**BIO 114 Populations, Community and Biosphere (for Science Majors)**

**Fall Semester 2024 MWF Section**

Lecture-Discussion Section 02 (CRN 50551) NMM LR2 MWF 12:00 – 12:50 (schedule below and BlackBoard course site)

**Instructors:**

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***A syllabus is not a contract between instructors and student, but rather a guide to course procedures. The instructors reserve the right to amend the syllabus when conflicts, emergencies or circumstances dictate. Students will be duly notified.***

**Course Description:**

BIO 114 is one of the three required introductory courses for biology majors. This is a 4-credit hour course that integrates laboratory research and lecture-discussion. This course focuses on living systems at the highest levels of organization: populations, communities, ecosystems and the global biosphere. This course is not intended to be comprehensive. However, we will explore key ecological concepts and processes in depth.

The major subjects of the course will include:

A. Ecology, Evolution and Natural Selection
B. Ecology: Population Growth Dynamics
C. Ecology: Energy Flow and Matter Flows in Food Webs
D. Ecology: Global Energy Flow and Climate

Skills to be developed and enhanced in this course are as follows:

A. Apply the process of science
B. Use quantitative reasoning
C. Model biological processes and simulation reasoning
D. Apply concepts from physics, chemistry and mathematics to biology
E. Describe and evaluate the relationship between science and society
F. Effective communication of science, orally and in writing

**Prerequisites for BIO 114:**

*BIO 114 has no pre-requisites and may be taken at any time in the first three semesters in relation to BIO 111 and BIO 112. BIO 111 is the pre-requisite for BIO 112. This is a freshmen-sophomore-level course and the introductory trifecta (BIO 111-114-112) is the pre-requisite for all upper-level biology courses.*

**Required Texts**
Life: The Science of Biology, 12th edition, with Achieve online access. 2020. David M. Hillis; Craig H. Heller; Sally D. Hacker; David W. Hall; Marta J. Laskowski; David E. Sadava. MacMillan Learning.

**Optional Text**
A Student Handbook for Writing in Biology, 3rd edition (2009) Knisely, Sinauer and Freeman

**Course Learning Outcomes**
1. Students will be able to describe the process of evolution by natural selection and predict the outcomes of that process
2. Students will be able to describe the structure and function of ecosystems including trophic relationships (food webs), productivity, population dynamics, energy flow through ecosystems and biogeochemical cycles.
3. Students will be able to discuss the evidence for global climate change and predict the future consequences of anthropogenic enhancement of the global greenhouse effect.
4. Students will design and conduct a scientific experiment (either in the field or laboratory environment) and conduct authentic research with the guidance of their instructors.
5. Students will collect and analyze data, conduct library research, and evaluate scientific hypotheses as an outcome of the research they conduct.
6. Students will report their research findings orally (seminar format) and in writing (scientific research report).

**Detailed Course Content**

A. Ecology, Evolution and Natural Selection
   1. Evolution, phenotypic change over time in a population, is a fundamental process in all living systems
   2. The phenotypes observed in a population are a product of the genotype-environment interaction
   3. Evolution may be caused by Mutation, Genetic Drift, Migration, or Natural Selection
   4. Natural Selection requires Phenotypic Variation, a Cause for Selection, and consequently Differential Survival and Reproduction
   5. Evolution by Natural Selection involves natural selection and the requirement that phenotypic differences are caused by underlying genetic differences (=heritability).
   6. There are three forms of Natural Selection and resulting evolution
   7. Directional selection and Directional Evolution are responsible for the evolution of antibiotic resistance and insecticide resistance.
   8. Stabilizing selection and Stabilizing evolution are responsible for the maintenance of the sickle-cell gene in populations
   9. Mutation is essential for causing genotypic change but mutation does not direct evolution
   10. Natural Selection is the principal guiding force in Evolution

B. Ecology: Population Growth Dynamics
1. Population growth can be described with simple mathematical models
2. Exponential growth is growth at a constant per individual rate
3. Some populations, including world human population, appear to grow exponentially
4. Exponential doubling time permits predictions about the future
5. Logistic growth is growth with limits, in which the per individual rate of change decreases as population size increases
6. Carrying capacity is the maximum sustainable population size in a given place and time
7. Human population carrying capacity depends on how resources are used
8. Human population growth changes as a population goes through demographic transition
9. Human population age structure is related to population growth rate, lifetime fertility, and demographic transition

C. Ecology: Energy Flow and Matter Flows in Food Webs
1. Energy disperses but matter is recycled in food webs
    a. Energy pyramids
    b. The rule of 10% - states that only 10% of the energy at each trophic level gets passed on to the next trophic level. The remaining 90% is lost during conversion and transfer or is used by the organisms and lost as heat
2. The laws of thermodynamics apply in ecology
3. Matter moves through biogeochemical cycles involving the hydrosphere, atmosphere, biosphere and lithosphere
4. Elements important for life (CHONPS) cycle in an out of living things
5. Each element or molecule important to life is found most abundantly in a slow moving reservoir, but matter reservoirs are different for different elements and molecules
6. Ecological interactions include: competition, predation (parasitism), mutualism, and commensalism and may involve symbioses
7. Living systems interact with both biotic and abiotic factors
    a) Biotic factors are living components of an environment. Examples: plants, animals, humans
    b) Abiotic factors are nonliving components of an environment. Examples: rocks, air, water

D. Ecology: Global Energy Flow and Climate
1. Global energy flow follows the laws of thermodynamics so the sunlight energy arriving on earth is either absorbed, scattered or reflected
2. Most of the sunlight energy absorbed is re-emitted as IR light (heat)
3. Most of the earth atmosphere gases (nitrogen, oxygen and argon) are transparent to IR
4. Trace gases in the atmosphere, composing less than 0.1% of the total, are greenhouse gases
5. Greenhouse gases (including $CO_2$, $CH_4$, CFCs, $NO_x$, $SF_6$, $H_2O$, and $O_3$) are transparent to visible light but absorb and re-emit IR.
6. Human activity, fossil fuel combustion and deforestation since 1750, are causing significant increases in greenhouse gas concentrations because these are trace gases
7. Increased greenhouse gas concentrations is the cause for global warming
8. The consequences of global warming are melting ice caps and glaciers, sea level rise, changes in climate and weather, droughts and wild fires, intense or more frequent severe weather, and significant changes in natural ecosystems
9. These changes will have significant impacts on agriculture production, disease outbreaks, freshwater water availability and political and economic stability worldwide.
10. Addressing this global environmental problem requires both individual and government-level international responses to reduce greenhouse gas emission

**Course Evaluation:**

Your grade in this course will be based on your combined performance on examinations and quizzes (40%) and your work in the laboratory (60%). In the discussion part of the course, your performance will be based three examinations and a comprehensive final examination given during the final examination period, and any quizzes/homework assigned during the semester. All examination questions will be drawn from the subjects we actually address in the course, but it is essential that you keep-up with the reading and pre-discussion assignments and homework. There will be regular in-class quizzes and online quiz assignments that will be part of your discussion grade. A separate laboratory syllabus (distributed in the laboratory class) describes the laboratory part of this course.

**Course Grading:**

Discussion part of course (40% of total grade)

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|---|---|---|
| Three Hour-Examinations, 100 pts. each | | 300 points |
| Comprehensive Final Examination | | 100 points |
| Weekly Quizzes/Homework | | Up to 200 points |
| | Total = | Up to 600 points |

**You will receive a single letter grade for this 4-hour course. Discussion comprises 40% of that grade, and Laboratory comprises 60% of that grade.**

**Laboratories start immediately on 21 August 2024.**

Letter grades for the entire courses (Discussion and Laboratory combined) will be assigned as described below:

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|---|---|---|---|---|
| A | = | 90 | to | 100% |
| A- | = | 88 | to | 89% |
| B+ | = | 86 | to | 87% |
| B | = | 80 | to | 85% |
| B- | = | 78 | to | 79% |
| C+ | = | 76 | to | 77% |
| C | = | 70 | to | 75% |
| C- | = | 68 | to | 69% |
| D+ | = | 66 | to | 67% |
| D | = | 60 | to | 65% |
| D- | = | 58 | to | 59% |
| F | = | 57% and less | | |

**Examinations:** All examinations will be take-home and open book. Hour examinations will be posted on BlackBoard and may be taken starting on Wednesday at 1:00pm but must be started by 9:00pm the Friday of that week. As you work on each examination, you may consult any resources you wish **but you may not consult with any students**. Each examination will be timed and will remain open for 1-hour from the time you begin the examination. Examinations will automatically submit after a total of 60 minutes elapsed time.

**Discussion Schedule** BIO 114 Fall 2024 MWF 12:00-12:50

| **Week** | **Activities** | **Readings and work PRIOR to class** |
|---|---|---|
| 1<br>21-Aug Wednesday<br>23-Aug Friday | Introduction to Course Format<br><br>Introduction to Course | Read Syllabus Blumer/Vereen |
| 2<br>26-Aug Monday<br>28-Aug Wednesday<br><br>No meeting on Friday – work on assignments | Evolutionary process and causes for evolution<br><br>Process of Natural Selection | Blumer Part 5 Chapter 19<br><br>Submit Syllabus Quiz via BlackBoard<br><br>Work on Evolution and Natural Selection Workbook |
| 3<br>**2-Sep Monday-Labor Day and no class**<br>**4-Sep Wed**<br>6-Sep Fri | Process of Evolution by Natural Selection<br><br>Evolution by other causes<br><br>Population growth dynamics | Blumer Part 5 Chapter 19<br><br>Part 9 Chapter 53 |
| 4<br>9-Sep Mon<br>11-Sep Wed<br><br>**No Meetings on Fridays** | Population growth dynamics | Blumer Part 9 Chapter 53 |
| 5<br>16-Sep Mon<br>18-Sep Wed | Limits to population growth<br><br>Population growth in human populations | Blumer Part 9 Chapter 53 |

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| 6<br>23-Sep<br>Monday<br>25-Sep<br>Wednesday | Population growth in human populations<br><br>**Examination 1** (on BlackBoard) | Blumer<br>Part 9 Chapter 53 |
| 7<br>30-Sep Mon<br>2-Oct Wed | Communities and Ecosystems | Vereen<br>Part 9 Chapter 55 |
| 8<br>9-October<br>Wednesday | **Fall Break (no classes 7 – 8 October)**<br><br>Environmental Drivers of Ecosystems | Vereen<br>Part 9 Chapter 56 |
| 9<br>14-Oct Mon<br>16-Oct Wed | Environmental Drivers of Ecosystems | Vereen<br>Part 9 Chapter 56 |
| 10<br>21-Oct Mon<br>23-Oct Wed | Environmental Drivers of Ecosystems<br>Biogeochemical Cycles | Vereen<br>Part 9 Chapter 56 |
| 11<br>28-Oct Mon<br>30-Oct Wed | Ocean Biodiversity and Function | Vereen<br>Part 9 Chapter 56 |
| 12<br>4-Nov Mon<br>6-Nov Wed | Ocean Biodiveristy and Function<br>Environmental Justice<br><br>**Examination 2** (on BlackBoard) | Vereen |
| 13<br>11-Nov Mon<br>13-Nov Wed | Global energy flow dynamics<br><br>Atmospheric composition | Vereen<br>Part 9 Chapter 57 |
| 14<br>18-Nov Mon<br>20-Nov Wed | Greenhouse gases and climate change | Blumer<br>Part 9 Chapter 57 |
| 15<br>25-Nov Mon | Global warming consequences and solutions | Blumer<br>Part 9 Chapter 57 |
| 16<br>2-Dec Mon<br>4-Dec Wed | Global warming consequences and solutions | Blumer/Vereen<br>Part 9 Chapter 57 |
| 17<br>11-Dec | **Final Exam Week**<br>**Examination 3 Final Examination Due Wednesday 11 December 11:59pm.** | |

**Examination 3 and Final Examination (separate examinations)**

Will be available on BlackBoard Wednesday, 4 December, 1:00pm

Examinations must be started no later than Wednesday, 11 December, 9:00pm

**Attendance Policy:**
Absences will not be excused unless permitted in writing by the Dean of Students. No exceptions. More than five unexcused absences will result in a failing grade. Class will begin promptly. Tardy arrival to discussion or laboratory will be counted as an unexcused absence. Attendance in discussion and laboratory will be taken each day by means of a sign-in sheet.

Policy on Absences from Examinations

All students are required to take 3 scheduled examinations and the final examination.

Absences from examinations will be handled as follows: An unexcused absence from any examination will yield a score of zero for that examination grade.

An excused absence (a written excuse from the Dean of Students) from a lecture examination will be handled as follows: The first excused absence from a lecture examination will simply excuse you from that examination; there will be **no make-up examination**. Your grade for the lecture part of the course will be based on three lecture examinations and the final examination.

The second excused absence from a lecture examination will result in a **grade of Incomplete** provided the remainder of the course is completed, including the final examination. All examinations that were excused must be taken by midterm of the next semester to remove the Incomplete. If you know in advance that you will miss a scheduled examination, speak to your instructor **prior** to that examination date.

An excused absence for the final examination will result in a grade of Incomplete.

Any documentation from the Dean of Students that excuses an absence must be submitted to the instructor no later than **five (5) business days** following the absence.

**REASONABLE ACCOMODATIONS**

Morehouse College is committed to removing barriers and providing equal access for students in course instruction or design. If you have been diagnosed with a documented disability and reasonable accommodations are necessary to provide equal access, please contact the Office of Educational Accessibility (OEA) at sas@morehouse.edu You should request accommodations as early as possible since they may take time to implement. If adjustments to your communicated accommodation plan are needed, you should notify OEA at any time during the semester.

**Academic Honesty (Plagiarism):**

All the work that you submit in this course must be your own. Copying the work of others and submitting it as your own is dishonest and will not be tolerated (this includes problem set answer keys). Copying on an examination is an obvious example of academic dishonesty. Submitting work copied from a group effort is unacceptable when individual grades are to be given. Working with your fellow students on laboratory studies, problem sets, models or presentations is fine, but the work you actually submit or present must be the result of your own efforts and must be written in your own words. Paraphrasing the work of others is NOT acceptable. At the very least, dishonesty will result in a **grade of zero** for the assignment or examination, and a report to the Dean of Students, and could result in a grade of F for the course.