

Evolution and Medicine PCB 4678

Fall 2014

Evolutionary Medicine is a neglected field that studies the evolution of the pathogenic organisms that cause infectious disease and how the evolution of humans affects our health. If doctors, nurses, and public health officials understood and implemented Evolutionary Medicine's principles, the practice of medicine in the world today would be vastly different. By examining evolutionary medicine, not only may more effective treatments and vaccines be created, but also pathogen evolution may be directed toward lower levels of lethality. This semester we will delve into Evolutionary Medicine through readings, discussions, writings, and projects.

Course Objectives

- To understand the principles of evolutionary biology and integrate them into medical topics.
- To become a skilled reader and critic of scientific literature.
- To understand the relevance of evolutionary biology to human society, particularly human health issues.

Class Meetings: PCB 4678 (3 credits) Tuesday/Thursday 9:00-10:20 am, BA1-205

Instructor: Dr. Tiffany M. Doan (Costa)

Office: BL 439, 407-823-5424

E-mail: Tiffany.Doan@ucf.edu

Twitter: @DoanTiffany, Class Hashtag: #EvoMedUCF

Office Hours: Tuesday 1:30-3:00 pm, Wednesday 1:00-3:30 pm (I will do my best to be in my office during those times, but things occasionally come up requiring me to be away from my office. Check office door for my location. You can always e-mail me for another meeting time.)

Webcourses Site:

I have a course web site set up on Webcourses (<https://webcourses.ucf.edu>) that I will use to post materials for the course, including the syllabus, calendar dates, assignment descriptions, readings, and grades. The course Twitter feed may also be followed on our webcourse. If you need to contact me, please do so using the Inbox Conversations function in Webcourses.

Required Text:

Ewald, P. W. 1994. Evolution of Infectious Disease. Oxford University Press, New York.

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Additional Readings:

- Brockman, J., ed. 2001. *The Next Fifty Years: Science in the First Half of the Twenty-First Century*. Vintage Books, New York.
- Ewald, P. W. 2002. *Plague Time: The New Germ Theory of Disease*. Anchor Books, New York.
- Fisher, M. C., and T. W. J. Garner. 2007. The relationship between the introduction of *Batrachochytrium dendrobatidis*, the international trade in amphibians and introduced amphibian species. *Fungal Biology Reviews* 21:2-9.
- Kluger, J. 2007. When worry hijacks the brain. *Time* 170: 44-47.
- Martínez del Río, C. 1996. Murder by mistletoe. *Natural History* 105: 65-70.
- Nesse, R. M., S. C. Stearns, and G. S. Omenn. 2006. Medicine needs evolution. *Science* 311: 1071.
- Peters, C. J., and M. Olshaker. 1997. *Virus Hunter: Thirty Years of Battling Hot Viruses Around the World*. Anchor Books, New York.
- Sherman, I. W. 2006. *The Power of Plagues*. ASM Press, Washington, DC.
- Trevathan, W. R., E. O. Smith, J. J. McKenna, eds. 2008. *Evolutionary Medicine and Health: New Perspectives*. Oxford University Press, New York.
- Weldon, C., L. H. du Preez, A. D. Hyatt, R. Muller, and R. Speare. 2004. Origin of the amphibian chytrid fungus. *Emerging Infectious Diseases* 10: 2100-2105.

Class Policies:

1. Attendance at all class meetings is required. Participation in discussions will be a major portion of the grade so missing classes is not an option. If you must miss class for a good reason, contact me to let me know.
2. Assigned readings must be completed before attending class. Without doing the readings there will be nothing to discuss in class!
3. You are encouraged to discuss any and all portions of the class with me. Please feel free to come to my office hours or make an appointment to discuss the class, especially if you are having trouble in the class.
4. Respect should be given to fellow students and the instructor. Please do not arrive late to class, walk out in the middle of class, or leave early.
5. Hateful or offensive speech or writing will not be tolerated.
6. Cell phones, iPods, and other electronic devices should be turned off and put away before class starts.
7. Due dates for assignments are firm. Extensions to due dates will not be granted without documented exceptional circumstances. A penalty of 10% per day will be deducted from your assignment grade for any late work.
8. Academic dishonesty (cheating and plagiarism) is strictly prohibited and will be taken very seriously and will result at least in an "F" for that assignment (and may, depending on the severity of the case, lead to an "F" for the entire course) and may be subject to appropriate referral to the Office of Student Conduct for further action. See the UCF Golden Rule for further information.

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Course Accessibility:

It is my goal that this class be an accessible and welcoming experience for all students, including those with disabilities that may impact learning in this class. If anyone believes the design of this course poses barriers to effectively participating and/or demonstrating learning in this course, please meet with me to discuss reasonable options or adjustments. You may also contact SDS (Ferrell Commons 185; 407-823-2371; sds@ucf.edu) to talk about academic accommodations.

Grading:

The grade for this course will be based on five aspects and will be out a total of **1000 points**. Grades will be assigned according to the following scale: 93-100 = A; 90-92 = A-; 87-89 = B+; 83-86 = B; 80-82 = B-; 77-79 = C+; 73-76 = C; 70-72 = C-; 60-69 = D; ≤ 59 = F.

Participation is a large portion of the grade and will be based on daily discussion. (8 points per discussion day; lowest score dropped = 180 points)

Two **exams** will be given on the dates indicated on the schedule. They will consist of essays and shorter answer questions. (150 points each)

A **paper** will be completed by each student on the evolutionary medicine of one pathogen. A short presentation of the paper will also make up part of the paper grade. Dates and paper topics will be selected early in the semester. (150 points)

Four **response papers** will be completed concerning presentations of other students in the class. Response papers will be due one week after student presentations. (30 points each)

A **group project** will be completed by pairs of students which will focus on increasing awareness and practices of evolutionary medicine in the world. Project proposals will be due on 16 October; finished projects will be due at the end of the semester. (250 points)

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Evolution and Medicine (PCB 4678) Schedule			
Date	Topic	Readings	
19-Aug	T	Introduction to Evolutionary Medicine	
21-Aug	TH	Why Evolutionary Medicine, Introduction to Immunology	Nesse et al., Sherman Ch10, EID Ch 1
26-Aug	T	Symptomatic Treatment	EID Ch 2
28-Aug	TH	Vectors and Vertical Transmission	EID Ch 3
2-Sep	T	Predators, Parasitoids, and Durability	EID Ch 4
4-Sep	TH	Waterborne Transmission	EID Ch 5
9-Sep	T	Attendant-Borne Transmission	EID Ch 6
11-Sep	TH	War and Virulence	EID Ch 7
16-Sep	T	Evolution of AIDS	EID Ch 8 (pp. 119-143)
18-Sep	TH	Evolution of AIDS	EID Ch 8 (pp. 144-157)
23-Sep	T	The Fight Against AIDS	EID Ch 9
25-Sep	TH	A Look Backward	EID Ch 10
30-Sep	T	A Glimpse Forward	EID Ch 11
2-Oct	TH	Exam 1	
7-Oct	T	Disease Evolution in Other Species	Weldon et al., Fisher and Garner, Martinez del Rio
9-Oct	TH	Plague Time, STDs, The Chronic	PT Introduction, Ch 2, 3
14-Oct	T	The Endless War, Blood and Steel	PT Ch 5, 9
16-Oct	TH	Atherosclerosis	EMH Ch 19
21-Oct	T	The Prepared Mind, Mastering Disease	PT Ch 15, The Next Fifty Years
23-Oct	TH	Hygiene Hypothesis	Strachan, Summers et al.
28-Oct	T	Diet and Nutrition	Kluger, BBC News, EMH Ch 2
30-Oct	TH	Menstruation and Contraceptives, Eclampsia	EMH Ch 9, 11
4-Nov	T	Sleep	EMH Ch 16
6-Nov	TH	Evolution and Medicine	EMH Ch 22, 23
11-Nov	T	Veteran's Day NO CLASSES	
13-Nov	TH	Biobombs, Looking Ahead	PT Ch 12, Peters
18-Nov	T	Group Project Presentations	
20-Nov	TH	Group Project Presentations	
25-Nov	T	Group Project Presentations	
27-Nov	TH	Thanksgiving NO CLASSES	
4-Dec	TH	Exam 2 8:00-9:50 am	

"We and all other living creatures are products of evolution—the ultimate game of chance. Bacteria, rickettsias, viruses, fungi, worms, protozoans, insects, and ticks are unaware that they are playing this game, and they know nothing about its rules. The game's rules are really quite simple: play and win, and the prize is the privilege of playing another round of the game. Biologically speaking, those participants who lose are unable to reproduce and thus they are eliminated from the game. Leaving the game is tantamount to extinction, because losers in this game of chance never get another turn; there are no second chances. Most of the players in the game eventually pay this penalty. Those players who enter the next round of play have a chance of winning proportionate to their previous success. That is, the more progeny produced, the greater the chances that some of these will be winners too. However, the game of evolution is complicated by the fact that the rules for selecting the winners can be changed from one round to the next without any predictability. In other words, the feature that allowed a win in the past need not allow a win in the future. In the final analysis, both the environment and the inherited competence of the participants determine those who will be allowed to play another round. In this sense, nature is both adversary and jury in the evolutionary game of chance."

—Irwin W. Sherman *The Power of Plagues*