Course Outline
Biology 218C, Organisms in their Environment
Fall 2017
Dr. Ryan Butler

Class Time:  MTR 9:00 am – 9:50 am
Class Location:  B501

Lab Time:  Multiple sections, check schedule
Lab Location:  1407

Office:  1607 H
Office Phone: (403) 342-3110

E-mail:  ryan.butler@rdc.ab.ca
Office Hours:  Tuesday 10:00 – 11:00, Thursday 1:00 – 2:00, Friday 1:00 – 2:00 (or by appointment)

Credit Hours:  3-0-3
Prerequisite:  Biology 30

Academic Calendar Entry:
This course examines the major lineage of life on Earth. Overview of evolutionary principles and classification, the history of life, and the key adaptations of prokaryotes, protists, fungi, plants, and animals. Laboratories survey the diversity of biological form and function, and introduce the students to data collection and scientific writing. Prerequisite: Biology 30 Note: BIOL 217 is not a pre-requisite for BIOL 218. Note: BIOL 217 and 218 can be taken in either order.

Required Texts and Equipment:


Course Topics:

<table>
<thead>
<tr>
<th>Course Topics</th>
<th>Chapter (Campbell 11th Edition)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic 1. Introduction: Biological Themes and Organization</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>Topic 2. Evolution, Natural Selection and the Darwinian View of Life</td>
<td>Chapter 22</td>
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<tr>
<td>Topic 3. The Evolution of Populations</td>
<td>Chapter 23</td>
</tr>
<tr>
<td>Topic 4. Speciation and the Pace of Evolution</td>
<td>Chapter 24</td>
</tr>
<tr>
<td>Topic 5. The History of Life on Earth</td>
<td>Chapter 25</td>
</tr>
<tr>
<td>Topic 6. Phylogeny and the Tree of Life</td>
<td>Chapter 26</td>
</tr>
<tr>
<td>Topic 7. Evolution and Classification of Prokaryotes</td>
<td>Chapter 27</td>
</tr>
<tr>
<td>Topic 8. Evolution and Classification of First Eukaryotes</td>
<td>Portions of Chapter 13, 25, 28</td>
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<td>---------------------------------------------------------</td>
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<tr>
<td>Topic 9. Evolution and Classification of Fungi</td>
<td>Chapter 31</td>
</tr>
<tr>
<td>Topic 10. Evolution and Classification of Animals</td>
<td>Chapters 32, 33, 34</td>
</tr>
<tr>
<td>Topic 11. Evolution and Classification of Plants</td>
<td>Chapter 29, Chapter 30, Portions of Chapter 38</td>
</tr>
</tbody>
</table>

**Learning Outcomes:**

By the end of this course, students will be able to:

1. Describe how the diverse organisms on Earth have been affected by their environment.
2. Explain how the current environment is the product of the activities of organisms through time.
3. Explain how evolution has occurred over time to produce all major groups of organisms and how evolutionary origins are reflected in their classification.
4. Describe the key adaptations of selected Prokaryotes (Bacteria and Archaea) and Eukaryotes (Protists, Plants, Fungi, Animals).
5. Discuss how form fits function in selected lineages of life.
6. Describe the involvement of organisms, including humans, in major ecosystem processes.
7. Employ accepted methods of data collection and scientific observation.
8. Employ principles of the scientific method to develop, test and evaluate hypotheses.
9. Correctly use scientific terminology relating to biological organisms and processes.

**Learning Activities:**

Lectures, labs, group work

**Assessment, Assignments and Exams:**

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory Component:</td>
<td>30%</td>
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<tr>
<td>Lecture Component:</td>
<td>70%</td>
</tr>
<tr>
<td>Quizzes and assignments:</td>
<td>5%</td>
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<tr>
<td>Clickers (participation):</td>
<td>5%</td>
</tr>
<tr>
<td>Midterm Exam 1 (Oct 19):</td>
<td>15%</td>
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<tr>
<td>Midterm Exam 2 (Nov 23):</td>
<td>15%</td>
</tr>
<tr>
<td>Final Exam (cumulative):</td>
<td>30%</td>
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</tbody>
</table>

Dates of examinations are approximate and subject to change (updates will be provided later in the term if changes are required). Information on quizzes/assignments will be provided as the term progresses, these short assessments will provide students with a chance to review material and see their strengths/weaknesses. Detailed information on laboratory assessments will be provided by your lab instructor.

**Clickers** will be used throughout the duration of this course. Students will sign up for a clicker on the first day and use the same clicker for the entire course. Clickers are to be returned at the end of each class. Answering questions via clickers will provide students with a means to interact during lectures and also provide the instructor with information on students’ understanding of the topics. Grades will not be assigned for correct answers, these will be a form of participation marks (80% participation required for full marks).
**Attendance Requirements:**
Attendance may take many forms. Lack of attendance may impact the students’ ability to successfully complete the course. You are strongly encouraged to attend all sessions. However, if you do miss a class or lab, you should arrange to borrow notes from other students, because you are still responsible for all information covered. Attendance in lectures will also be necessary to obtain participation marks via the clicker questions. Absence from quizzes or exams is generally excused only when a valid medical reason is submitted. An alternative written or oral examination may then be administered, or credit may be reassigned at the discretion of the instructor and agreement of the student. Late assignments may be accepted depending on the circumstances, but may be docked marks.

**Grading Scale:**
Percentage grades will be reported for assignments and exams written throughout the semester. A final average will then be calculated and converted to a letter grade based on relative performance within the class and the instructor’s overall assessment of that particular class. Thus, there is no direct correspondence between a percentage grade and final letter grade, but I have listed the approximate conversions below.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Grade Value</th>
<th>Point Description</th>
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<tbody>
<tr>
<td>A/A+</td>
<td>4.0 (A+ ≥ 95%, A=90-94%)</td>
<td>Excellent</td>
</tr>
<tr>
<td>A-</td>
<td>3.7 (= 85-89%)</td>
<td></td>
</tr>
<tr>
<td>B+</td>
<td>3.3 (= 80-84%)</td>
<td>Good</td>
</tr>
<tr>
<td>B</td>
<td>3.0 (= 75-79%)</td>
<td></td>
</tr>
<tr>
<td>B-</td>
<td>2.7 (= 70-74%)</td>
<td></td>
</tr>
<tr>
<td>C+</td>
<td>2.3 (= 65-69%)</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>C</td>
<td>2.0 (= 60-64%)</td>
<td></td>
</tr>
<tr>
<td>C-</td>
<td>1.7 (= 55-59%)</td>
<td></td>
</tr>
<tr>
<td>D+</td>
<td>1.3 (= 53-55%)</td>
<td>Pass</td>
</tr>
<tr>
<td>D</td>
<td>1.0 (= 50-52%)</td>
<td></td>
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<tr>
<td>F</td>
<td>0.0 (≤ 49%)</td>
<td>Fail</td>
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**The RDC Final Examination Policy:**
In courses with Final Examinations, the RDC Final Examination Policy will apply. Please review this document to ensure that you understand the contents and implications of the policy.

**Academic Misconduct:**
Academic misconduct in all its forms is a serious offence. Academic misconduct is the giving, taking, or presenting of information or material that unethically or dishonestly aids oneself or another on any work which, under normal circumstances, is to be considered in the determination of a grade or the compilation of academic requirements or the enhancement of that student’s record or academic career. The two key areas of academic misconduct are plagiarism and cheating. Please read the definitions that follow.

**Plagiarism:** The use or close imitation of language, paintings, films, prototypes and ideas of another author and representation of them as one’s own original work. The most common forms of plagiarism are copying or paraphrasing another author’s work without proper acknowledgement, using the ideas or lines of reasoning of another author’s work without proper acknowledgement, submitting work to which someone else has made substantial improvements to the content, and submitting the same work for multiple courses without approval.
Plagiarism can be judged to have occurred if the instructor has both the submitted material and original source that was copied, or if the student is unable to explain the terminology or ideas of a submission.

**Cheating:** Any attempt to give or obtain unsanctioned assistance in a formal academic exercise (e.g., examination). Some examples of cheating are unauthorized cheat sheets in a test or exams, the unauthorized use of electronic devices during an exam, and copying from an adjacent student.

- **Student Misconduct: Academic and Non-Academic Policy**
- **Appeal: Formal Policy**
- **Appeals: Informal Resolution Policy**

### Important Red Deer College Dates - 2017-2018 Fall

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>~ Fall 2017</td>
<td>New Student Orientation</td>
</tr>
<tr>
<td>September 5th</td>
<td>First day of classes for Fall Term 2017 and Full Year 2017-2018 courses</td>
</tr>
<tr>
<td>September 15th</td>
<td>Last day to register late or add/drop Fall term 2017 or Full year 2017-2018 courses</td>
</tr>
<tr>
<td>September 15th</td>
<td>Last day for tuition refund for Fall term 2017 and Full year 2017-2018 courses</td>
</tr>
<tr>
<td>October 1st</td>
<td>First day to apply for Fall term 2018</td>
</tr>
<tr>
<td>October 3rd</td>
<td>Emergency Response Day</td>
</tr>
<tr>
<td>October 9th</td>
<td>Thanksgiving Day –<em>College closed</em></td>
</tr>
<tr>
<td>October 27th</td>
<td>Mid-term feedback for Fall term 2017</td>
</tr>
<tr>
<td>November 9th</td>
<td>Final Exam schedule posted for Fall term 2017</td>
</tr>
<tr>
<td>November 10th</td>
<td>College open – No Credit Classes</td>
</tr>
<tr>
<td>November 11th</td>
<td>Remembrance Day –<em>College closed</em></td>
</tr>
<tr>
<td>November 13th</td>
<td>Statutory Day –<em>College closed</em></td>
</tr>
<tr>
<td>November 14th</td>
<td>Credit classes resume Fall term 2017</td>
</tr>
<tr>
<td>December 6th</td>
<td>Last day to withdraw from Fall term 2017 and receive a WD</td>
</tr>
<tr>
<td>December 11th – 16th</td>
<td>Last day of classes for Fall term 2017</td>
</tr>
<tr>
<td>December 11th</td>
<td>Final Exams written</td>
</tr>
<tr>
<td>December 18th</td>
<td>Deferred Exams written for Fall term 2017</td>
</tr>
<tr>
<td>December 20th</td>
<td>Last day for submission of final grades for Fall term 2017 courses</td>
</tr>
<tr>
<td>December 21st</td>
<td>Final grades available for Fall term 2017</td>
</tr>
<tr>
<td>December 22nd</td>
<td><em>College closed at noon</em></td>
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<tr>
<td>December 25th – 31st</td>
<td><em>College closed</em></td>
</tr>
<tr>
<td>January 13th 2018</td>
<td>Supplemental Exams written for Fall term 2017</td>
</tr>
</tbody>
</table>

### Prior Learning Assessment:

This course may be eligible for [Prior Learning Assessment and Recognition](#). Students should refer to the [RDC Academic Calendar](#) for a list of excluded courses.

### Student Services on Campus:

Students should be aware that Personal Counselling, Career, Learning and Disability Resources are provided by RDC. Students may inquire about locations at the Information Desk. It is the responsibility of students to discuss their specific learning needs with the appropriate service provider.
Learning Support (Library: 403-342-3264, help_learn@rdc.ab.ca )
  • Writing Skills Centre  (writingskills@rdc.ab.ca)
  • Math Learning Centre (math concepts and advanced theoretical math)
  • Learning Strategies (note-taking, studying, and exam-writing strategies)
  • Peer-Assisted Study / Tutoring (one-on-one tutoring by students)

Disability Resources (Library: 403-357-3629, disabilityservices@rdc.ab.ca)
  • Coordination of services (tutoring, alternate format text, note-taking, and so on)
  • Academic accommodations, including exam accommodations

Counselling and Career Centre (Room 1402: 403-343-4064, counselling@rdc.ab.ca)

Changes to the Course Outline:

It is the student’s responsibility to be familiar with the information contained in this course outline and to clarify any areas of concern with the instructor.

Students should refer to the Appeals: Formal Policy, Appeals: Informal Resolution Policy and Student Misconduct: Academic and Non-Academic Policy should questions or concerns about the Course Outline not be resolved directly with the instructor.

No changes will be made to this course outline without the consent of the class and the approval of the Associate Dean of the School of Arts and Sciences.
**Reading/Class Schedule** (subject to adjustments as required or in consultation with the class)

**Note:** Detailed objectives with specific page numbers and reading assignments will be posted on blackboard.

**Lecture Objectives**

**Topic 1. Introduction: Biological Themes and Organization (Chapter 1)**

1. Describe the unifying themes that pervade the science of biology
2. Describe seven emergent properties associated with life.
3. Define science; describe its unique characteristics, and explain how science is used to solve problems.
4. Be able to differentiate between deductive and inductive reasoning.

**NOTE:** All reading assignments are testable.

**Topic 2. Evolution, Natural Selection and the Darwinian View of Life (Chapter 22)**

1. Explain how other scientists like James Hutton and Charles Lyell contributed to Darwin's theory of evolution.
3. Describe the facts and inferences that led Darwin to propose natural selection as the mechanism for evolutionary change.
4. Explain the concept of "fitness" and its role in evolution.
5. Be able to discuss at least five of the presently accepted sources of evidence for evolution (e.g. fossils, molecular biology, biogeography, comparative anatomy, etc).

**Topic 3. The Evolution of Populations (Chapter 23)**

1. Define mutation in terms of DNA and chromosome structure and describe the effects of mutation and recombination on genetic variability and survival potential of a population.
2. Define the following: microevolution, average heterozygosity, nucleotide variability, and cline.
3. State the Hardy-Weinberg equilibrium (theorem), its conditions, and explain its relevance to the study of how populations evolve.
4. Name the three elemental evolutionary forces which may lead to sequential evolution (microevolution) and list the various types of isolating factors which are believed to interact with these forces to result in speciation and divergent evolution (macroevolution).
5. What types of natural selection exist, and why is natural selection the only evolutionary force that is considered “adaptive”? Despite this, why doesn’t natural selection produce "perfect" organisms?
6. What is sexual selection and how does it interact with natural selection?

**Topic 4. Speciation and the Pace of Evolution (Chapter 24)**

1. Define the Biological Species Concept and explain its significance and limitations. Distinguish between pre-zygotic and post-zygotic isolating mechanisms.
2. Explain what Linnaeus had in mind regarding the morphospecies concept and explain how this concept can be useful to biologists today.
3. Distinguish between allopatric and sympatric speciation.
4. Describe the role of polyploidy and sexual selection in sympatric speciation.
5. Understand the significance of hybrid zones in speciation and incomplete reproductive isolation.
6. Compare the two schools of thought regarding the pace of speciation (gradualism vs. punctuated equilibrium).

**Topic 5. The History of Life on Earth (Chapter 25)**

1. Outline conditions believed to increase the probability of extinction of species and specify two general periods in the geological history of the Earth when widespread extinctions are believed to have occurred.
2. Describe how global and regional adaptive radiations have influenced species diversity after major extinction events.
3. What was Louis Pasteur’s contribution to the study of the origins of life?
4. Describe the evidence from experiments such as those of Miller and Urey concerning abiotic formation of organic compounds from mixtures of gasses, and discuss current hypotheses relating to the question of origin of life on Earth.
5. Briefly explain the “problem” with oxygen.
6. Briefly explain the role RNA (ribonucleic acid) is believed to have played in the early steps leading to life on Earth.
7. Represent in the form of a geological timetable current interpretations of the history of life on Earth (summarized on Table 25.8, p. 530 in Campbell 2016).

**Topic 6. Phylogeny and the Tree of Life (Chapter 26)**

1. Define taxonomy, classification, phylogeny, systematic and explain how each is used in biology.
2. What is the binomial system of nomenclature used for; who first proposed it; why; and why is it still in use today?
3. Explain how species are named and categorized into a hierarchy of EIGHT taxa.
4. Who came up with the three domain system and why?
5. Explain how phylogenetic trees are constructed and list the sources of information used to construct such trees.
6. Be able to “read” and construct a phylogenetic tree.
7. Distinguish between homologous and analogous traits and explain why it is important to do so when constructing a phylogeny.

**Topic 7. Evolution and Classification of Prokaryotes (Chapter 27)**

1. Compare and contrast prokaryotic cells and eukaryotic cells.
2. Discuss the significance of the ability of some prokaryotes to “fix” atmospheric nitrogen.
3. Describe three ways in which prokaryotes adapt rapidly to their environment.
4. Describe four modes of bacterial nutrition and give specific examples of each.
5. Distinguish between obligate aerobes, facultative anaerobes, and obligate anaerobes.
6. List several unique characteristics that distinguish the Archaea from the Bacteria.
7. Briefly describe three very different and unusual habitats where Archaea may be found in and explain what they do there.
8. List the three main clades (groups) of Bacteria (namely, cyanobacteria, proteobacteria, and Gram positive bacteria) and describe the distinguishing features of each.
9. Explain how photosynthesis altered the Earth's early atmosphere and the direction of evolution.
10. Distinguish among mutualism, commensalism, and parasitism. Describe examples of prokaryotes in each of these relationships.
11. Describe how humans exploit the metabolic diversity of prokaryotes for scientific and commercial purposes.

**Topic 8. Evolution and Classification of First Eukaryotes (portions of Chapters 13, 25, and 28)**

1. Discuss the "when", "why", and "how" of eukaryotic evolution. What limits prokaryote evolution?
2. Explain the serial endosymbiont theory of eukaryotic cell evolution and provide at least four pieces of evidence that support this theory.
3. List two characteristics that distinguish Protists from organisms in the other four kingdoms and explain why the Protista taxon is no longer valid according to modern phylogenetics.
4. Describe the life history and characteristics of the protist examples we study in class.
5. Explain how multicellularity may have evolved.
6. Distinguish between asexual and sexual reproduction.
7. Compare & contrast mitosis with meiosis. (Refer to 13.08 in 11th ed, 13.10 in 10th ed, fig. 13.9 in 9th ed)
8. Explain how crossing-over (during prophase I of meiosis) contributes to genetic variation in sexually reproducing organisms. (Reading assignment – pg 260 in 10th and 11th ed, pg 259 in 9th ed)
9. Distinguish among the life cycle patterns of animals, fungi and plants.
10. Define the concept of “alternation of generations” and explain how it works and why it only applies to sexually reproducing organisms.

**Topic 9. Evolution and Classification of Fungi (Chapter 31)**

1. List at least four characteristics that distinguish fungi from organisms in the other four kingdoms.
2. Explain how fungi acquire their nutrients.
3. Describe the basic body plan of a fungus.
4. Explain what lichens are; describe their anatomy, and briefly explain how they reproduce.
5. Describe how the mutualistic relationship in mycorrhizae is beneficial to both the fungus and the plant and explain their importance to natural ecosystems as well as agriculture.
6. Discuss why fungi are ecologically important as well as the pros and cons of fungi to humans.
7. Be able to name and provide the basic (defining) characteristics of the five major groups of fungi.
8. Be able to compare and contrast the life cycles of the different fungal phyla.
Topic 10. Evolution and Classification of Animals (Chapters 32, 33, 34)

1. List at least 5 characteristics that distinguish animals from organisms in the other four kingdoms.
2. Outline the major phylogenetic branches of the animal kingdom, which are based on degree of organization; symmetry; embryonic germ layers; and the absence or presence of a coelom; and protostome-deuterostome embryonic development.
3. Discuss the importance of cephalization and discuss the importance of the development of a true coelom (body cavity).
4. Describe the distinguishing characteristics found in the various invertebrate Phyla covered in class.
5. Describe the four distinguishing characteristics found in the Phylum Chordata and explain how each is beneficial to survival.
6. Describe the key characteristics of each of the subphyla in the Phylum Chordata.
7. Describe the distinguishing characteristics found in the following Chordate clades: Cephalochordata, Urochordata Gnathostomes, Osteichthyans, lobe-fins, tetrapods, and amniotes.
8. Explain why the reptiles are considered to be the first “TRUE” terrestrial animals (completely adapted to living on land).
9. Explain why mammals underwent an adaptive radiation (divergent evolution) during the Paleocene (early Cenozoic).

Topic 11. Evolution and Classification of Plants (Chapters 29, 30, Portions of Chapter 38)

1. List five characteristics that distinguish plants from organisms in the other four kingdoms.
2. Compare environmental conditions faced by algae in an aquatic environment and plants in a terrestrial environment.
3. List the selected plant phyla covered in class: give the common name of each, and describe at least two distinguishing characteristic of each.
4. Explain why most bryophytes grow close to the ground.
5. Explain why seedless vascular plants are most commonly found in damp habitats.
6. Explain why pollen grains were an important adaptation for successful reproduction on land.
7. Explain the process and function of double fertilization.
8. List the four major events of plant evolution that have allowed them to successfully colonize land. Provide an approximate time period (mya) for each.
9. Explain WHY nature would select for the major events of plant evolution – namely: the colonization of land by plants, the evolution of vascular tissue, the evolution of seeds, the evolution of flowering plants.