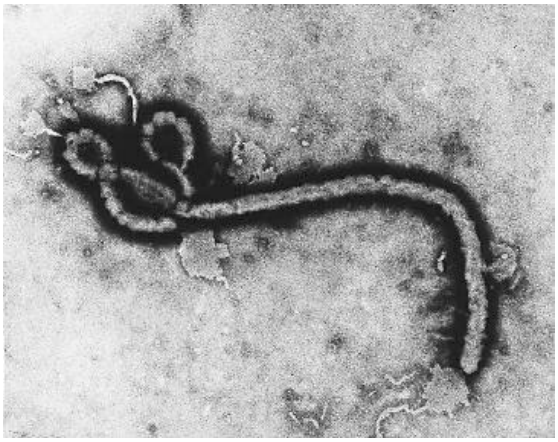
Evolutionary Medicine - UNST 301

Fall Semester 2009 – TR 2:00 – 3:15 PM

Hodgin Hall 208



Electron micrograph of Ebola virus

Instructor:

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Office Hrs: MW 3 – 5PM; R 10 – 12 N; F 10 – 12 N and by appointment.

Tips for Successful Office Visit

It is important that students utilize office hours to help them clarify topics on which they have questions. It will be useful for you to write down specific questions that you wish to have addressed before your visit. Often times group office visits may be useful and are encouraged.

Required Texts:

Neese, R.M. and George C. Williams, *Why We Get Sick: The New Science of Darwinian Medicine*, (New York, NY: Vintage Books), 1996.

Ewald, P., *Plaque Time: How Stealth Infections cause cancers, heart disease, and other Deadly Ailments*, (New York, NY: The Free Press), 2000.

Suggested Text:

Graves, J.L., *The Race Myth: Why We Pretend Race Exists in America*, (New York: Dutton Books), 2005…Available at Amazon.com (used copies run as little as $1.99.)

Readings: Additional readings as assigned.
Learning Objectives

This course is interdisciplinary. It will utilize subject matter from a variety of academic disciplines, through the range of organization that exists within them (molecular to societal). Students will read and discuss the established principles of evolutionary medicine along with new material as it arises from the primary literature. The pedagogy of this course introduces students to how to think critically about the origin, maintenance, and approaches to curing disease in humans. This course will specifically address the following university-wide general education learning goals: 5. use analytical thinking skills to evaluate information critically; 7. apply scientific reasoning skills to model natural, physical, social, and aesthetic phenomena using multiple modes of inquiry; 8. use a wide range of disparate information and knowledge to draw inferences, test hypotheses, and make decisions; 14. understand and apply ethical reasoning principles to resolve moral, social, and professional issues; 16. understand and promote principles of wellness that include nutrition, exercise, avoidance of mind-altering chemicals, development of healthy relationships and personal growth; 17. recognize behaviors that place individuals, families and communities at risk.

This course will address a variety of more specific learning objectives. Here are examples of how some of these can be scored along Bloom's Taxonomy of Learning. Levels 1 – 6 represent more sophisticated understanding of a topic.

Competency
Blooms 1
Blooms 2
Blooms 3

Hypothetical reasoning as it is applied to evolutionary medicine.
Remember the scientific method and be able to define each component step in the context of disease.
Understand how hypothetical reasoning differs from other ways of knowing about disease (e.g. superstition.)
Apply hypothetical reasoning to the origin and maintenance of disease.

Health, disease, and aging.

Remember the definitions of health, disease, and aging and apply to evolutionary medicine.
Understand how health is influenced by disease and aging.
Apply your understanding of health, disease, and aging to a new phenomenon, e.g. health disparity.

Social construction of race.
Remember the biological and social definitions of race.
Understand how biological and social definitions of race impact biomedical research.
Apply biological and social concepts of race to biomedical research on health disparities.

Higher Level Taxonomies

Competency
Bloom4
Bloom5
Bloom6

Hypothetical reasoning as it is applied to evolutionary medicine.
Analyze hypothetical reasoning and explain how each constituent part logically implies evolutionary medicine.
Evaluate specific hypotheses with regard to evolutionary medicine.
Create and test new hypotheses to examine diseases not previously addressed by the evolutionary approach.

Health, disease, and aging
Analyze arguments concerning disease and aging and explain how these fit within the paradigm of evolutionary medicine.
Evaluate specific arguments that relate to disease and aging within evolutionary medicine.
Create new arguments concerning disease and aging and be able to determine their validity within evolutionary medicine.

Social definitions of race.
Analyze biological and social explanations and explain how their constituent parts are explained within evolutionary reasoning.
Evaluate specific causal arguments concerning biological and social definitions of race within evolutionary reasoning.
Create new causal arguments concerning biological and social concepts of race and their impact in evolutionary medicine.

Course Organization and Evaluation:

The course periods will consist of lecture, discussion, and active learning (individual and group exercises.) Time may be given in sessions for students to spend time in the library, at the computer center, or for working on problems. Students should bring a scientific calculator to every class. Formative evaluations will be given consistently through the term, and may consist of things such as one minute papers, muddiest points, pro & con grids, and concept maps. Also, formative assessments will be conducted throughout the course using the Turning Point Classroom response system. The summative evaluation will consist of one test, two in class examinations, weekly homework assignments, and one research term paper.

Prerequisites:

The prerequisites for this class are completion of the UNST foundation courses (100, 110, 120, 130, & 140.) The other prerequisite is an inquisitive mind. Students should be aware that this class will build on the analytical reasoning skills you developed in UNST 130 and therefore does require use of mathematical and statistical tools. I will review all the mathematics required to comprehend the topics addressed in the course. Finally, since this course does focus on biological and medical topics, students should consider their background in biology before deciding to take this (Biol. 100 or Biol. 101 are recommended but not required.)

Readings:

These will be assigned weekly from the required texts and also from additional journal and magazine articles from the primary research literature as they become relevant. Whenever additional readings are assigned, there will be a 1 page typed summary and critique of them due at the next class. Finally, all lecture notes will be made available on black board, after the lecture is given in class.

Grading:

The final grade will consist of one in-class test [0.20], quizzes (clicker and paper) [0.20], midterm examination [0.20], final examination [0.20], and homework [0.20].

Clickers:

We will be using the Turning Point Classroom response system, all students should have their TP clickers from last year, if not you can purchase one at the bookstore. Students should have their clicker at each class.

Turnitin

All written materials in this class will be turned in electronically via Turnitin.com. Access to this web site will be given to you by the instructor. Turnitin compares your writing with virtually every reference that exists on the internet as well as a bank of student papers that have been submitted from all over the world. Its purpose is to help students learn the difference between proper citation and quotation of other authors' work and plagiarism (copying others writing without citation.)

The URL for turnitin.com is: http://www.turnitin.org/static/home.html

You will go there and create a user profile using the following information:

class ID: 2765661
password: GCWilliams

Enrollment:

All students must be officially enrolled in the course by the end of the first week of the semester. No requests to add the course will be approved by the professor. Enrolling officially and on time is solely the responsibility of each student.

Attendance/Participation:

University Studies strives to professionalize its students; therefore, regular attendance and punctuality are mandatory in all UNST courses. Attendance will be taken at the beginning of each class. Tardiness will not be tolerated. Absent or tardy students are responsible for any missed class work, including any changes to the syllabus or assignments announced in class. In short, absences and tardiness can/will diminish your grade. If you suffer prolonged illness or misfortune, you should consider dropping the course. Persistent tardiness and failure to observe established classroom etiquette will lead to failure of the course. Student athletes must submit a schedule of days they will be absent within the first week of classes.

Students will automatically receive an "F" for missing the equivalent of two weeks of class (six absences for a M, W, F schedule; four absences for a T, R schedule). At half the allotted absences (three absences for a M, W, F schedule; two absences for a T, R schedule), students are required to meet with instructor for a mandatory one-on-one conference concerning their performance in class. Students are responsible for checking her/his email for instructor communication. If the instructor does not receive a response regarding an attendance conference, the opportunity is revoked.

Absence or tardiness is only excused for emergency situations. Students are responsible for submitting acceptable documentation for the excused absence within one week of the absence.

Examples of acceptable documentation include:
Written doctor's note specifically requesting an excused absence (with the specific time and date on the notification)
Obituary or service
An official written summons to court

Persistent tardiness and failure to observe established classroom etiquette will not be tolerated. All cell phones and personal pagers must be tuned off for the duration of the class period.

Timely Submission of Work

All assignments are due on the dates indicated in the schedule. Late work will not be accepted. Exceptions will be made only in cases of emergencies involving family, medical, or religious reasons and must be arranged before the assignment is due. You can reach your professor by e-mail or by leaving a phone message. Employment or other academic pressures do not constitute an excuse. Please note all due dates on the syllabus and plan ahead. There is no provision in this course for additional papers for extra credit or to substitute for requirements.

Academic Integrity: Academic honesty is absolutely essential. Cheating, plagiarism or other academic misconduct will not be tolerated. If you are caught cheating, you will not pass this course and will be subject to any and all penalties specified in the student honor code.

Students with a disability are responsible for making their needs known to the instructor and seeking necessary assistance in a timely manner.

Student Conduct & Discipline:

North Carolina A&T State University has rules and regulations that govern student conduct and discipline meant to ensure the orderly and efficient conduct of the educational enterprise. It is the responsibility of each student to be knowledgeable about the rules and regulations. Please consult the undergraduate bulletin: http://www.ncat.edu/~acdaffrs/Bulletin_2008-2010/2008-2010_Undergraduate_Bulletin .pdf and the student handbookhttp://www.ncat.edu/~deanofst/Handbook.htm for detailed information about specific policies such as academic dishonesty, cell phones, change of grade, disability services, disruptive behavior, general class attendance, grade of appeal, incomplete grades, make up work, student grievance procedures, withdrawal, etc.

Student Handbook: http://www.ncat.edu/~deanofst/handbook.htm

Family Educational Rights and Privacy Act:
http://www.ncat.edu/~registra/ferpa_info/index.htm

Projected Topics Schedule[1]:

Part I. Nothing in biology makes sense except in the light of evolution…

Weeks 1 - 3. Basic definitions

The scientific method (reviewed.)

Pre-scientific medicine (zoopharmacognosy and ancient medicine)

Definition of life and the logical necessity of evolution.

Simple versus complex genetics
The evidence falsifying creationism: simply explained – why this is relevant to medical research and practice.
Differential reproductive success – Darwinian fitness

In this part students will test evolutionary predictions utilizing state of the art computer applications such as Populus 5.4 and AVIDA (artificial life simulation.) Both are free access software downloadable from the internet:

http://www.cbs.umn.edu/populus/

http://avida-ed.msu.edu/

Readings:

Raman, R. and Kandula, S, Zoopharmacognosy: Self-Medication in Wild Animals, *Resonance*, March 2008.

Dobzhansky, T, Nothing in Biology Makes Sense Except in the Light of Evolution, *The American Biology Teacher*, *35*(3), 125-129, (1973).

Graves, J.L., Making Sense of Biology: http://evostudies.org/blog/?p=97, 7-2-2009.

Articles on Evolutionary Genetics at Nature Scitable:
http://www.nature.com/scitable/topic/Evolutionary-Genetics-13

1. Negative Selection
2. Natural Selection: Uncovering Mechanisms of Evolutionary Adaptation to Infectious Disease
3. Genetic Mutation
4. Evolutionary Adaptation in the Human Lineage

First in class Clicker Quiz: August 25, 2009 (others quizzes TBA).

First In-class Test: September 3rd, 2009

Term Paper Thesis Due: September 3rd 2009
Term Paper Outline Due: September 17th 2009
Homework is "just in time", which means assignments will be devised as needed to reinforce core concepts in the course. You can expect at least one homework assignment per week.

Part II. Understanding the Meaning of Health in an Evolutionary Context
Weeks 4 - 6. Tuesday – Thursday: Definition of health, disease, and aging.

Readings:

Neese and Williams, chapters 1 – 5, pp. 3 – 76.
Graves, J.L., General Theories of Aging: Unification and Synthesis, in Principles of Neural Aging, pp. 35-55, Eds. Sergio F. Dani, MD., Akira Hori, MD., and Gerhard F. Walter, MD, Ph.D, (Amsterdam: Elsevier Press), 1997*.

Nesse, R., How is Darwinian medicine useful? Western J. Med., v.174 (5); May 2001*.

(*In course documents – Blackboard.)

Part III. Critical Thinking About Biomedical Research and Clinical Practice

Weeks 7 - 9

Readings

Nesse and Williams, Chapters 6 – 10, pp. 77-158.

Graves, J.L. and Rose, M.R. (2006) Against Racial Medicine, Patterns of Prejudice vol. 40 (4-5): 481-493, Sander Gilman editor*.

Wilkinson R. and Marmot, M., The Social Determinants of Health: The Solid Facts, 2nd Ed, World Health Organization, 2001*.

Graves, J.L., Making Sense of Biology: http://evostudies.org/blog/?p=97, 8-6-2009.

(in course documents)

Midterm Examination: October 8, 2009

Part IV. Birth, Life, Death, and Insanity: Homage to the Red Queen.

"But that the dread of something after death, — The undiscover'd country, from whose bourn No traveller returns, — puzzles the will, And makes us rather bear those ills we have Than fly to others that we know naught of?"

Hamlet, Act 3, Scene I.

Weeks 10 - 12

Neese and Williams, Chapters 11 - 14.

Trevathan, W.R., Evolutionary Obstetrics, in Evolutionary Medicine, (New York, NY: Oxford University Press), 1999.*

Liberles, D.A., Red queens, linkage, redundancy and synfunctionalization, *Heredity* (2008) 101, 299–300; doi:10.1038/hdy.2008.81; published online 13 August 2008.*

(*in course documents).

Thursday November 13, 2009: First Draft Term Paper Due

Part IV. Critical Thinking About Stealth: What you don't know will kill you or why it is good to be a venereal disease.

Weeks 13 - 15

Ewald, Chapters 1 – 4, pp. 1 – 59.
Dvm, E. et al., Viruses use stealth technology to escape from the host immune system, Molecular Medicine Today vol. (3):3, pp. 116-123, 1997*.
(*In course documents.)

Part VI. Recapitulation and Conclusion: How I learned to stop worrying and embrace evolution.

Week 16.

Readings

Ewald, Chapters 5 – 8, pp. 71 - 126.

Rose, M.R., The Long Tomorrow, in *The Long Tomorrow: How Advances in Evolutionary Biology Can Help Us Solve Aging*, (New York, NY: Oxford University Press.)

Term Paper due: Thursday December 3rd, 2009 at 2:00 PM.

Final Examination: Friday December 8, 2009; 3:30- 5:30 PM.

1. **The topic schedule is subject to change.**