

**BIO 217 EVOLUTION** (Class Number 21982, Section Number 0001, Class ID Number 015131)

**Course Meetings: Tuesdays & Thursdays; 3:30PM - 4:45PM**

**Instruction Mode: In-Person**

**Classroom: Payson-Smith Hall, Room 208 (Portland Campus)**

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**Instructor: Ken Weber**

**Office Location: Room 212, Science Building, Portland**

**Email: [keweber@maine.edu](mailto:keweber@maine.edu)**

**Office Phone: 207-780-4265**

**Office Hours and Access:** You can call or email me, or request a Zoom meeting. Zoom meetings can be with one person or a group. The best times for me are Monday through Wednesday, from 11:30 AM to 1:00 PM, and again from 5:00 PM to 5:30 PM. Weekends are often good too, since I am often in the lab. Please note that I have no office hours on the same day as an exam.

### **Course Materials & Books:**

**For this course, no textbook is required.** Two textbooks are suggested. The first is *Biology*, by Campbell, *et al.* (any edition). This is the same comprehensive introductory textbook that was used in the courses leading up to this course: BIO 105, BIO 107, and BIO 201. You can use the book to review aspects of those courses if needed, as they relate to this course. You can use either the 8th, 9th, 10th, or 11th edition. Copies of Campbell are on reserve in the Portland campus library for those who don't already own it. If you use this textbook, the best approach is to check the readings given in the outline below, arranged by topics, and focus on the specific parts that I may have talked about in class.

The other book suggested for this class is *Evolutionary Analysis*, 5<sup>th</sup> Edition, by Herron & Freeman. This book is mostly more advanced and technical than the level of this course. You can consult it on many subjects if you are interested, but it is not in any way essential. You can buy access to the e-book version for ~\$75. You'll get a PIN for access and can start reading right away.

**You can make an A in this class without using any books.** Everything is in the lectures and the handouts. Tests will include only material that was covered in class.

**Technology Requirements:** The only technology requirements are the ability to go online, join in Zoom sessions, and engage in email. If you will have any problem with these things, please let me know soon.

### **Course Description, Including Format:**

BIO 217 Evolution: This is a study of the fossil record, adaptive and neutral change in genes and traits, natural selection, and the evolution of diversity and complexity. We also review some essential basics of the earth's geological history. The course will be taught in person, with masks and distancing required, and with the possibility of switching to remote teaching by Zoom at times. Prerequisite: grades of C- or higher in BIO 107 and BIO 201, or permission of instructor. Cr 3.

### **Learning Outcomes:**

Our objectives are to understand how adaptive and neutral evolution both occur during natural selection, how evolution acts at the levels of ecosystem, phenotype, and gene pool, and how evolution is revealed through phylogenetic reconstructions based on the fossil record, embryonic development, and homology at the anatomical and the molecular levels.

### **Outline Schedule of Meetings and Exams**

There will be 26 class meetings, following the general plan of major evolutionary topics outlined below. This outline is likely to be modified during the semester. There will be three exams, on the dates given below.

#### **1. The Earth in Time: Plate Tectonics, Biostratigraphy and Geochronology (3)**

#### **2. The Fossil Record of Organisms and Ecosystems: Micro- and Macroevolution (5)**

First Exam: Tuesday, February 15, 2022 3:30 – 4:45 PM

#### **3. The Tools of Phylogenetic Reconstruction: Fossils, Homologies, Embryos, Genes (9)**

Second Exam: Tuesday, March 29, 2022 3:30 – 4:45 PM

#### **4. Mutation, Recombination and Natural Selection (3)**

#### **5. Some Major Adaptive Radiations (3)**

#### **6. The Evolution of Complex Systems: Examples in Vertebrates (3)**

Final Exam: Tuesday, May 3, 2022 2:00 - 4:00 PM

## **Readings from Campbell's *Biology* for Background and Review**

The suggested readings below are chapter sections from Campbell's *Biology*. You may have used this book already, and perhaps you even studied some of these chapters in the courses BIO 105, 107 and 201, which are prerequisites for this course. The readings below may provide useful background and review of some concepts for this class. Most USM students taking this course already own this book. In case you don't own a copy, I've placed six copies of Campbell (8<sup>th</sup> Edition) on reserve in the Portland campus library. **This book is not required. These readings are not required. The tests are based only on the lectures.** You will not be tested on facts, concepts or examples which were never mentioned in class. The handouts and your own lecture notes are your best study guides.

### **1. The Earth in Time**

25.2 The fossil record documents the history of life.

25.3 Key events in life history include the origins of single-celled and multi-celled organisms and the colonization of land.

### **2. The Fossil Record of Organisms and Ecosystems: Micro- and Macroevolution**

25.4 The rise and fall of groups of organisms reflect differences in speciation and extinction rates.

25.6 Evolution is not goal oriented.

### **3. The Main Tools of Phylogenetic Reconstruction: Fossils, Homologies, Embryos and Genes**

22.... Parts of Chapter 22 touch briefly on phylogenetic reconstruction using fossils, homologies, embryos and genes.

22.3 Evolution is supported by an overwhelming amount of scientific evidence.

### **4. Mutation, Recombination and Natural Selection**

21.5 Duplication, rearrangement, and mutation of DNA contribute to genome evolution.

23.1 Genetic variation makes evolution possible.

23.3 Natural selection, genetic drift, and gene flow can alter allele frequencies in a population.

24.3 Hybrid zones reveal factors that cause reproductive isolation.

24.4 Speciation can occur rapidly or slowly and can result from changes in few or many genes.

### **5. Some Major Adaptive Radiations**

30.1 Seeds and pollen grains are key adaptations for life on land.

30.2 Gymnosperms bear "naked" seeds, typically on cones.

30.3 The reproductive adaptations of angiosperms include flowers and fruits.

### **6. The Evolution of Complex Systems: Examples in Vertebrates**

34.1 Chordates have a notochord and a dorsal, hollow nerve cord.

34.2 Craniates are chordates that have a head.

34.3 Vertebrates are craniates that have a backbone.

34.4 Gnathostomes are vertebrates that have jaws.

34.5 Tetrapods are gnathostomes that have limbs.

34.6 Amniotes are tetrapods that have a terrestrially adapted egg.

34.7 Mammals are amniotes that have hair and produce milk.

34.8 Humans are mammals that have a large brain and bipedal locomotion.

### **If you need to review any genetics for this class, the sections of Campbell's *Biology* below would be helpful:**

Proteins & DNA: Chapter sections 5.4 & 5.5, in any edition.

Mitosis & Meiosis: Chapters 12 & 13 (except section 12.3), in any edition.

Molecular Genetics: Chapter sections 16.2, and 17.1, 17.2, 17.3 & 17.4, in any edition.

Genetic Regulation: Chapter sections 18.1, 18.2 & 18.3, in any edition.

Mutation: Chapter section 17.5, in any edition.

## **Tests and the Semester Grade:**

There will be three exams. The first will be on Tuesday, February 15, at 3:30–4:45 PM. The second will be on Tuesday, March 29, at 3:30–4:45 PM. The third and final exam will be on Tuesday, May 3, at 2:00–4:00 PM. Each exam will cover everything that was covered in class up to that point, but the main emphasis will always be on the things covered after the last previous exam. The exams will consist of short-answer questions or multiple choice. Each exam will count as one third of the course grade. Questions on tests will be based only on the lectures. Any graded quizzes or homework during the semester will be counted as part of the next following exam.

Exams are expected to take place in the classroom at the times given above. But if exams are given online, then they will be emailed to everyone simultaneously at the beginning of the time slot (3:30PM-4:45PM for the first two exams; 2:00-4:00PM for the final), and will have to be returned to me by email at the end.

No exams will be given early. No exams will be given late unless there is a compelling reason. There will normally be no second opportunity to take a missed exam, and no make-up exam. If you have a documentable and compelling reason why you had to miss an exam, and you only miss one, you will be graded only on the other two exams. If your absence was foreseeable, you must let me know in advance. Otherwise a missed exam is a failed exam, except in extraordinary circumstances.

## **Grading:**

For each of the three exams, the total points earned will be converted to a letter grade according to a scale based on percentages, but not in the usual way. Approximately the top 15% of the class will get above B+; approximately the bottom 15% of the class will get below C-minus. After these upper and lower thresholds are determined, the other letter grades will then correspond to equal divisions on the scale of total points. I will post the scale for each exam, so that everyone can see how letter grades were determined. This approach to grading is called scaling, or grading “on the curve.” It can only be used in larger classes that one has taught often enough to know what to expect. It means the tests can never be too hard, or too easy, because there will always be a top 15% and a bottom 15% of the class. I also adjust those percentages somewhat, as warranted by the general level of class performance.

## **Course Evaluations:**

At the end of each semester all students have the opportunity to exercise their right of free speech regarding the course. It is important to me that you take the time to let me know your thoughts about the course. I use your feedback to make improvements in the course materials, assignments, and outcomes.

## COURSE POLICIES

### ATTENDANCE POLICY

I won't take attendance. You can decide for yourself whether to participate in class meetings.

If major issues arise in your life, threatening your ability to succeed in the class, you should let me know as soon as possible, so that we can try to work out a way for you to deal with the problem and make it through the class with something to show for your efforts.

### CLASS CANCELLATION

**If a meeting of this class is ever cancelled, everyone will be notified.**

#### ATTENDANCE POLICY: Inclement Weather

From time to time USM is likely to close the University due to bad weather. When the cancellation causes a missed class, the class content will be made up at another time or through additional assignments outside of class. If there is a closure for any reason at the same time as an exam, the exam will be postponed until the next scheduled meeting time.

When the school opens late or closes early, and the time selected is during the middle of class, we will still hold the class unless you are otherwise notified by me. Two examples:

- If class starts at 1pm, but the University is closing at 1:30pm, we will still have class unless you hear from me.
- If class starts at 1pm, but the University is opening at 1:30pm, we will still have class unless you hear from me.

### TECHNOLOGY IN THE CLASSROOM

**Because of the size of the class, there will be no classroom meetings. The only technology you need is the ability to participate in Zoom meetings and to communicate by email.**

### ACADEMIC INTEGRITY / PLAGIARISM

Everyone associated with the University of Southern Maine is expected to adhere to the principles of academic integrity central to the academic function of the University. Any breach of academic integrity represents a serious offense. Each student has a responsibility to know the standards of conduct and expectations of academic integrity that apply to academic tasks. Violations of academic integrity include any actions that attempt to promote or enhance the academic standing of any student by dishonest means. Cheating on an examination, stealing the words or ideas of another (i.e., plagiarism), making statements known to be false or misleading, falsifying the results of one's research, improperly using library materials or computer files, or altering or forging academic records are examples of violations of this policy which are contrary to the academic purposes for which the University exists. Acts that violate academic integrity disrupt the educational process and are not acceptable.

Evidence of a violation of the academic integrity policy will normally result in disciplinary action. A copy of the complete policy may be obtained from the office of Community Standards and Mediation, online at [usm.maine.edu/community-standards-mediation/academic-integrity](https://usm.maine.edu/community-standards-mediation/academic-integrity) or by calling and requesting a copy at (207) 780-5242.

## **FINAL EXAMINATIONS/FINAL PROJECT**

There will be a final exam in this class, given during the final exam period, on Tuesday, May 4, 2021, 2:00-4:00 PM. The exam will include questions from the whole semester, but it will put more emphasis on the material covered after the second exam. There will be no additional final papers or projects.

It is a USM academic policy that no tests or exams may be scheduled during the last week of classes.

## **UNIVERSITY POLICIES AND RESOURCES**

### **DISABILITY ACCOMMODATIONS**

The university is committed to providing students with documented disabilities equal access to all university programs and services. If you think you have a disability and would like to request accommodations, you must register with the Disability Services Center. Timely notification is essential. The Disability Services Center can be reached at 207-780-4706 or at [dscusm@maine.edu](mailto:dscusm@maine.edu). If you have already received a faculty accommodation letter from the Disability Services Center, please provide me with that information as soon as possible. Then please contact me so that we can review your accommodations.

### **TUTORING AND WRITING ASSISTANCE**

Tutoring at USM is for *all* students, not just those who are struggling. Tutoring provides active feedback and practice, and is available for writing, math, and many more subjects. Walk-in tutoring is available at the Glickman Library in Portland, the Gorham Library, and the LAC Writing Center. For best service, we recommend making an appointment at <https://usm.maine.edu/learningcommons/schedule-tutoring-appointment>. Questions about tutoring should be directed to Naamah Jarnot at 207-780-4554. Interested in becoming a more effective, efficient learner? Check out <https://usm.maine.edu/agile!>

### **COUNSELING**

Counseling is available at USM. The best way to schedule an appointment is by phone at 780-5411. More information is available at <https://usm.maine.edu/uahcs>.

### **RECOVERY ORIENTED CAMPUS CENTER (ROCC)**

A peer support community for students in recovery from substance abuse and other mental health conditions is available at USM. More information may be found online at <https://usm.maine.edu/recovery> or by contacting ROCC at 207-228-8141.

### **NONDISCRIMINATION POLICY AND BIAS REPORTING**

The University of Southern Maine is an EEO/AA employer, and does not discriminate on the grounds of race, color, religion, sex, sexual orientation, transgender status, gender expression, national origin, citizenship status, age, disability, genetic information or veteran's status in employment, education, and all other programs and activities. The following person has been designated to handle inquiries regarding non-discrimination policies: Amie Parker, Interim Director of Equal Opportunity, The Farmhouse, University of Maine Augusta, Augusta, ME 04333, 207.581.1226, TTY 711 (Maine Relay System). Incidents of discrimination or bias at USM should be reported to Associate Vice President for Student Affairs David Roussel at 207-780-5242.

## **STATEMENT ON RELIGIOUS OBSERVANCE FOR USM STUDENTS**

Absence for Religious Holy Days: The University of Southern Maine respects the religious beliefs of all members of the community, affirms their rights to observe significant religious holy days, and will make reasonable accommodations, upon request, for such observances. If a student's religious observance is in conflict with the academic experience, they should inform their instructor(s) of the class or other school functions that will be affected. It is the student's responsibility to make the necessary arrangements mutually agreed upon with the instructor(s).

## **TITLE IX STATEMENT**

The University of Southern Maine is committed to making our campuses safer places for students. Because of this commitment, and our federal obligations, faculty and other employees are considered mandated reporters when it comes to experiences of interpersonal violence (sexual assault, sexual harassment, dating or domestic violence, and stalking). Disclosures of interpersonal violence must be passed along to the University's Deputy Title IX Coordinator who can help provide support and academic remedies for students who have been impacted. More information can be found online at <http://usm.maine.edu/campus-safety-project> or by contacting Sarah E. Holmes at [sarah.e.holmes1@maine.edu](mailto:sarah.e.holmes1@maine.edu) or 207-780-5767.

If students want to speak with someone confidentially, the following resources are available on and off campus: University Counseling Services (207-780-4050); 24 Hour Sexual Assault Hotline (1-800-871-7741); 24 Hour Domestic Violence Hotline (1-866-834-4357).

## **POLICY ON ACCEPTABLE CONDUCT IN CLASS SETTINGS**

If a student substantially disrupts a class, the professor may ask the student to align with this policy on conduct in a class setting. If the student refuses, the professor may, at their discretion, ask the student to leave. If the professor takes this step, they must attempt to communicate with the student and provide informal counsel and advice. The professor may elect to notify their dean of the situation as well. If the student disrupts the class again, the professor may, at their discretion, provide a written notification to the student, describe the offending behavior, and refer the student's case to the appropriate academic dean and notify the dean of students that an official student conduct code violation has occurred [<https://usm.maine.edu/community-standards-mediation/conduct-process>].

## **COVID FACE COVERING REQUIREMENT**

Per USM and the University of Maine System, all students, faculty, and staff members are required to wear a face covering, including during all face-to-face classes. Resident students are exempted from this requirement when in their own room in the residence hall. Students seeking additional exceptions from this requirement should refer to the DISABILITY ACCOMMODATIONS section of this syllabus. <https://www.maine.edu/together/community-guidance/everyone/>