### ANG6930 Evolutionary Medicine

Mondays, 12:50-3:50 pm, FLI 0113 (Keene-Flint Hall)

Dr. Alyson Young Office: 496 Grinter (4<sup>th</sup> floor, CAS) Email: <u>agyoung@ufl.edu</u> Office Hours: Weds. 11 am-1 pm and by appt. Course website: <u>https://lss.at.ufl.edu/</u>

#### **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:**

- Nesse, R. and G. Williams (1996) Why We Get Sick: The New Science of Darwinian Medicine. Vintage Press.
- Sapolsky, R. (2004) Why Zebras Don't Get Ulcers (3<sup>rd</sup> ed.) Henry Holt and Company, New York.

#### Strongly recommended:

- Stearns, S. and J. Koella (2008) Evolution in Health and Disease (2<sup>nd</sup> ed.) Oxford University Press.
- Trevathan, W., E.O. Smith, and J. McKenna (2008) *Evolutionary Medicine and Health*. Oxford University Press.

#### **Course Requirements and Grading**

This course is a seminar, so the primary format will be discussion. Each week a student will lead discussion based on the readings for a particular topic starting Sept. 19<sup>th</sup>.

Final grades are based on a total of 275 points. Point totals are calculated based on participation in discussion, discussion leadership, 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.

*Class Participation* (100 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 (50 pts.)
- 2) Leading topic discussion (50 pts.)

### 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:

- 1) **Research topic (25 pts):** You are required to submit a poster proposal outlining the topic of your research project by **Sept. 26th**; 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 20 carefully selected references from scholarly literature are due **Oct. 24th**.
- 3) Poster submission (50 pts.): You must submit your final poster (electronically) by Friday, Dec. 2nd.
- 4) **Research forum (50 pts.):** The final poster will be presented on **Dec. 5**<sup>th</sup>. You will give a brief 15minute presentation about your research to other students and answer questions.

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

# 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.

Date	Торіс	Reading/Assignment
Week 1 (Aug. 22)	Introduction & overview	Nesse & Williams Ch 1, 15 Lewis (2008) Gluckman et al. (2011)
Week 2 (Aug 29)	Evolutionary biology, life history theory, and human variation	Nesse & Williams Ch 2-3, 7 Gluckman et al. (2009) Gould & Lewontin (1979)
Week 3 (Sep. 5)	No class (UF holiday)	
Week 4 (Sep. 12)	Adaptation, human adaptability, and biocultural approaches to health	Ulijaszek (1997) Wiley (1993) Sapolsky Ch 17
Week 5 (Sep. 19)	Evolution and medicine	Schell (1997) Nesse (2008) Stearns et al. (2008)
Week 6 (Sep. 26) <b>Research topic due</b>	Stress and stressors	Sapolsky Ch 1-5, 8 Nepomnaschy and Flinn (2009)

Week 7 (Oct. 3)	Pathogens, toxins, and parasites (oh my!)	Nesse & Williams Ch 4, 6 Koella and Turner (2008) Read and Makinnon (2008)
Week 8 (Oct. 10)	Allergies, injury and immune function	Nesse & Williams Ch 5, 11 Sapolsky Ch 9 Long and Graham (2011)
Week 9 (Oct. 17)	Nutrition and evolutionary legacies	Nesse & Williams Ch 9 Kuzawa et al. (2008) Leonard (2008) Turner et al. (2008) Wiley (2008)
Week 10 (Oct. 24) Abstract and annotated bibliography due	Noninfectious and degenerative disease	Nesse & Williams Ch 10, 12 Ewald (2008) Lieberman (2008)
Week 11 (Oct. 31)	Sex, pregnancy and reproduction	Nesse & Williams Ch 13 Sapolsky Ch 6-7 Leidy Sievert (2008) Robillard et al. (2008)
Week 12 (Nov. 7)	Human aging	Nesse & Williams Ch 8 Sapolsky Ch 12 Austad and Finch (2008) Ackermann and Pletcher (2008)
Week 13 (Nov. 14-18)	No class (AAA meetings)	
Week 14 (Nov. 21)	Stress, emotion, and behavior	Sapolsky Ch 10-11, 13 Flinn (2008) Straussmann & Mace (2008) Worthman (2008)
Week 15 (Nov. 28)	Emotional health and addiction	Nesse & Williams Ch 14 Sapolsky Ch 14, 15, 16. Lende (2008)
Week 16 (Dec. 5)	Student Poster Presentations	

# **Supplementary Reading List**

**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.

**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. **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.

**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.

**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., 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.

**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.

**Schell, L. (1997)** The evolution of human adaptability: society, funding, and the conduct of science. In *Human Adaptability: Past, Present, and Future*. Edited by S. Ulijaszek and R. Huss-Ashmore. Oxford University Press. Pp. 281-294.

**Straussmann, 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.

**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. (1993)** Evolution, Adaptation, and the Role of Biocultural Medical Anthropology. *Medical Anthropology Quarterly*, 7(2): 192-199.

**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.

Worthman, C. (2008) After Dark: The Evolutionary Ecology of Human Sleep. In Evolutionary Medicine and Health. Edited by W. Trevathan, E.O. Smith, and J.J. McKenna. Oxford Univerity Press. Pp. 291-313.