New Undergraduate Course Approval Cover Form
Montana State University

This four-page form collects basic information about the proposed new course, provides information on the approval process, and includes all required approvals. Additional information (see INFO sheet) is also required as part of the New Course Packet.

Proposed New Course Information

Requested Rubric, Course Number, Core Designation (if needed): ENSC 260

Course Title: Evolution and Environmental Science

Abbreviated Course Title (≤ 30 chars): Evolution & the Environment

First Semester to be Offered: Spring 2015

Submitted by: Kevin M. O'Neill

Submitter’s Contact Info: Phone, Email: 994-2333  koneill@montana.edu

Instructor: Kevin M. O'Neill

Department: Land Resources and Environmental Sciences

College: Agriculture

New Course Review Process

Instructor completes the New Course Packet, with Core information if a Core designation is required.

Instructor checks for “equivalent” course in the MUS system and recommends a common or unique course number.

Department Head's signature indicates that course has been approved by the process used within the Department.

The Chair of the College Curriculum Committee signs to indicate College academic approval.

The College Dean signs to indicate that adequate resources are available to offer the course; Supporting information (Dean's Statement) is typically required.

The New Course Packet (as PDF) is uploaded to the Provost's Office server for distribution to other committees.

Course requests are sent to Curriculum and Program Committee (CPC). Core reviews are sent to appropriate Core subcommittee. Committees work in parallel when possible to speed approval process. Special topics courses (291, 491) skip the CPC review (limited to two years.)

Provost's Office reviews the new course request. New courses are submitted to MUS for Common Course Number (CCN) review. Dean and Department informed upon approval.

Approved new course sent to Registrar for inclusion in the Catalog and Schedule of Classes

Note: This diagram illustrates the typical flow path, but at any review step there can be a request for additional information or modifications. Careful review in early steps is the best way to speed the overall process. * Special topics courses (x91) require fewer signatures, but cannot be offered more than two times without committee review.
INFORMATION NEEDED FOR COMMON COURSE NUMBERING

The process for identifying a common course number for a new course is as follows:

1. Course learning outcomes are prepared for the new course.
2. The person submitting the new course request looks at the CCN website to see if a course with similar outcomes already exists in the MUS system.
   
   www.mus.edu/Qtools/CCN/ccn_default.asp
   
   • If a course exists with at least 80% of the same outcomes, the course is considered “equivalent” to the proposed new course, and the new course should use the existing rubric and course number.
   
   • If no “equivalent” course is found, the person submitting the new course request should identify a unique course number that has not been used by any other course in the MUS system.
3. The requested rubric and course number are submitted as part of the new course packet.
4. The Provost’s Office submits the learning outcomes and the requested rubric and course number to the MUS to have a course number assigned to the course. (This will typically be the requested course number, but it could be changed.)
5. The assigned common course number is reported back to the person submitting the new course request.

Requested Rubric, Course Number, Core Designation (if needed):

Course Title: ENSC 260
Abbrev. Course Title (≤ 30 char): Evolution and Environmental Science
Credits: 3
Department Offering Course: Evolution & the Environment
College: Land Resources and Environmental Sciences
Agriculture

Is this course “equivalent” to a course in the MUS System?: □ Yes ☑ No

Learning Outcomes for the Course:

Students completing the course will:
1) understand the basic mechanisms that drive micro- and macro-evolutionary change,
2) understand how micro-evolutionary hypotheses are tested in the lab and field, using a variety of organisms,
3) understand patterns of macro-evolutionary change of short and long time periods,
4) understand how macro-evolutionary hypotheses are created and tested,
5) how concepts and methods of evolutionary biology inform issues in the environmental sciences,
6) how to explore the literature for information on evolutionary biology, and
7) how to communicate basic ideas in evolutionary biology to non-specialists.
INFORMATION REQUIRED BY THE REGISTRAR

The data needed to enter the new course into the MSU Catalog and Schedule of Classes is collected on this page. Once the new course has been approved, this page is automatically forwarded to the Registrar for data entry.

Assigned Rubric, Course Number, Core Designation (if needed):

| ENSC 260 |
| Evolution and Environmental Science |
| Evolution & Environment |

First Semester to be Offered:

| Spring 2015 |

Restricted Entry/Consent of Instructor Required:  
Yes [ ] No [ ]

Instructor’s GID (last 4 digits only):

| 8127 |

Is the requested course number available? (x4155 to check):

| Yes [ ] No [ ] |

Semester(s) offered (check all that apply):

| Summer [ ] Fall [ ] Spring [ ] |

Summer Options (check all that apply):

| First 6 weeks [ ] Second 6 weeks [ ] 12 weeks [ ] |

Credits by mode of instruction:

| Lecture: 3 |
| Seminar: |
| Independent Study: |
| Lab/Studio: |
| Recitation/Discussion: |

TOTAL CREDITS: 3

Primary Mode(s) of Delivery:

| Face-to-face [ ] Web-Enhanced (small on-line component) [ ] |
| On-Line Only [ ] Blended (significant on-line portion) [ ] |

Time and Location – Call the Registrar’s Office at x4155 to find a time and location for the course.

| M [ ] Tu [ ] W [ ] Th [ ] F [ ] Sa [ ] Su [ ] |

Co- and Pre-Requisites – Courses numbered 200 and above are normally expected to have prerequisites. When listing multiple prerequisites, please separate courses with “and” if both are required, or “or” if only one is required.

| Prerequisite(s): |
| Co-Requisite(s): |

Course Description – Provide a course description of 40 words or less for the MSU Catalog.

Overview of the mechanisms and patterns of evolution, focusing methods in the field the role of evolutionary biology in understanding issues in environmental science.
DEAN’S STATEMENT

The requested course ENSC 260 is now a required course for all LRES options within the new configuration of our LRES Environmental Science major (one major with 4 options) which was approved by Faculty Senate and the Regents in Fall 2013. This request is resource neutral because the instructor, Kevin O’Neill, will transition from co-teaching BIOB 420 with Matt Lavin in PSPP to developing and teaching ENSC 260. PSPP Department Head John Sherwood is aware of this transition in LRES’ curriculum, and will have the new Plant Genetics faculty line co-teach BIOB 420 with Matt Lavin.
New Undergraduate Course Narrative  
Montana State University  
Updated August 23, 2012

Please provide the following information in narrative format. Substantive responses to all criteria are required. Although not required, a draft syllabus can also be helpful to the committee in understanding the details of the proposed course.

General Course Information

1. Requested Rubric, Course Number, and Core Designation (if any)
   - ENSC 260 (3 credits)
   - Instructor: Professor Kevin O’Neill

2. Course Title
   - Evolution & the Environment

3. Provide a general description of the course explaining the need for the course, its goals, and its overall structure. This is the most important part of the application and should offer a good sense of what students will experience by taking this class.

   General (catalog) description: Overview of the mechanisms and patterns of evolution, focusing methods in the field the role of evolutionary biology in understanding issues in environmental science.

   Need for course: At present, just one of the five degree programs in LRES requires a course in evolution (BIOB 420, which is presently co-taught by Kevin O’Neill), and this course is generally taken by students during their senior years. After a series of discussions among LRES faculty, there was a clear consensus that 1) all majors in LRES programs should be required to take a course in evolution, 2) the course should come earlier than their senior year to prepare them better for upper division courses, and 3) a major portion of the course should focus on the role evolutionary biology in informing the environmental sciences.

   All LRES majors already take BIOB 1701N (Principles of Biological Diversity) which deals with "evolutionary relationships among organisms". However, we feel that our students need a course that delves into the topic in greater detail. Students in the LRES Environmental Biology option presently take BIOB 420, but this senior-level course requires a course in genetics as a pre-requisite. The proposed course will come earlier in students' careers and include a section providing the requisite genetics background, building what students learned in BIOB 160 (Principles of Living Systems).

   The goals (learning outcomes): Students completing the course will:
   - understand the basic mechanisms that drive micro- and macro-evolutionary change,
   - understand how micro-evolutionary hypotheses are tested in the lab and field, using a variety of organisms,
   - understand patterns of macro-evolutionary change of short and long time periods,
   - understand how macro-evolutionary hypotheses are created and tested,
• how concepts and methods of evolutionary biology inform issues in the environmental sciences,
• how to explore the literature for information on evolutionary biology, and
• how to communicate basic ideas in evolutionary biology to non-specialists.

how evolutionary biology informs the environmental sciences when they deal with such issues as pesticide resistance, invasive species, habitat disturbances including pollution and climate change, conservation of endangered species, public health, and life in extreme environments.

4. **Based on what types of student work (e.g., tests, homework assignments, papers, performances, etc.) will grades be determined?**
   - Three exams
   - Frequent quizzes given on D2L, based on readings and lectures
   - Homework assignments that include work with computer simulations
   - Participation in discussions on D2L and in the classroom
   - One major semester paper
   - One short presentation to class

5. **Provide a course content outline containing all major topics plus a brief description of the material to be covered under each major topic heading.**

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Description</th>
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| 1    | Major misconceptions about evolution  
      Defining evolution and adaptation  
      A brief history of evolutionary thinking  
      Evolutionary biology and scientific methods | Perhaps no other area of modern science causes more controversy outside of science than evolutionary biology. Current and historical controversies about evolutionary thinking; sources of alternative viewpoints; working definitions of evolution and adaptation; scientific methods and the study of historical events. |
<p>| 2    | Genetics and evolutionary biology | Review of basic genetics; molecular, developmental, and population genetics. The week will focusing on what students will need to understand later materials in the course. |
| 3    | Micro-evolutionary processes: mutation, drift, and gene flow | Three of the four major processes that drive genetic and adaptive evolution: mutation, drift, and gene flow. Week will include hands-on work with basic computer simulations. |
| 4-5  | Micro-evolutionary processes: natural selection | Models and examples of natural selection, including further work with computer simulations, as well as discussion of different forms of selection: directional, stabilizing, disruptive, frequency-dependent, and the heterozygote advantage; how selection interacts with mutation, drift, and gene flow. |
| 6    | Sexual selection and kin selection | Specific models and examples of the evolution of sexual strategies of both males and females; inclusive |</p>
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<td>Constraints on adaptive evolution</td>
<td>Genetic, developmental, and environmental factors that place constraints on adaptive evolution; how to quantify rates of evolution over different time scales; how natural selection can be used to explain the evolution of complex traits.</td>
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<td>The history of life on earth</td>
<td>An overview of the history of life, based on both fossil and comparative evidence; the role of extinction; how evolutionary relationships are determined; how evo-devo studies inform studies of adaptive evolution.</td>
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<td>Macro-evolutionary processes: speciation and adaptive radiation</td>
<td>Different models of how species are formed and how those processes relate to adaptation; how evolution generates biological diversity.</td>
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<td>12-13</td>
<td>Evolution and anthropogenic habitat disturbance</td>
<td>Evolutionary responses to anthropogenic habitat disturbances; evolution in extreme environments; evolution and public health; evolution and conservation biology, including responses to climate change.</td>
</tr>
<tr>
<td>14</td>
<td>Human evolution</td>
<td>Overview of human evolutionary history; evolutionary psychology of how humans interact with their environments.</td>
</tr>
<tr>
<td>15</td>
<td>Student presentations</td>
<td>Short presentations by students that summarize papers they write on a topic relating to how evolutionary biology informs important issues in the environmental sciences.</td>
</tr>
</tbody>
</table>

6. **List required texts or other required references.**
   - *Evolution: Making Sense of Life* by Carl Zimmer and Douglas Emlen
   - *The Evolving World: Evolution in Everyday Life* by David Mindell
   - Materials written by instructor and placed on D2L

7. **What are the estimated enrollment and student credit hour (SCH) production?**
   - 30-35 students
   - 90-105 SCH (based on 3 credits)

8. **Will there be an enrollment cap that restricts enrollment below the level of student demand? If so, what is the enrollment cap and why is it necessary?**
   - No, but due to the nature of the course and the fact that it is not a Core course, we expect that enrollment will probably be mainly LRES majors.
9. Will course be a “restricted enrollment” course? If so, why is restricted enrollment necessary?
   - No

10. Describe how the success of the course will be evaluated? (“End-of-semester student evaluations” is not the answer to this question. How will the instructor determine if the learning outcomes are being met, and how will the department determine if the course is fulfilling its intended purpose?)
   - Students will be given a set of learning outcomes at the beginning of the semester, be reminded of them from time to time as they embark on new subjects or projects. A set of embedded questions on the cumulative final exam will be tailored to determine how well the outcomes were met.

11. Is the instructor a member of the regular faculty (i.e., tenured or tenure-track)? If no, please describe the instructor’s qualifications, attach a Vita, and provide a separate letter of support, signed by the department head (or appropriate unit director), addressing the instructor’s qualifications to teach this course.

   The instructor, Dr. Kevin O’Neill, is a Full Professor in LRES who has taught the following courses dealing wholly or partly with evolutionary biology at MSU:
   - Evolution (BIOB 420, formerly BIOL 403; 1999-2014); usually co-taught with Dr. Matt Lavin.
   - Behavioral Ecology (ENTO 514; 1989-2010); a course on the evolution of behavior.
   - Introduction to Entomology (BIOO 262, formerly ENTO 204), 1989-2013, a course that embeds ideas from evolutionary biology throughout.
   - Graduate Seminar (ENTO 594, formerly ENTO 500; 1985-2014); topic varies, but has included such titles as Relentless Evolution, Evolution of Social Behavior, Climate Change and Insects, The Origin of Species Revisited, Evolution of Insect Social Behavior, Evolution of Infectious Disease, Philosophical Ideas in Ecology and Evolution, and Natural Selection.
   - Science and Religion (LS 301; 2007-2012); a seminar course that included discussion of readings dealing with intersection of evolutionary biology and religion; usually co-taught with Dr. Sue Monahan.
   - Human Social Evolution (UH 494; 2013); co-taught with Dr. Steve Swinford
   - Darwin’s Insight and Darwin’s Legacy (2011, Extended University course in Wonderlust Program).

Level of Offering

12. Has the course been offered previously under 280/291 or 480/491? If so, when? Under what number? What was the enrollment? What level of students took the course?
   - Not previously offered
   - The course is designed for sophomores
   - Proposed course number: ENSC 260

13. Justify the level of course offering.
   - As noted in 3 above, the course is designed to give sophomores sufficient background in evolutionary biology to prepare them for upper division courses in their LRES majors. Existing courses at the sophomore level do not provide the level of detail that we envision.
Relationship to other Courses, Curricula, and Departments

14. Does this course build on or interrelate with other courses in your curriculum or related curricula? If so, which ones?
   - Builds on materials students receive in the pre-requisite, BI0B 160.
   - As noted above, prepares them for upper division courses in their majors.

15. Do the topics in the proposed course duplicate or reiterate those in other courses in this or any other department? If so, how do the coverage and educational experience differ and how is this duplication or reiteration justified? Also, what liaison (which is expected in cases of apparent overlap) has been conducted with other departments? Report reactions, both favorable and unfavorable.
   - No other courses in LRES (other than graduate seminars) focus on this subject
   - Behavioral and Evolutionary Ecology (BI0E 405) in the Ecology Department focuses on the "abundance and distribution of organisms in relation to their evolution, behavior, population biology and interactions with other organisms" so, overall, a different set of topics.
   - Evolution (BI0B 420) is a more advanced course, requires a pre-requisite not taken by all LRES majors, and does not focus on applied issues in the environmental sciences.

16. What programs (departments, colleges) will be impacted by the SCH production of this course? That is, where do you think the SCH in the proposed course are likely to come from? If the expected SCH production of the proposed course is greater than 1000, and the SCH are expected to come from other colleges, what steps have been taken to make the other units aware of the potential loss of SCH? Report reactions, both favorable and unfavorable.
   - The only course directly affected will be BI0B 420 (Evolution) which is presently co-taught by Dr. O’Neill. However, this semester, just 4 of 75 students in the course are LRES majors, so the viability of that course will not be affected.
   - BI0E 405 (Behavioral and Evolutionary Ecology), BI0B 428 (Molecular Evolution), and BI0M 415 (Microbial Diversity, Ecology, and Evolution) focus on different aspects of the subject, whereas the proposed course is more general. It should not compete with these other courses, which are already required in certain majors.

17. If this proposed course has a significant interdisciplinary component, please explain briefly. Otherwise, indicate n/a.
   - n/a

Students Served

18. Does the proposed course serve majors only? Non-majors only? Both majors and non-majors? What other majors might be interested in this course? State areas or disciplines to be served and indicate the specific efforts that will be made to make the course material relevant to all disciplines served.
   - The course is designed for LRES majors, but will be open to students in other majors. However, it is likely to be taken mainly by LRES majors (and perhaps by a few non-science majors who have interest in the subject area and have taken BI0B 160). It is also possible
that a few Liberal Studies majors in the Environmental Studies option will be interested if they happen to have taken BIOB 160.

Resources

19. What additional resources (e.g., additional instructional FTE, required technologies), if any, will be required to offer this course? Are there any resource issues for the students who will take the course (e.g., required technologies, travel, on-line access requirements)? Will there be an additional fee charged to students taking this course? Please explain.
   • No additional resources required
   • No fee (the required computer software is available free on the internet).

20. What existing information resources – print (books, journals, documents), audiovisual (videos, DVDs, CDs or other), and/or electronic (e-books, databases, electronic journals and web sites) – provided by the MSU Libraries will be used by students in this course? Provide examples as well as descriptive information. If additional information resources are necessary, please discuss those acquisitions with the library (x6549 Collection Development) at least three months prior to the beginning of the semester in which this course will be taught.
   • To complete their semester project, students will certainly require use of Research Databases already available through the MSU Library (e.g., BIOSIS, AGRICOLA).

Other Supporting Material

21. Include any additional information you feel is needed to support this request.
ENSC 260 Proposed Syllabus
Dr. Kevin O’Neill
Department of Land Resources and Environmental Sciences

What this course is about: As scientists, there are several basic questions that we can ask about evolution:

1. Has evolution occurred? As a general question, this has been answered in the affirmative in countless short-term scientific studies in which evolution has been directly observed both in the laboratory and field. There is also overwhelmingly strong indirect evidence (e.g., from the fossil record, DNA analyses) that evolution has occurred over billions of years on the planet Earth. The answer to this question is a resounding YES - if you want a scientific answer (and that is what you are here for, of course). Creationists might tell you that the answer to this question is NO! But the data doesn’t lie and they are as wrong as anyone can be about a scientific matter. But, of course, they are motivated by something other than the desire to do science correctly.

2. What causes evolution to occur? The question of whether evolution occurs is different from the question of why it occurs. So the 2nd question addresses the mechanisms that cause evolution, including mutation, natural selection, genetic drift, and gene flow. The mechanisms, particularly natural selection, are the main subject of the first half of this course. Charles Darwin and Alfred Russell Wallace discovered the basic mechanism of adaptive evolution, natural selection, well over a century ago. The basic logic of natural selection is simple and straightforward, but there are many variations on the basic theme. This course will show how scientists have demonstrated how selection causes evolution in the lab and in the field.

3. What path has evolution followed? The most basic answer to this question, one that is well-documented, is that life on Earth began over 3.5 billion years ago and progressed from simple single-celled organisms through simple multi-cellular organisms, and on to a wide variety of complex multi-cellular organisms (such as yourself). Again, there is no reasonable scientific objection that can be raised to this overall claim (though there may be much controversy over the details). By analyzing the fossil record and relationships among present-day organisms, we also have a very good idea of the temporal and geographical patterns of evolutionary change. For example, because of anatomical and DNA-sequencing studies, we know which primates (living and extinct) are most closely related to humans, which mammals are most closely related to primates, which non-mammals are most closely related to mammals, etc. By putting this information together with fossil and geological data, we can construct a hypothesis for the pattern of evolution followed by mammals since the Triassic period. There is much yet to be done, but we already know a lot, and future evidence will be used to test specific hypotheses. How evolutionary biologists study the patterns of evolutionary change is one the main subjects of Dr. Lavin’s lectures in the second half of the course.

4. What is the significance of the study of evolution to the overall field of biology? Evolution, along with basic principles of chemistry and physics, are the organizing principles for the entire field of biology. So, can you call yourself a biologist without having good knowledge of theories of and evidence for evolution? Absolutely not. And it does not matter what kind of biologist you plan to be...even dentists and doctors can benefit from knowledge of evolutionary biology, and certainly teachers and fish/wildlife biologists cannot be very good at what they do without a good working knowledge of evolutionary biology.
5. **Do you have to reject religion all together in order to accept the evidence for evolution?** Of course not! Many well-known evolutionary biologists, such as Francisco Ayala and Kenneth Miller, are also devoutly religious. In addition, many religious denominations have expressed their support for the acceptance of the conclusions of evolutionary biologists and for the teaching of evolution in public schools (http://nseweb.org/media/voices/religion).

6. **What is the significance of evolutionary biology for human understanding and well-being (and that of the rest of the planet)?** Clearly, its significance is profound. Among the questions that can be answered by science, what could be more important (and interesting) than obtaining an understanding of the evolutionary origins of Homo sapiens? Or the evolutionary origins of our minds? Or the origins of sex? Or the evolutionary causes of the biological diversity that humans seem so intent on destroying? Or the causes of antibiotic resistance in bacteria, pesticide resistance in insects and weeds, the origin and spread of HIV, the fate of endangered species, evolutionary responses of organisms to global warming, etc.? Anyone who is concerned with the fate of humans and other organisms on this planet ignores evolutionary studies at their own (and other’s) peril.

**Materials on D2L:** The course will have various handouts associated with blocks of lectures. The content section with have full color/full size pdfs of the PowerPoint presentations. They will be posted within several days of the completion of each lecture section.

**Simulation of gene frequencies:** **How to get the software:** In the first part of the course, we will use a software package called *Allele A1* developed by Jon Herron+. The program can be downloaded free from the web at: http://wps.prenhall.com/esm_freeman_evol_3/0,8018,849199-00.html. After reaching the web site, click on “Simulations” near the bottom of the banner on the left hand side of the page (you may have to scroll down). Then click on “PopCycle; Allele Simulation”...and then, under the Selection and Mutation list, download the appropriate file for your computer. You will find this an invaluable tool for the course.

**Course grading:**

- Exams (50% of grade); will include multiple choice questions and short essays
- In-class pop quizzes and online quizzes (20%); same format as exams
- Class participation (15%); class will include discussion of questions posed by instructor and by other students (based on reading and lecture materials)
- Student presentations (15%); during the last weeks of the semester, students will choose a topic related to evolution and the environmental sciences, and give a 20 minute presentation to the class based on literature-based research. Each student will work closely with the instructor to choose a topic.

**Grades**

- final grades in this class include plus/minus grades (e.g., A, A-, B+,...)
- because each individual exam in curved, the final grade is not curved.
- hard copies of exams are not returned to students. However, you can check your exam against key at my office.
Office hours by appointment: arrange after lecture or by e-mail (koneill@montana.edu) or by phone (2333). My office is in room 18 Marsh Labs (on 19th), but we can arrange to meet in a more convenient location on campus.

Class rules and etiquette (The following represents a binding agreement between you and the instructors. If you stay in the class, we assume that you accept all of the conditions outlined.

1. *Show up on time to lectures.* Class will begin exactly as schedules. Late entry into the classroom is disruptive to everyone and you might miss something important (because, of course, everything that the instructor says is profoundly important). Students who are repeatedly late will find their grades lowered.

2. *Treat your instructor and fellow students with respect.* Besides showing up on time, this includes no cell phone use in class (not even for texting and Googling) and no talking to each other during lecture (repeat offenders will find their grades lowered - it has happened before).

3. Bring *PowerPoint* notes to class because the pace of lecture assumes that you have the notes in front of you.

4. *Exams will be given only at the scheduled times.* Alternative arrangements will require a written excuse from your doctor, the Dean of Students office, a coach, or faculty advisor for a club who’s activities conflict with an exam. The excuse *cannot* involve forgetting the exam, oversleeping, or fresh powder at Bridger, etc. Make-up exams (if we agree to give one) will be more difficult, as they are 100% essay in format.

5. *You must comply with the guidelines for academic integrity in MSU’s Student Academic and Conduct Guidelines and Grievance Procedures* (if you are not familiar with these, see [http://www2.montana.edu/policy/student_conduct/cg600.html](http://www2.montana.edu/policy/student_conduct/cg600.html)).

6. *If, during an exam, I have even the slightest suspicion that you are gazing at your neighbors exam, I will have you move to a different seat.* If it is really obvious that you are cheating, I will confiscate your exam and give you a zero for the exam.

7. Ask questions during and after class. That’s the best way to make sure that you understand the material if you are confused.

8. *If the instructor goes too fast, ask him to slow down.*

9. *If you attend the review meeting held prior to each exam, come prepared to ask specific questions about course content.* The review sessions are *not* extra lectures. I will not answer questions like "What’s going to be on the exam?" (you will already know that because the study guides for the exams are the PowerPoint and pdf handouts) or "Do we have to know that?" or "Would repeat everything that you said in the 12 lectures about natural selection?"
### Lecture outline

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<tr>
<th>Week</th>
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<td>Genetics and evolutionary biology</td>
<td>Review of basic genetics; molecular, developmental, and population genetics. The week will focusing on what students will need to understand later materials in the course.</td>
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<td>Three of the four major processes that drive genetic and adaptive evolution: mutation, drift, and gene flow. Week will include hands-on work with basic computer simulations.</td>
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<td>Models and examples of natural selection, including further work with computer simulations, as well as discussion of different forms of selection: directional, stabilizing, disruptive, frequency-dependent, and the heterozygote advantage; how selection interacts with mutation, drift, and gene flow.</td>
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<td>Sexual selection and kin selection</td>
<td>Specific models and examples of the evolution of sexual strategies of both males and females; inclusive fitness theory and the evolution of social behavior.</td>
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<td>7</td>
<td>Constraints on adaptive evolution Rates of evolution Cumulative selection</td>
<td>Genetic, developmental, and environmental factors that place constraints on adaptive evolution; how to quantify rates of evolution over different time scales; how natural selection can be used to explain the evolution of complex traits</td>
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<td>10-11</td>
<td>Evolution and agroecology</td>
<td>Evolution of resistance to pesticides in insects and weeds, and strategies for management of resistance; evolution of crop plants, insect pests, beneficial insects, and invasive species</td>
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<td>Evolution and anthropogenic habitat disturbance</td>
<td>Evolutionary responses to anthropogenic habitat disturbances; evolution in extreme environments; evolution and public health; evolution and conservation biology, including responses to climate change</td>
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</tr>
<tr>
<td>15</td>
<td>Student presentations</td>
<td>Short presentations by students that summarize papers they write on a topic relating to how evolutionary biology informs important issues in the environmental sciences.</td>
</tr>
</tbody>
</table>