CC106: Biodiversity / Causes & Consequences

I. COURSE DESCRIPTION

A. Why this course should interest you.

Everyone is regularly confronted by questions that relate to biodiversity — in the voting booth, at the auto dealership, in the doctor's office, and in the supermarket aisle. Should you vote in favor of more stringent anti-pollution legislation? Should you drive an SUV? Should you buy genetically modified produce? Should you take antibiotics to treat a cold? Beyond their immediate impacts on your day-to-day existence, these questions have broader consequences for biodiversity and for the future well being of humanity.

B. Scientific explanations for biodiversity.

This course is designed to supply the conceptual framework for a lifelong understanding of the causes and consequences of biodiversity. The course will center on an inclusive biodiversity equation that encapsulates both the creative forces that generate biological novelty and the destructive forces that eliminate it. These forces span the entire biological hierarchy from molecules to cells, organisms, societies, and ecosystems. Major topics will include the origin of life, the history of organismal complexity, the relationship of the biosphere to the geosphere, and the various forms of intimate interaction that exist between species, both beneficial and exploitative.

C. A different perspective on human history.

Human activity impacts biodiversity and biodiversity impacts human history. The concluding section of the course will evaluate aspects of human evolution and human history in light of biodiversity principles.

II. COURSE INSTRUCTORS

If you need to meet with an instructor, but can’t attend his or her office hours, contact them by e-mail to arrange an appointment.

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Office</th>
<th>E-mail</th>
<th>Dept. Web Link</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Finnerty</td>
<td>BRB 425</td>
<td><a href="mailto:jrf3@bu.edu">jrf3@bu.edu</a></td>
<td>Bio Dept</td>
<td>Tu/10-12</td>
</tr>
<tr>
<td>(course coordinator)</td>
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<td>Daniel Hudon</td>
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<td><a href="mailto:hudon@bu.edu">hudon@bu.edu</a></td>
<td>Core</td>
<td>TBA</td>
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<td>(lab coordinator)</td>
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<td>Alex Coverdill</td>
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<td>Scott Mohr</td>
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<td>TBA</td>
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<td>Nathan Phillips</td>
<td>STO 441</td>
<td><a href="mailto:nathan@bu.edu">nathan@bu.edu</a></td>
<td>CEES</td>
<td>TBA</td>
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III. GRADING

<table>
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<tr>
<th>Component of Grade</th>
<th>Description</th>
<th>Fraction of Grade</th>
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<tbody>
<tr>
<td>Mid-term Exam I</td>
<td>This exam will cover material from lectures 1-9, discussions A-D, lab 1, and integrating forum I. Questions will be in multiple choice format. The material contained in the lecture notes will be heavily emphasized. You will be expected to understand the required readings, particularly as they pertain to the material covered in lecture. You will not be asked to remember details from the readings that were not covered in lecture.</td>
<td>20%</td>
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<tr>
<td>Mid-term Exam II</td>
<td>This exam will cover material from lectures 10-14, discussions E-H, lab 2-3, and integrating forum II.</td>
<td>20%</td>
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<tr>
<td>Final Exam</td>
<td>This exam will cover material from lectures 15-23, discussions I-L, labs 4-5, and integrating forum III.</td>
<td>20%</td>
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<tr>
<td>Discussion</td>
<td>Short quizzes (or exercises) will be given during each discussion. Quizzes will focus on issues that were covered in lecture and the readings that are assigned for each discussion. Additionally, one quarter of your discussion grade (or 5% of your total course grade) will be based on writing assignments assigned by your discussion instructor.</td>
<td>20%</td>
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<tr>
<td>Lab</td>
<td>The labs will require you to perform exercises and answer questions. You will work in teams of two, and you will each receive the same grade for the material you submit to your lab instructor.</td>
<td>20%</td>
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IV. READINGS

- **Biodiversity** (2002; custom edition for Boston University) Campbell & Reece.
  This text is a recommended (but not required) reference book for the course. Several copies are available for 24-hour loan in the Core office.

- **Evolution and Ecology of the Organism.** 6e. (2006) Rose & Mueller
  This text is a recommended (but not required) reference book for the course. Several copies are available for 24-hour loan in the Core office.

- **Why is Sex Fun? The Evolution of Human Sexuality** (1998) Jared Diamond
  Several chapters are required reading for the course. *Purchase is recommended.*

  Several chapters are required reading for the course. *Purchase is recommended.*

  Two chapters are required reading for the course. *Pdf files for these chapters are posted on the course website.*

V. COURSE WEB SITE: (http://www.bu.edu/core/cc106)

The course website contains all the information present in this syllabus plus additional resources including downloadable course notes, laboratory manuals, required and supplemental readings, animations, announcements, and biodiversity news. You should consult the course web site often. When important updates are made to the course website, you will be notified by e-mail.
VI. LECTURE & EXAM SCHEDULE

Location: SMG 105; Time: Tuesdays and Thursdays from 2:00-3:30.

Students are expected to attend all lectures. The material covered during lecture will be weighted heavily on the two midterm term examinations and the final exam.

January 15  1. Why biodiversity matters to humanity.
Lecturer: Finnerty
Readings: none

January 20  2. Life & biodiversity; definitions, causes, & consequences
Lecturer: Finnerty
Readings: Ridley, pp. 1-27 "Keeping Living Things Simple"

January 22  3. Historical evidence of Earth’s biodiversity. The fossil record.
Lecturer: Hudon
Readings: Campbell & Reece, pp. 510-533

January 27  4. The history of life on Earth
Lecturer: Hudon
Readings: Campbell & Reece, pp. 510-533

January 28  LAST DAY TO ADD CLASSES

January 29  5. Emergence of life at the molecular level: the nature of biological macromolecules & hypotheses on the first life forms.
Lecturer: Mohr

February 3  6. Heredity. Mendelian genetics and the architecture of the genome
Lecturer: Finnerty
Readings: Rose & Mueller, pp. 3-23, especially "Darwin Needed Mendel;" pp. 125-143, "Natural Selection"

February 5  7. Diversity at the DNA Level
Lecturer: Mohr
Readings: Rose & Mueller, pp. 165-186, "Molecular Evolution"

February 10  8. Diversity at the DNA level affects diversity at the protein level
Lecturer: Mohr
Readings: Campbell & Reece, pp. 303-326, "From Gene to Protein"

February 12  9. Protein function and diversity
Lecturer: Mohr
Readings: Campbell & Reece, pp. 71-80, "Proteins—Many Structures, Many Functions"
February 19  INTEGRATING FORUM I: Synthetic Life  
Moderator: Mohr  
Readings: To be announced.

February 21  Last Day to Drop with a ‘W’; Last Day to Change from Credit to Audit

February 24  EXAM I; Covers lectures 1-9, discussions A-D, lab 1, and forum 1.

February 26  10. The Cell  
Lecturer: Coverdill  
Readings: Campbell & Reece, pp. 106-135 "A Tour of the Cell"

February 28  11. Multicellular Development as an Engine of Complexity & Diversity  
Lecturer: Coverdill  

March 3  12. Why Sex?  
Lecturer: Finnerty  
Readings: Ridley, pp 108-132, “The ultimate existential absurdity;”  
Rose & Mueller, pp. 531-555, “Evolution & Ecology of Sex”

March 7-15  SPRING BREAK

March 18  13. The Consequences of Sex & The Diversity of Mating Systems.  
Lecturer: Phillips  

March 19  14. Game Theory & Evolutionary Stable Strategies—How Does What You Do Affect What I Should Do?  
Lecturer: Snyder  
Readings: To be announced.

March 24  INTEGRATING FORUM II: Parental Investment in 21st Century America. The Shifting Roles, Rights, and Responsibilities of Men & Women  
Moderator: Phillips  
Readings: Diamond—Why is Sex Fun?: pp. 41-62, "Why Don’t Men Breastfeed?"

March 26  EXAM II. Covering lectures 10-14, discussions E-H, labs 2-3 & forum II.

March 30  Last Day to DROP Classes and Earn a ‘W’

March 31  15. What is the “Environment”  
Lecturer: Phillips  
Readings: Rose & Mueller, pp. 351-379, “Competition”
16. How does the environment impact the organism—Natural Selection and Phenotypic Plasticity

Lecturer: Coverdill
Readings: Gilbert (2001) "Ecological Developmental Biology"

17. Organisms Affect the Abiotic Environment

Lecturer: Phillips

18. The Biotic Environment / Organismal Co-Evolution

Lecturer: Finnerty

19. Human Evolution and The Human Diaspora

Lecturer: Finnerty

20. The Evolution of Food Production.

Lecturer: Finnerty

21. Biodiversity as a Factor in Human Conflicts

Lecturer: Finnerty
Readings: Diamond, —*Guns, Germs, & Steel*, pp. 53-66, "A Natural Experiment of History"

22. Anthropogenic Environmental Change and Its Consequences for Biodiversity

Lecturer: Finnerty

23. Substitute Monday Schedule

24. Integrating Forum III. Global Climate Change

Moderator: Phillips
Readings: To be announced.

May 7      FINAL EXAM. Covering lectures 15-23, discussion I-L, forum III, (9-11 am) & labs 4-5.
VII. LAB SCHEDULE [All labs are held in SCI 307]
(http://www.bu.edu/core/cc106/CC106_2009_LabSchedule.html)

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<tr>
<th>LAB</th>
<th>SECTION</th>
<th>DATES</th>
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<tbody>
<tr>
<td></td>
<td>GROUP 4 [M2, M4, M6]</td>
<td>Lab meets: Feb. 4 Report due: Feb. 18</td>
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<tr>
<td></td>
<td>GROUP 4 [M2, M4, M6]</td>
<td>Lab meets: Feb. 18 Report due: March 4</td>
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<td></td>
<td>GROUP 3 [L4, L5]</td>
<td>Lab meets: March 2 Report due: March 30</td>
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<td></td>
<td>GROUP 4 [M2, M4, M6]</td>
<td>Lab meets: March 4 Report due: April 1</td>
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<tr>
<td>IV. Biosphere 3, part A</td>
<td>GROUP 1 [L1,L3]</td>
<td>Lab meets: March 23 Report due: April 6</td>
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<td>GROUP 2 [M1, M3, M5]</td>
<td>Lab meets: March 25 Report due: April 8</td>
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<td></td>
<td>GROUP 3 [L4, L5]</td>
<td>Lab meets: March 30 Report due: April 13</td>
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<td></td>
<td>GROUP 4 [M2, M4, M6]</td>
<td>Lab meets: April 1 Report due: April 15</td>
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<tr>
<td>V. Biosphere 3, part B</td>
<td>GROUP 1 [L1,L3]</td>
<td>Lab meets: April 6 Report due: April 21*</td>
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<td></td>
<td>GROUP 2 [M1, M3, M5]</td>
<td>Lab meets: April 8 Report due: April 21*</td>
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<td>GROUP 3 [L4, L6]</td>
<td>Lab meets: April 13 Report due: April 28*</td>
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<td></td>
<td>GROUP 4 [M2, M4, M6]</td>
<td>Lab meets: April 15 Report due: April 30*</td>
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* The report for lab 5 is due at lecture on the specified date.
VIII. DISCUSSION SCHEDULE

Attendance at discussion is mandatory. We will not directly review lecture material in discussion (as is done in CC105). Rather, the material covered in discussion will reinforce the lecture material by focusing on the same major topics, but from a different perspective. You will be responsible for the material covered in discussion on the midterm exams and the final exam. The handouts that are distributed during discussion will not be made available elsewhere.

Jan. 21, 26  A. Introduction to the course. Description of writing assignment.
Jan. 28, Feb. 2  B. Misconceptions about evolution.
Feb. 4, 9  C. Evaluating alternate hypotheses for origin of biodiversity—(1) evolution, (2) special creation, (3) “intelligent design.”
Feb. 11, 17  D. Understanding the genetic code.

End of material covered on the first midterm exam.
Feb. 18, 23  E. Sexual reproduction and the generation of diversity. How meiosis shuffles and deals the genetic cards.
March 2, 4  F. Self-organization. How simple “rules” can produce complex coordinated behavior.
March 16, 18  G. The evolution of gender differences. Why don’t male mammals lactate?

End of material covered on the second midterm exam.
Mar. 30, Apr. 7  I. Game theory.
April 6, 8  J. The evolution of agriculture and human history.
April 13, 15  K. Disease in human history.
April 22, 23  L. Global climate change.

VIII. ACADEMIC CONDUCT

It is each student's responsibility to know and understand the provisions of the Academic Conduct Code in the College of Arts and Sciences. The Code is available online at http://www.cs.bu.edu/ugradprogram/conduct.html.

Cases of suspected misconduct will be referred to the Dean of the College. If the Dean's office comes to the conclusion that cheating or plagiarism have occurred, a grade of zero will be awarded for the assignment in question.