

Anthropological Sciences 179, Human Biology 179
Environmental Change and Emerging Infectious Disease

Winter 2006

Instructors:

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Course Description:

This is a lecture course on the changing epidemiological environment, with particular attention to the ways in which human-induced environmental changes are altering the ecology of infectious disease transmission, thereby promoting their re-emergence as a major global public health threat. Organized by case studies of environmental change at (roughly) local to global scales, we focus on the role that environmental changes (such as deforestation and land-use conversion, urbanization, human migration, international commerce, and global warming) play in contemporary disease transmission. The diseases affected by these environmental changes include SARS, Malaria, HIV, Chagas disease, Lyme, Influenza, Cholera, Hantavirus, BSE/vCJD, and West Nile Virus.

Expectations:

Attendance at lecture and discussion sections is mandatory. There is a take-home midterm and in-class final, for the 3-unit option, and the same midterm plus a 15-page research paper for the 5 unit option. The research paper may be on any related topic that is approved by the instructors. Paper proposals will be due during week 5 of the course (details TBA). Collaborative papers are encouraged, subject to the requirement of roughly 15 pages per author.

Prerequisites:

One of the following: HUMBIO 2A & 2B, the Bio Core, the Earth Systems Core, or permission of the instructors.

Sections:

Discussion sections will meet for one hour weekly starting the second week of the course. Locations TBA. Sections are a required part of the class.

Grading:

Grades for 5-unit enrollment will be based on midterm (30%), section (10%), and the 15-page paper (60%). Grades for 3-unit enrollment will be based on midterm (30%), section (10%), and final (60%).

Readings:

There are four required texts for this class. We will supplement these books with readings from the primary scientific literature throughout the quarter. All articles will be available on coursework.

The MacArthur book provides the theory of community ecology that we will employ for understanding disease emergence and how anthropogenic environmental change is likely to affect patterns of emergence. The theory of community ecology is mathematical, but MacArthur separates the mathematical treatment of the material into technical appendices following each chapter. We strongly recommend that you read these appendices, but they are not strictly necessary for successful completion of the class.

Abraham, T. 2005. *Twenty-First Century Plague: The Story of SARS*. Baltimore: Johns Hopkins University Press.

Aron, J.L., Patz, J.A., eds. 2001. *Ecosystem Change and Public Health: A Global Perspective*. Baltimore: The Johns Hopkins University Press.

Garrett, L. 1995. *The Coming Plague: Newly Emerging Diseases in a World Out of Balance*. New York: Penguin Press.

MacArthur, R.H. 1972. *Geographical Ecology*. Princeton: Princeton University Press (Paperback Reprint Edition, 1984).

Course Outline:

(Version of 1/10/06)

Lectures are on Tuesday and Thursday from 11-12:30 in Building 420, room 040.

Week 1. Introduction: What EIDs are and R_0

- 01.10 SARS: A Taste of the Future? (Jones)
Readings: Abraham, *Twenty-First Century Plague*
- 01.12 Epidemiology Meets Ecology: Some Tools (Jones)
Readings: Aron & Patz, Chs. 2 and 10; Jones Lecture Notes

Week 2. Local Deforestation and Disease: Frontier Malaria in Rondônia

- 01.17 Colonization in Rondônia: How not to Change R_0 (Durham)
Readings: Aron and Patz, Ch 12, "Malaria and Global Ecosystem Change;" Singer & Caldas de Castro (2001), 184-222, skimming 210-212; Vittor et al, 2006
- 01.19 Ecology Meets Epidemiology: Some More Tools (Durham)
Readings: MacArthur, Ch 1, "Climates on a Rotating Earth," Ch 8, "Comparisons of Temperate and Tropics," and Ch 2, "The Machinery of Competition and Predation"

Week 3. Ecological Mysteries: HIV & Ebola in Central Africa

- 01.24 Guest Lecture: Nathan Wolfe, Johns Hopkins University, Bushmeat Hunting and Retrovirus Spillover in Central Africa
Readings: Hahn et al. (2000); Gao et al. (1999); Wolfe et al. (2004); Jones (2006); Garrett, ch. 11
- 01.26 Ebola: Quest for the Filovirus Reservoir (Jones)
Readings: Peterson et al. (2004); Walsh et al. (2005); Garrett, ch. 7

Week 4. Regional Plagues: Haunted by Hantavirus

- 01.31 Death in the Southwest: Hantavirus Pulmonary Syndrome (Jones)
Readings: Engelthaler et al. (1999); Garrett, ch. 15; MacArthur Ch. 1. "Climates on a Rotating Earth"
- 02.02 Hantavirus in Latin America (Durham)
Readings: TBA

Week 5. The Challenge of Chagas: Who's the Guinea Pig?

- 02.07 American Trypanosomiasis: Disease of Poverty (Durham)
Readings: Bastien 2003, Coimbra 1988, Nitz et al, 2004
- 02.09 The Political Ecology of Landscape Transformation and R_0 (Durham)
Readings: Cohen and Gurtler 2001

Week 6. Changes in the Land: Tick Community Ecology in New England Oak Forest

- 02.14 Lyme Disease and Deflected Succession (Jones)
Readings: van Buskirk & Ostfeld (1998); LoGiudice et al. (2003)
Paper Topic Proposals Due (5-unit option only)
- 02.16 Lyme Disease, Mast Fruiting, and ENSO (Jones)
Readings: Jones et al. (1998); Randolph (2001); MacArthur Chs 5, "Island Patterns" and 7 "Patterns of Species Diversity"
Take-home Midterm Exam Passed Out

Week 7. Global Environmental Change: Climate and Cholera

- 02.21 Guest Lecture: Gary K. Schoolnik, Environment and Endemism in South Asia: The Case of Cholera
Readings: Aron & Patz, Ch 11, "Cholera and Global Ecosystems"; Garrett, ch.16
Take home Midterm Exam Due
- 02.23 El Niño and its Copepods: The Peruvian Cholera Epidemic (Durham)
Readings: Faruque, et al. (2005), Lipp, Huq, & Colwell 2002, Gil et al. (2004)

Week 8. National & International Change: The Flu and You

- 02.28 The Spectre of Highly Pathogenic Avian Influenza: The Challenges of Epidemic Control in Multi-Host Diseases (Jones)
Readings: Ferguson et al. (2003); Earn et al. (2002); Garrett, ch. 6
- 03.02 Of Ducks, Pigs, and Lots and Lots of People... (Jones)
Readings: Webster et al. (1992); Gilchrist (2005); Webster et al. (2006)

Week 9. Bound by the Food Chain: Prions

- 03.07 Be Careful What You Eat: The Tragic Case of Kuru (Durham)
Readings: Goldfarb 2002, Durham (2006)
- 03.09 How Now Mad Cow: A to Z on the TSE's (Chiou and Durham)
Readings: Smith and Bradley 2004, Prusiner 2004

Week 10. Wrap-Up: Humanity's Changing Epidemiological Environments

- 03.14 Lessons for Control: How Can Human Ecology Help? (Jones)
Readings: Daily & Ehrlich (1996)
- 03.16 Concluding Remarks (Durham, Jones)
Readings: Galvani (2002)
- 03.23 Final Exam and Paper Due (details TBA)**