

Course Title: Ecology of Infectious Disease

Proposed Course Number: OCN 340

Prerequisites: Biol 171, 172, or consent of instructor.

Course Format: Lecture, 3 hours/week

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Course Description:

Microbes, both beneficial and harmful, are ubiquitous inhabitants of humans, other animals, and plants. In this course we will explore the ecology of infectious diseases, their impact on humans and wildlife, and the effects of human activities on disease spread and transmission. We will learn fundamentals of infectious disease ecology: the interplay between host, pathogen, and environment. We will begin with basic ecology of infectious disease, including concepts of transmission, virulence, density dependence, and the continuum of symbioses from harmless to disease-causing infections. Building on these concepts, students will learn how human-mediated activities such as transport, travel, and environmental change can affect disease transmission. Case studies will be used to illustrate how biology and human activities combine to affect disease transmission. Students will learn about diseases of both humans and wildlife, with an emphasis on diseases that are locally relevant to Hawaii.

Course Format:

This is a lecture based course (3 hour lecture per week), but student participation is expected and encouraged through in-class discussions.

Learning Objectives:

Through this course, students will gain a fundamental understanding of ecological factors that affect the transmission of infectious diseases and their impacts. Students will learn to think critically about the interplay between individual decisions and the larger scale population level consequences for disease risk, and will be asked to consider the ethics of such decisions. This course will emphasize interdisciplinary thinking by illustrating the links between human activities (individual and societal factors) and disease transmission (ecological and biological outcomes). This course will use case studies to emphasize the impacts of infectious disease in Hawaii.

Tentative Schedule:

- Week 1      Introduction:  
Germ theory and its history  
The disease triangle
- Week 2      Virulence, incidence, and prevalence  
Susceptibility and immunity: overview of SIR models  
Transmission modes: direct versus vector-transmitted
- Week 3      The outlook on infectious disease: then and now  
Historical optimism on the fight against infectious disease  
Current emergence of infectious diseases of humans and animals
- Week 4      Sources of "new" diseases  
Environmental change  
Movement of hosts or pathogens  
Evolution of virulence  
Host range shifts (e.g. zoonoses)
- Week 5      Vector-borne diseases in Hawaii  
Dengue, Zika, others
- Week 6      Disease threats to plants and animals of Hawaii  
Avian malaria  
Coral diseases  
Rapid ohia death  
Chytridiomycosis: should we be concerned?
- Week 7      Globalization, travel, tourism and disease  
Disease and the media: The importance of perception of disease to tourism industry  
The importance of herd immunity  
Disneyland and measles outbreak in 2015  
Relevance to Hawaii's tourism industry
- Week 8      Seasonality, climate, and infectious disease  
Is the common cold cold?  
Global warming: effects on malaria transmission?  
Disease transmission and climatic events: cholera and tropical storms.
- Week 9      Antibiotics  
Discovery and history  
Resistance and over-use  
Sources of new antibiotics
- Week 10     Vaccination  
Ecology: Herd immunity  
Importance of good science communication: vaccination and autism.  
Ethics: should vaccination be required?

- Week 11      Transport and transmission  
                 Ecology: introduction of previously absent pathogens  
                 Hawaii as a hub of transport and travel  
                 Case examples.
- Week 12      Civic involvement and infectious disease policy
- Week 13      Hawaii and "neglected tropical diseases"
- Week 14      Symbiosis and the continuum from mutualism to parasitism (disease)  
                 Hawaiian endemic flora, fauna, and symbiotic microbes  
                 Hawaiian endemic plants and importance of endophytes.  
                 Hawaiian bobtail squid: *Vibrio fischeri*
- Week 15      The joys of living on a tropical island  
                 Taro farming and leptospirosis
- Week 16      Review and discussion