstanding students in the incoming class at the University of Tennessee.

Attained the Rank of Eagle Scout. 2002. Scouting's highest honor.

PUBLICATIONS

Perkins, T.A., S.E. Riechert and T.C. Jones. Interactions between the social spider *Anelosimus studiosus* and foreign spiders that frequent its nests. *Journal of Arachnology* [accepted]

Perkins, T.A., W.R. Holmes, and J.F. Weltzin. Multi-species interactions in competitive hierarchies: new methods and empirical test. *Journal of Vegetation Science* [accepted]

Perkins, T.A., E. Staaterman, and J. Harte. Testing the climate-envelope hypothesis: effect of snowmelt date on conifer saplings along an elevational gradient [in preparation]

Perkins, T.A. An individual-based model of the social spider *Anelosimus studiosus*. College Scholars Senior Project.

MEETINGS AND WORKSHOPS ATTENDED

Ecological Society of America Annual Meeting. August 2006. Memphis, TN.

SAMSI / CRSC Undergraduate Workshop. May 2006. North Carolina State University.

Marine Resources Population Dynamics Workshop. January 2006. Mote Tropical Research Laboratory. Summerland Key, FL. Presented by National Marine Fisheries Service and Virginia Tech.

Society of Mathematical Biology Annual Meeting. July 2004. University of Michigan. Ann Arbor, MI.