

SEMESTER AT SEA COURSE SYLLABUS
University of Virginia, Academic Sponsor

Voyage: Fall 2014
Discipline: Biology
BIOL 1559-101: Modern Evolutionary Theory
Division: Lower
Faculty Name: John Dahl
Credit Hours: 3; Contact Hours: 38

Pre-requisites:

A high-school course that has covered basic molecular and cellular biology, botany, and zoology.

COURSE DESCRIPTION

The theory of evolution is a simple but elegant idea that species arose from a common ancestor and that new species continue to arise as a result of natural selection working on the biological diversity of existing populations. Evolutionary Biology is a cornerstone of modern science, and since its introduction by Charles Darwin over 150 years ago it has produced a dramatic paradigm shift in how humans view themselves and all life on this planet. The established truth of evolutionary theory has long been muddled and misinterpreted in American classrooms, which has contributed to an estimated 46% of Americans claiming not to believe in human evolution. This course will explore the history of evolutionary theory, review scientific evidence for evolution-particularly focusing upon the explosion of insights provided by Molecular Biology in the past 20 years, discuss social implications of the theory of evolution, and examine modern challenges like infectious diseases, genetic modification of crops, and climate changes that are particularly interesting from the perspective of evolution. Several sites on the voyage will be significant with regards to the topic of Evolution, and the course syllabus was designed to match topics with individual countries and regions. Darwin visit to South America played a pivotal role in the formulation of his theory. HIV and drug-resistant tuberculosis are modern examples of evolution in Russia and Africa, Morocco is a treasure trove of Cambrian fossils, and human ancestry traces its origins to Africa.

COURSE OBJECTIVES

1. To help students understand why it is important to understand evolutionary theory, what its modern implications are, and how evolution is one of the most simplest and powerful ideas in the history of human thought.
2. To have students understand how science operates ('scientific method') and the types of problems science can and cannot successfully address.
3. To show students the wide breadth of evidence that supports the fact of evolution by natural selection; evidence that draws from the areas of comparative anatomy, biogeography, paleontology, and molecular biology.
4. To introduce students to the lives, life-styles, and discoveries of several historical figures that played major roles in the formulation of the evolutionary theory including Charles Darwin, Alfred Wallace, and numerous others.
5. To explore with students the impact that evolutionary theory has had on 19th -21st century world society, including the economic policy of the former USSR and fundamentalist Christian movements in the USA.
6. To expose students to modern evolutionary writing aimed at the general public (selected works by Wilson, Gould, and Dawkins).
7. To provide students with a global perspective of evolutionary theory and an appreciation of the planet's biological diversity that has been made possible by evolution by natural selection.

REQUIRED TEXTBOOKS

AUTHOR: Jerry A. Coyne

TITLE: Why Evolution is True

PUBLISHER: Viking (Penguin)

ISBN #: 978-0-670-02053-9

DATE/EDITION: 2009/1st

One bound notebook to turn in written assignments

One bound drawing pad to make observations and drawings in

TOPICAL OUTLINE OF COURSE

Depart **Southampton**- August 23:

B1- August 26: Introduction to the course and to its field program. Why understanding evolution matters and an overview of evidence for evolution

Questions to be Addressed:

- What is the evolution of the theory of evolution?
- What is evolution and why do you need to know about it?
- Is evolution a fact or a theory?
- What evidence exists for evolution?

Reading Assignment:

Why Evolution is True (WEIT) Preface and Introduction

What Darwin Didn't Know (Nat. Geographic) (pdf)

Assignment Due Today:

Watch the movie BBC films *The Genius of Darwin* (part 1)* and *The Voyage of Charles Darwin* (part 1) before next period

* = film is available to each student on a DVD containing downloaded material

B2-August 28: Russia: Early theories of life, Lamarckian evolution, MDR-TB

Questions to be Addressed:

- How did political-social forces in the Soviet Union lead to disastrous decisions based upon faulty ideas of evolution?
- Where did *M. tuberculosis* come from?
- What factors have driven the rise of multiple drug-resistant tuberculosis (MDR-TB)?
- How bad is drug-resistant tuberculosis?

Reading Assignment:

Why Evolution is True (WEIT) Chpt. 1

Chpt. 7 from the book *Timebomb* (pdf), Timebomb book review (pdf)

Illustrated letter (pdf)

Assignment Due Today:

Watch the PBS films *Evolution: Evolutionary Arms Race** and *Radioactive Wolves** before arriving in Russia

St. Petersburg: August 29- September 2

B3- September 2: Charles Darwin and the Origin of Species

Questions to be Addressed:

- Who was Charles Darwin?
- What led him to formulate his theory of evolution?
- Why did it take him so long to present his case to the public?
- Was Darwin right?

Reading Assignment:

Read Chpt. 4 of *Annotated Origin of Species* (pdf) and a graphic novel version of this chapter (pdf)

Assignment Due Today:

Watch the BBC film *The Voyage of Charles Darwin* (part 2)* and *Race: The Power of Illusion* before next period

B4- September 4: Keeping a naturalist journal

Questions to be Addressed:

- What kinds of drawings should I make?

Reading Assignment:

Assignment Due Today:

Will practice making drawings by the end of the period

Gdansk: September 5-7

Rostock: September 8-9

B5- September 11: Biological definition of “race”, Evolution as a tool of political propaganda in Nazi Germany

Questions to be Addressed:

- Does the term “race” have any biological significance?
- What is the origin of the idea of a master (Aryan) race?
- What is eugenics philosophy?

Reading Assignment:

WEIT Chpt. 8, p. 212-216

Case-based study: *Desiree’s Baby*

Assignment Due Today:

Watch the movies *GATTACA* and *The Genius of Darwin* (part 2)* and the short video *Walt Disney’s Education for Death* (10 min)* before next class period

B6- September 13: Evolution of Social Behavior, parallels with the Great War (WW I)

Questions to be Addressed:

- Does evolution drive the formation of altruistic social systems?
- What is inclusive fitness and kin selection?
- What is a social cheater?

Reading Assignment:

Read the Scientific American article: *Punishing Cheaters Promotes the Evolution of Cooperation* (pdf)

Altruism and Aggression from the book *In Search of Nature* (pdf)

Assignment Due Today:

Writing assignments for Case-based study: *Desiree’s Baby*

Watch the movie *Paths of Glory* and *Myxobacteria* (10 min)* before arriving in Belgium
Quiz #1

Antwerp: September 14-16

Le Havre: September 17-19

B7-September 21: The Engine of Evolution: Natural Selection and Genetic Drift

Questions to be Addressed:

- What is the Hardy-Weinberg equation and how is it used?
- What are some of life's most amazing adaptations?
- Is evolution a random event?
- How can something as complex as the vertebrate eye arise by evolution?
- What was Malthus' contribution to the theory of evolution?

Reading Assignment:

WEIT Chpt. 5

Case-based study: *The Death of Baby Pierre*

Assignment Due Today:

Watch the BBC film: *The Voyage of Charles Darwin* (part 3) before next period

B8- September 23: Food issues involving evolution

Questions to be Addressed:

- Why are crops and genetically modified?
- What concerns exist for genetically modifying food?
- Is genetic erosion a threat to our food supply?

Reading Assignment:

Three Scientific American Articles on food: *History of Processed Food*, *Are Engineered Goods Evil*, and *Fight the GM Food Scare* (pdf)

Chapter 9 (*Evolution and Our Food*) from *Evolving: The Human Effect and Why It Matters* by D.J. Fairbanks (pdf)

Assignment Due Today:

Case-based study: *The Death of Baby Pierre*

Watch the film *Food, Inc.* before next period

At dinner tonight class eats and discusses domesticated food crops

Dublin: September 24-27

B9- September 29: Origin of Life, Cambrian Explosion

Questions to be Addressed:

- What are different theories for the origin of life?
- How has life altered the planet?
- How did multicellular life begin?
- Could life exist on other planets?

Reading Assignment:

Chpt 14 from the book *Vital Dust* (pdf) and Chpt 2 from the book *Wonderful Life* (pdf); Burgess Shale images (pdf)

Case-based study: *The Molecular Origin of Life*

Assignment Due Today:

Watch the movie *First Life-Arrival* (David Attenborough* and Watch the BBC film: *The Voyage of Charles Darwin* (part 4) before the next class period

B10- October 6: Age of Earth and the fossil record

Questions to be Addressed:

- What is a “missing link” and is it necessary to support the theory of evolution?
- How are fossils made and dated and how do they show gradual change?
- What are some of the most amazing fossil finds and what do they tell us?

Reading Assignment:

WEIT Chpt. 2

Case-based study: *Seven Skeletons and a Mystery*

Assignment Due Today:

Watch the movies *The History of Earth** and *Decoding Neanderthals** before next class

Quiz #2

Lisbon: October 1-2

In transit: October 3

Cadiz: October 4-5

B11- October 12: Speciation

Questions to be Addressed:

- What drives variation in species?
- Of what value is biological diversity to humans?
- Can we see evolution of new species happening today?

Reading Assignment:

WEIT Chpt. 7

Assignment Due Today:

Casablanca: October 8-11

B12-October 14: Biogeography: the study of the distribution of species on Earth

Questions to be Addressed:

- What was so special about the Galapagos Islands?
- What is convergent evolution?
- How do island ecologies support the theory of evolution?

Reading Assignment:

WEIT Chpt. 4

Assignment Due Today:

Watch the BBC film: *The Voyage of Charles Darwin* (part 5) before next class

B13- October 20: A12- October 19: Human Evolution

Questions to be Addressed:

- Did humans evolve from chimpanzees?
- What evidence exists for human evolution and human migration?
- Who was “Mitochondrial Eve”?

Reading Assignment:

WEIT Chpt. 8

Chpt. 2 from the book *The Secret of Life* (pdf); Human Hybrids (pdf);

Time magazine – Up from the Apes (pdf)

Assignment Due Today:

Watch the movies *Journey of Man**, *NOVA: What Makes Us Humans?**, and *NOVA: Becoming Humans** before leaving Senegal

Dakar: October 16-19

B14- October 22: HIV: the origin and evolution of a virus

Questions to be Addressed:

- Where did HIV come from?
- Why is it so hard to stop HIV?
- Why does the virus evolve so quickly?

Reading Assignment:

Chpt. 1 from *Evolutionary Analysis* 4th edition (pdf)

Case-based study: *Chimp droppings*

Assignment Due Today:

Watch the movie *Origin of AIDS** before the next class period

B15- October 24: HIV: evolution of resistance to the virus

Questions to be Addressed:

- Why are some people naturally immune to HIV disease (AIDS)?

Reading Assignment:

Chpt. 1 from *Evolutionary Analysis* 4th edition (pdf)

Assignment Due Today:

Watch the movie *Surviving AIDS** before arriving in Ghana

Quiz #3

Takoradi: October 25-26

Tema: October 27-28

B16- October 30: Co-evolution and Evolutionary Ghosts

Questions to be Addressed:

- What kinds of symbiotic relationships are possible?
- What evidence exists for co-evolution?
- What are “Ghost” species of plants?
- What role did “Spiritualism” play in the history of evolution?

Reading Assignment:

Case-based study: *No Bats in the Belfry*

Wallace and spiritualism (pdf); Nature – Russell Wallace Radical (pdf)

WEIT Chpt. 2

Chpt. 1 from the book *Ghosts of Evolution* by C. Barlow (pdf)

Assignment Due Today:

Watch the movies *Evolution: Extinctions** and *The Day the Earth Almost Died** before next period

Watch the three part BBC series *Sea Monsters* before arriving in South America

B17- November 1: Radiations and Extinction

Questions to be Addressed:

- What is the Cambrian Explosion?
- How many massive extinctions have occurred in Earth’s history and why?

- Are humans driving the next great extinction?

Reading Assignment:

Is Humanity Suicidal? from the book *In Search of Nature* (pdf)

Case-based study: *Of Mammoths and Men*

Chpt. 10 (Radiations & Extinctions) from the book *The Tangled Bank* by C. Zimmer (pdf)

Assignment Due Today:

Watch the BBC film: *The Voyage of Charles Darwin* (part 6) and *End of the Line*

Study Day: November 2

B18-November 4: A Tale of Three Lice

Questions to be Addressed:

- When did hominins lose their body hair?
- When did hominins begin to wear clothes?

Reading Assignment:

WEIT Chpt. 8

Case-based study: *A Tale of Three Lice*

Assignment Due Today:

Watch the movies *Evolution: The Mind's Big Bang** and the BBC film: *The Voyage of Charles Darwin* (part 7) before next period

B19- November 6: Evolution and Sex: evolutionary reasons for sex and sexual selection

Questions to be Addressed:

- What evolutionary advantage can exist for the peacock's tail?
- What advantages and disadvantages does sexual reproduction provide?
- Do bacteria have sex?

Reading Assignment:

WEIT Chpt. 6

Case-based study: *Why is Sex Good?*

Assignment Due Today:

Watch the movies *Evolution: Why Sex?** and *The Emerald Forest* before next class

Homework before next class period: While in Brazil, everyone watch the 4 part video Bowerbirds, the Art of Seduction, and then each man will build a "bower nest" and photograph it

Rio de Janeiro: November 7-9

In-transit: November 10-11

Salvador: November 12-14

B20- November 16: Evolution in culture, art, film, and literature

Questions to be Addressed:

- How has human evolution been portrayed by Hollywood?
- What did paleoartists like Charles Knight contribute to public perception of evolution?
- What evolutionary themes appeared in the dystopian novels of H.G. Wells?

Reading Assignment:

Select chapters from *The Island of Dr. Moreau* by H.G. Wells (pdf)

Assignment Due Today:

Watch the movies *Island of Lost Souls* and *Titanoboa** before next period

Watch several short video clips* including *Gertie the Dinosaur*, *Fantasia the Rite of Spring*, *King Kong*, *The Lost World*, *2001: a Space Odyssey*, *Caveman*, *Quest for Fire*, *Skullduggery*, *Planet of the Apes*, and *Jurassic Park*

Show photographs of the man-made bowers and allow women to choose

B21- November 18: Remnants: Vestiges, Embryos, and Body Design

Questions to be Addressed:

- How do vestiges and atavisms offer evidence for how anatomy evolves?
- How are our bodies unintelligently designed?
- How do “pseudogenes” provide evidence of evolution?

Reading Assignment:

WEIT Chpt. 3

Assignment Due Today:

Watch the movie *Evolution-What Darwin Never Knew** before next class period

Study Day: November 19

B22-November 21: Evo-Devo: the evolution of development

Questions to be Addressed:

- Does the human genome size explain our complexity?
- How could the great diversity of animals evolve from a common ancestor?
- What do you have in common with a fruit fly and what are hox genes?
- What are a few genes that we share with chimpanzees that have significant differences in their sequences leading to major differences in our two species?

Reading Assignment:

Chpt 10 (A Beautiful Mind: the Making of Homo sapiens) from the book *Endless Forms Most Beautiful: The New Evidence for Evo Devo* by S. Carroll (pdf)

Assignment Due Today:

Watch the movie *Creation* before arriving in Barbados

Quiz #4

Bridgetown: November 22-24

B23-November 26: The debate over “Scientific Creationism” and Intelligent Design

Questions to be Addressed:

- What are creationist arguments?
- Does accepting the theory of evolution require one to become an atheist?
- Why is the theory of evolution such an emotionally charged issue for so many?

Reading Assignment:

WEIT Preface and Introduction

Read the letter from Richard Dawkins to his daughter (pdf)

Assignment Due Today:

Watch the films *Judgment Day: Intelligent Design on Trial** and *American Experience: The Monkey Trial* * and the youtube clips* *Richard Dawkins reads his hate mail*, *Aboriginal Creation Myth*, and *Kraus Creationist Museum Protest* before the next period

B24- November 28: Evolution of behavior

Questions to be Addressed:

- “Why should the fifth ape love thy neighbor?”
- Can evolution explain the existence of religion?
- What is origin of emotion and language?
- What evolutionary explanations exist for us being social animals?

Reading Assignment:

WEIT Chpt. 9

Chpt. 20 of the book *The Social Conquest of Earth* by E.O. Wilson (pdf)

Article from *The Economist*: “Where angels no longer fear to tread” (pdf)

The Ritual Animal (pdf)

Assignment Due Today:

Watch the movies *The Genius of Darwin* (part 3)*, *Evolution–What About God?**, and *Cuba: the Accidental Eden** before arriving in Havana

Havana: November 29- December 2

Study Day- December 3

Assignment Due Today:

Watch the collection of videos in the folder titled “Evolution humor” *
Completed Field Journal and Completed Class Journal

B25-December 4 (B Day Finals): Quiz #5

FIELD WORK

Field lab attendance is mandatory for all students enrolled in this course. Please do not book individual travel plans or a Semester at Sea sponsored trip on the day of our field lab.

***FIELD LAB** (At least 20 percent of the contact hours for each course, to be led by the instructor.)*

Visit a zoo and a botanical garden in **Belgium**. The day of the field lab would begin at the **Antwerp Zoo**, which is one of the oldest zoos in the world (founded in 1843) and within walking distance of the ship. A visit to the zoo would include a focused study of two areas (the monkey and reptile houses).

<http://www.zooantwerpen.be/>

Following this visit the students will take a 36 km (30 min bus ride) from the zoo to the **National Botanic Garden of Belgium** on the northern side of Brussels. The group will be led on a 2 hour tour of “The Evolution House” (one of several greenhouses in the giant Plant Palace) that spans 500 million years of plant evolution from the Jurassic period to the present.

<http://www.br.fgov.be/PUBLIC/GENERAL/universities.php>

Within 5 days of the visit, a 1000-word report will be due on the topic “How a visit to a zoological and botanical garden enhanced my understanding of the evolutionary process”. Participation in the zoo visit and the quality of this report will constitute 20% of the student’s course grade.

FIELD ASSIGNMENTS

- Students will keep a field journal of their experiences throughout the voyage with the intent of recording in drawings and descriptions flora and fauna they witness throughout the voyage. The purposes of this will be to simulate the experience Darwin had in his historic voyage, to train students in the skills of naturalistic observations, and to allow students to develop their skills in scientific illustration.
- Towards the conclusion of the course (following immediately after the fifth quiz on Dec. 8th), students will orally present short power point presentations in which they show 2-4 slides containing photos of images they took during the entire length of the trip that illustrates some evolutionary principle/observation. During these short presentations, students will also point out some problem they observed during the trip that has some kind of evolutionary significance.

METHODS OF EVALUATION / GRADING RUBRIC

Teaching Methods:

Lectures and discussions will be the primary formats for delivering content in class and will be interspersed with application-related experiences and small group work. Student work will include small group projects and attendance and participation is expected for each lecture period.

Readiness concept: The responsibility to learn is fundamentally that of the student. In order to succeed in a new subject, students must be actively engaged in the process of learning. Preparation for each class is essential and requires that each student read the assigned readings, have deeply processed issues, and be able to express a point of view.

Course requirements and Evaluation:

Final course grade will be based upon the following percentages:

5 quizzes (10% each). Each quiz will consist of multiple choice, true/false, and short essays

Completed Field Journal (15%)

Student paper based upon field lab (20%)

Completed Class Journal (15%)

Grade will be determined based upon the following final percentages of possible points:

A+	100 - 97.6%
A	97.5 - 92.6%
A-	92.5 - 90.0%
B+	89.9 - 87.6%
B	87.5 - 82.6%
B-	82.5 - 80.0%
C+	79.5 - 77.6%
C	72.6 - 77.5%
C-	72.5 - 70.0%
D+	69.9 - 67.6%
D	67.5 - 62.6%
D-	62.5 - 60.0%
F	59.9% and below.

RESERVE LIBRARY LIST

AUTHOR: Charles Darwin

TITLE: Origin of the Species by Means of Natural Selection

PUBLISHER:

ISBN #:

DATE/EDITION: (currently in SAS stacks)

ADDITIONAL RESOURCES

Students will have access to the following DVD movies via onboard CCTV. Watching these movies will be a required part of course activities:

Evolution: Darwin's Dangerous Idea

Evolution: Evolutionary Arms Race

Evolution: Great Transformations

Evolution: Why Sex?

Evolution: What About God?

Evolution: Extinctions

Evolution: The Mind's Big Bang

Food, Inc.

GATTACA

Creation

American Experience: The Monkey Trial

Judgment Day: Intelligent Design on Trial

End of the Line

Journey of Man

HONOR CODE

Semester at Sea students enroll in an academic program administered by the University of Virginia, and thus bind themselves to the University's honor code. The code prohibits all acts of lying, cheating, and stealing. Please consult the Voyager's Handbook for further explanation of what constitutes an honor offense.

Each written assignment for this course must be pledged by the student as follows: "On my honor as a student, I pledge that I have neither given nor received aid on this assignment." The pledge must be signed, or, in the case of an electronic file, signed "[signed]."