## ANT 3930/ANG6930 Evolutionary Medicine

MWF Period 7 (1:55 pm-2:45 pm) Location: Turlington Hall Rm 2336

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## **Course Description**

This course explores Darwinian medicine and the application of modern evolutionary theory to understanding health and disease among contemporary human populations. Evolutionary insight is yielding important advances in understanding the nature of disease and evolutionary approaches are becoming widely used for both disease surveillance and control. This course focuses on the principles of evolutionary medicine and emphasizes the difference between proximate and ultimate explanations of disease patterns and how these different explanations shape our view of human health.

This course will cover a diverse range of themes related to evolutionary medicine including:

- Human adaptation vs. human adaptability: Constraints, trade-offs, and competition
- Evolution of pathogens, parasites, and virulence
- Human immune function and other protective mechanisms
- "Diseases of civilization" or past environments and their impact on modern patterns of health and illness
- The role of evolution in shaping reproduction, childbirth, and young child health
- The neurobiology of stress and it's long term impacts on health and function
- Evolutionary components of emotion, addiction, and mental health

### **Required texts:**

- Elton, S. and O'Higgins (eds.) (2008) Medicine and Evolution: Current Applications, Future Prospects. CRC Press.
- Hrdy, S. (2011) Mothers and Others: The Evolutionary Origins of Mutual Understanding. Belknap/Harvard University Press.
- Dennett, D. (1995) Darwin's Dangerous Idea. Simon and Schuster.

# Supplementary Texts and Resources:

- Stearns, S. and J. Koella (2008) Evolution in Health and Disease (2nd ed.) Oxford University Press.
- Trevathan, W., E.O. Smith, and J. McKenna (2008) Evolutionary Medicine and Health. Oxford University Press.
- Henry Stewart Talk Series on Evolution & Medicine (<u>http://hstalks.com/main/browse\_talks.php?r=20&j=756&c=252</u>) (Username/Password for accessing HST will be available on E-Learning)
- Palo Alto Institute/Stanford University Talks on Evolutionary Medicine (<u>http://www.youtube.com/playlist?list=PL7CBB6CB6E9C5BC31</u>)

Additional readings will be provided electronically.

### Course Requirements and Grading

Final grades are based on a total of 275 points. Point totals are calculated based on participation in discussion, the midterm exam and the final research project. At any point you can calculate your grade in the course by dividing your points received by the total number of points for assignments thus far. There is no curve in this class.

*Class Participation* (50 pts.): I expect students to attend each class meeting and to take an active part in class discussions and activities. Active participation includes attendance but also requires that you read all assigned readings and prepare thoughtful questions and critical discussion points in advance of class meetings. I will evaluate your participation based on the *quality* of your contributions and not simply on how often you speak in class. The purpose of evaluating your participation is to encourage you to prepare for class and to promote thoughtful analysis and discussion.

In this class, participation will be divided into two components:

- 1) **Class participation** and discussion (30 pts.)
- 2) Five blog posts on either the Friday video series, the recommended readings, or the readings in the Dennett book (20 points). Posts must be uploaded to E-Learning the Friday the week that the material is covered in class and must be at least 250 words each with proper grammar and spelling. (Hint: I would recommend planning ahead to pick the topics you want to discuss and doing a post at least every two weeks.)

# Research Poster (175 pts):

You will be required to present a research project on a topic of your choice that relates to evolutionary medicine. In lieu of the typical research paper you will present a poster detailing the results of your research during the last week of classes.

Development of the research project will occur throughout the semester:

- Research topic (25 pts): You are required to submit a poster proposal outlining the topic of your research project by Feb. 15; this brief proposal should describe the topic, including why the topic is important, and should identify some of the key questions or issues your project will explore.
- 2) Abstract and annotated bibliography (50 pts): A 250-300 word proposal abstract (25 pts.), and an annotated bibliography (25 pts.) with at least 10 carefully selected references from scholarly literature are due March 15.
- 3) Poster submission (50 pts.): You must submit your final poster (electronically) by April 19.
- 4) **Research forum (50 pts.):** The final poster will be presented in class on **April 22 or 24.** You will give a brief presentation about your research to other students and answer questions.

Grading rubrics for each part of the poster project will be provided.

### Midterm exam (50 pts)

The midterm is a take home exam that is due March 1. The exam covers the basic concepts and terminology necessary for an adequate understanding of evolutionary approaches to human health.

## Grades

Final grades will be based on the following scale: A (94-100), A- (90-93), B+ (87-89), B (84-86), B- (80-83), C+(77-79), C (74-76), C- (70-73), D+(67-69), D (64-66), D-(60-63), E (<59).

I will do my best to return graded assignments to you within a week of their submission.

### Policy on Late Assignments

You are required to complete all assignments by the stated due dates. Late assignments will lose one half-letter grade for each day past the deadline. There are no make-up opportunities for any assignment, as you will have ample time to complete each requirement. I will not assign grades of "incomplete" except in the most unusual, extreme circumstances (i.e. alien abduction). You must provide documentation of such circumstances from an appropriate authority.

### Academic Honor Code

Students are expected to uphold the Academic Honor Code of the University of Florida. The Academic Honor Code is based on the premise that each student has the responsibility (1) to uphold the highest standards of academic integrity in the student's own work, (2) to refuse to tolerate violations of academic integrity in the University community, and (3) to foster a high sense of integrity and responsibility on the part of the University community. Please see the following website for a complete explanation of the Academic Honor Code: <a href="https://www.registrar.ufl.edu/catalog/policies/students.html">www.registrar.ufl.edu/catalog/policies/students.html</a>).

## Americans with Disabilities Act

Students with disabilities, who need reasonable modifications to complete assignments successfully and otherwise satisfy course criteria, are encouraged to meet with the instructor as early in the course as possible to identify and plan specific modifications. Students requesting accommodation must first register with the Dean of Students Office and then provide documentation to the instructor. For more information about services available to University of Florida students:

Dean of Students Office Disability Resource Center 202 Peabody Hall or 0020 Reid Hall Phone: (352) 392-1261 Phone: (352) 392-8570

# University of Florida Counseling Services

Resources are available on-campus for students that feel like they are struggling in their personal or academic life. These resources include:

- University Counseling Center, 301 Peabody Hall, 392-1575, personal and career counseling
- Student Mental Health, Student Health Care Center, 392-1171, personal counseling
- Sexual Assault Recovery Services (SARS), Student Health Care Center, 392-1161, sexual counseling
- Career Resource Center, Reitz Union, 392-1601, career development assistance and counseling.

## Course Schedule, Readings, and Assignments

This is a preliminary schedule of topics and readings. The syllabus is a guide for the course and may be subject to change with advance notice. Students are expected to complete the readings for a particular class before that class begins.

Section I: Setting the stage		( <b>E&amp;O</b> -Elton and O'Higgins)		
		<i>Read</i> : E&O Ch 1; Dennett Ch 1 and 2; Stearns, Nesse and Haig (2008)		
Week 1 (Jan 7-11)	Introduction & overview	Recommended: Guegan, Prugnolle and Thomas (2008); Trevathan (2007); Evolutionary Medicine: Envisioning the Opportunities (R. Nesse, 2012 PAI/Stanford Evolutionary Medicine Conference)		
Week 2 (Jap 14-18)	Natural selection, evolutionary	<i>Read</i> : E&O Ch 10; Gluckman, Low, Buklijas, Hanson and Beedle (2011); Dennett Ch 3		
week 2 (jan 14-16)	theory, and biomedicine	Recommended: Gould and Lewontin (1979)		
		Video: What Darwin Never Knew (NOVA, 2011)		
Week 3 (Jan 21-25)	Genetics: Variation, inheritance, and epigenetics	<i>Read</i> : Dennett Ch 4; Lewis (2008); Kidd and Kidd (2008)		
No class Jan. 21 (MLK Day)		Recommended: Crews and Gerber (2008)		
		Video: Ghost in Your Genes (PBS, 2007)		
		<i>Read</i> : Dennett Ch 5; Kuzawa, Gluckman, Hanson, and Beedle (2008)		
Week 4 (Jan 28-Feb 1)	EvoDevo and developmental plasticity	<i>Recommended</i> : Ulijaszek (1997); Kuzawa (2012); Developmental Plasticity, Evolution, and the Origins of Disease (MJ West-Eberhard, HST on Evolution and Medicine)		
		Video: TBA		
		<i>Read</i> : Dennett Ch 6; Gluckman, Beedle, and Hanson (2009)		
Week 5 (Feb 4-8)	Life histories and constraints	<i>Recommended</i> : Bribiescas and Ellison (2008); The Endocrinology of Human Life History Transitions (P. Ellison, HST on Evolution and Medicine)		
		Video: TBA		
Section II: Trade-offs: Evolutionary perspectives on human health and behavior				
Week 6 (Feb 11-15)	Reproduction	Read: E&O Ch 5 and 6; Dennett Ch 7; Robillard,		

Research topic due Feb 15		Dekker, Chanout, Chaline, and Husley (2008)
		<i>Recommended</i> : Leidy Sievert (2008); Evolutionary Obstetrics (W. Trevathan, HST on Evolution and Medicine)
		Video: TBA
		<i>Read</i> : E&O Ch. 3 and 7; Dennett Ch 8; Nepomnaschy and Flinn (2009)
Week 7 (Feb 18-22)	Child health and growth	<i>Recommended</i> : Haig (2008); Early Nutrition, Development and Health: Evolutionary Perspectives on the Metabolic Syndrome (C. Kuzawa, HST on Evolution and Medicine)
		Video: TBA
		<i>Read</i> : E&O Ch 2; Dennett Ch 9; Leonard (2008); Wiley (2008)
Week 8 (Feb 25-Mar 1) <b>Midterm due Mar 1.</b>	Nutrition	<i>Recommended</i> : Turner, Maes, Sweeney, and Armelagos (2008); What did Humans Evolve to Eat? Evolutionary Perspective on Human Nutritional Health (W. Leonard, 2012 PAI/Stanford Evolutionary Medicine Conference)
		Video: TBA
Week 9 (Mar 4-8)	SPRING BREAK	
		<i>Read</i> : Ackermann and Pletcher (2008); Austad and Finch (2008); Dennett Ch 10 and 11
Week 10 (Mar 11-15) Abstract and annotated bibliography due Mar 15.	Aging	<i>Recommended</i> : Ewald (2008); Can we Have it All? What Evolutionary Biology Says about Medically Slowing Aging (S. Austad, 2012 PAI/Stanford Evolutionary Medicine Conference)
		Video: TBA
		Read: Hrdy (all)
Week 11 (Mar 18-22)	Social organization and behavior	<i>Recommended</i> : Strassmann and Mace (2008); Improving Health by Changing Behavior: Evolution Science Shows How (S. Hayes, 2012 PAI/Stanford Evolutionary Medicine Conference)
		Video: TBA
Section III: Evolutionary perspec	ctives on human disease	Read E&O Ch & Koella and Turner (2000).
		Bergstrom and Feldgarden (2008); Dennett Ch 12 and 13
Week 12 (Mar 25-29)	Infectious disease	Recommended: Long and Graham (2011); Read and Mackinnon (2008); Infectious Disease (A. Read, 2012 PAI/Stanford Evolutionary Medicine Conference) and The Hygiene Hypothesis (G. Rook, HST on Evolution and Medicine)

		<i>Video</i> : TBA
Week 13 (April 1-5) No class April 1 (OU Conference)		Read: E&O Ch 4; Ewald 2008; Greaves (2008); Dennett Ch 14-15
	Chronic disease and cancer	<i>Recommended</i> : Lieberman (2008); Why Evolution Holds the Key to Curing and Preventing Cancer (C. Maley, 2012 PAI/Stanford Evolutionary Medicine Conference)
		Video: TBA
Week 14 (April 8-12)	Emotional health, and addiction	Read: E&O Ch 9; Lende (2008); Dennett Ch 16-17 Recommended: Flinn (2008); Where Darwin meets Freud: Psychiatric Conditions and Therapies at the Dawn of Evolutionary Genomics (B. Crespi, 2012 PAI/Stanford Evolutionary Medicine Conference. Video: TBA
Week 15 (April 15-19) Electronic version of poster due April 19	Future Directions: Evolutionary medicine as a "universal acid"?	Read: Dennett Ch 18; E&O Ch 13; Nesse (2008) Recommended: Nesse et al. (2010) Video: "Darwin's Dangerous Idea" BBC (2009)
Week 16 (April 22-24)	<b>Student Poster Presentations</b>	

## Supplementary Reading List (available on e-Learning)

Ackermann, M. and S. Pletcher (2008) Evolutionary biology as a foundation for studying aging and aging-related disease. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 241-252.

Austad, S. and C. Finch (2008) The evolutionary context of human aging and degenerative disease. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 301-311.

Bergstrom, C. and M. Feldgarden (2008) The ecology and evolution of antibiotic resistant bacteria. In *Evolution in Health* and Disease (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 125-137.

Bribiescas, R. and P. Ellison (2008) How hormones mediate trade-offs in human health and disease. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 77-92.

**Crews, D. and L. Gerber (2008)** Genes, Geographis Ancestry, and Disease Susceptability: Applications of Evolutionary Medicine to Clinical Settings. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 368-381.

**Ewald, P. (2008)** An Evolutionary Perspective on the causes of chronic diseases: Atherosclerosis as an illustration. In *Evolutionary Medicine and Health.* Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 350-367.

Flinn, M. (2008) Why Words Can Hurt Us: Social Relationships, Stress and Health. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 242-258.

Gluckman, P., A. Beedle, and M. Hanson (2009) Evolution of life Histories. In *Principles of Evolutionary Medicine*. Oxford University Press. Pp. 257-276.

Gluckman, P., Low, F., Buklijas, T., Hanson, M., and A. Beedle (2011) How evolutionary principles improve the understanding of human health and disease. *Evolutionary Applications* 4(2): 249-263.

Gould, S. J. and R. C. Lewontin (1979) The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme *Proc. R. Soc. Lond.* (205)1161: 581-598.

**Greaves, M. (2008)** Cancer: evolutionary origins of vulnerability. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 277-287.

**Guegan, J., Prugnolle, F. and F. Thomas (2008)** Global spatial patterns of infectious diseases and human evolution. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 19-29.

Haig, D. (2008) Intimate relations: Evolutionary conflicts of pregnancy and childhood. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 65-76.

Kidd, K. and J. Kidd (2008) Human genetic variance of medical significance. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 51-62.

Koella, J. and P. Turner (2008) Evolution of parasites. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 229-237.

Kuzawa, C. (2012) Why evolution needs development, and medicine needs evolution Int. J. Epidemiol. (2012) 41(1): 223-229.

Kuzawa, C., P. Gluckman, M. Hanson, and A. Beedle (2008) Evolution, developmental plasticity, and metabolic disease. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 253-264.

Leidy Sievert, L. (2008) Should Women Menstruate? An Evolutionary Perspective in Menstrual –Suppressing Oral Contraceptives. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J. McKenna. Oxford University Press. Pp. 181-195.

Lende, D. (2008) Evolution and Modern Behavioral Problems: The Case of Addiction. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 277-290.

Leonard, W. (2008) Lifestyle, diet, and disease: comparative perspectives on the determinants of chronic health risks. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 265-276.

Lewis, S. (2008) Evolution at the intersection of biology and medicine. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 399-415.

Lieberman, L. (2008) Diabesity and Darwinian medicine: The evolution of an epidemic. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 72-95.

Long, G., and A. Graham (2011) Consequences of immunopathology for pathogen virulence evolution and public health: malaria as a case study. *Evolutionary Applications* 4(2): 278-291.

Nepomnaschy, P. and M. Flinn (2009) Early life influences on the ontogeny of the nueroendicrine stress response in the human child. In *Endocrinology of Social Relationships*. Edited by P. Ellison and P. Gray. Harvard University Press. Pp. 364-384.

Nesse, W. (2008) The importance of evolution for medicine. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 416-433.

Nesse, R., Bergstrom, C., Ellison, P., Flier, J., Gluckman, P., Govindaraju, D., Niethammer, D., Omenn, G., Perlman, R., Schwartz, M., Thomas, M., Stearns, S. and David Valle. (2010) Colloquium Paper: Making evolutionary biology a basic science for medicine *PNAS* 2010 107 (suppl 1) 1800-1807; published ahead of print November 16, 2009, doi:10.1073/pnas.0906224106.

**Read, A. and M. Mackinnon (2008)** Pathogen evolution in a vaccinated world. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 139-152.

Robillard, P., G. Dekker, G. Chanout, J. Chaline, and T. Husley (2008) Possible Role of Eclampsia/Preeclampsia in Evolution of Human Reproduction. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 216-226.

**Strassmann, B. and R. Mace (2008)** Perspectives on human health and disease from evolutionary and behavioral ecology. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 109-121. **Stearns, S., Nesse, R., and D. Haig (2008)** Introducing evolutionary thinking for medicine. In *Evolution in Health and Disease* (2<sup>nd</sup> ed.) Edited by S. Stearns and J. Koella. Oxford University Press. Pp. 3-14.

Trevathan, W. (2007) Evolutionary Medicine. Annual Review of Anthropology, Vol. 36: 139-154.

**Turner, B., K. Maes, J. Sweeney, and G. Armelagos (2008)** Human evolution, diet, and nutrition: When the body meets the buffet. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 55-71.

Ulijaszek, S. (1997) Human adaptation and adaptability. In Human Adaptability: Past, Present, and Future. Edited by S. Ulijaszek and R. Huss-Ashmore. Oxford University Press. Pp. 7-16.

Wiley, A. (2008) Cow's milk consumption and health: An evolutionary perspective. In *Evolutionary Medicine and Health*. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford University Press. Pp. 116-133.