## Term Information

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| **Effective Term** | Spring 2013 |

## General Information

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|---|---|
| **Course Bulletin Listing/Subject Area** | Biology |
| **Fiscal Unit/Academic Org** | Biological Sciences Admin - D0300 |
| **College/Academic Group** | Arts and Sciences |
| **Level/Career** | Undergraduate |
| **Course Number/Catalog** | 2100 |
| **Course Title** | Biological Analysis |
| **Transcript Abbreviation** | Biol Analysis |
| **Course Description** | A case studies approach to biology with emphasis on quantitative and systems analysis |
| **Semester Credit Hours/Units** | Fixed: 4 |

## Offering Information

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|---|---|
| **Length Of Course** | 14 Week |
| **Flexibly Scheduled Course** | Never |
| **Does any section of this course have a distance education component?** | No |
| **Grading Basis** | Letter Grade |
| **Repeatable** | No |
| **Course Components** | Laboratory, Lecture |
| **Grade Roster Component** | Lecture |
| **Credit Available by Exam** | No |
| **Admission Condition Course** | No |
| **Off Campus** | Never |
| **Campus of Offering** | Columbus |

## Prerequisites and Exclusions

| | |
|---|---|
| **Prerequisites/Corequisites** | Level 2 Standing required. Chem 1220 or 1250 and Math 1152 or 1172 recommended. |
| **Exclusions** | Does not substitute for Biology 1113, 1114 for majors in the biological sciences |

## Cross-Listings

**Cross-Listings**

## Subject/CIP Code

| | |
|---|---|
| **Subject/CIP Code** | 26.0101 |
| **Subsidy Level** | Baccalaureate Course |
| **Intended Rank** | Sophomore, Junior, Senior |

## Quarters to Semesters

| | |
|---|---|
| **Quarters to Semesters** | New course |
| **Give a rationale statement explaining the purpose of the new course** | Intended to serve an an introductory biology course for engineering students and other students interested in an analytical approach to biology. |
| **Sought concurrence from the following Fiscal Units or College** | |

## Requirement/Elective Designation

General Education course:

Biological Science

The course is an elective (for this or other units) or is a service course for other units

## Course Details

**Course goals or learning objectives/outcomes**

- Successful students will be able to:

1. Apply quantitative approaches to analyze biological processes

- 3. Describe the processes of evolution as variation and selection acting upon that variation

4. Apply the physical and biological properties of biomolecules to characterize and alter chemical and biological processes in the cell.

- 5. Describe the major processes in the life of a cell

6. Apply biological concepts in the evaluation of contemporary issues

**Content Topic List**

- Origin of Life
- Evolution
- Membranes
- Energy Transfer
- Cellular Communication
- Ecosystems

## Attachments

- MolGen_Concurrence2100.pdf: Email from Mark Seeger

*(Concurrence. Owner: Stetson,David Leete)*

- Micro_Concurrence2100.pdf: Email from Chuck Daniels

*(Concurrence. Owner: Stetson,David Leete)*

- EEOB_Concurrence2100.pdf: Email from Roman Lanno

*(Concurrence. Owner: Stetson,David Leete)*

- Support letter for Biology 2100.pdf: Letter from Ed McCaul

*(Memo of Understanding. Owner: Stetson,David Leete)*

- 4194 Syllabus Au12-1.pdf: Current Syllabus

*(Syllabus. Owner: Stetson,David Leete)*

- 2100 GE Assessment plan.doc: Assessment and Rationale

*(GEC Course Assessment Plan. Owner: Eakins,Barbara Ann)*

## Comments

- Please attach GE rationale & GE assessment plan. See e-mail. *(by Vankeerbergen,Bernadette Chantal on 09/05/2012 12:43 PM)*
- Biology 2100 is currently being taught as Biology 4194. *(by Misicka,Matthew Alan on 09/04/2012 10:25 AM)*
- (1) Math 1520 does not exist. Please correct.

  (2) The GE goals are not the most updated ones. I will email Matt Misicka with the updated language from last academic year. *(by Hadad,Christopher Martin on 08/23/2012 05:45 PM)*

## Workflow Information

| Status | User(s) | Date/Time | Step |
|---|---|---|---|
| Submitted | Eakins,Barbara Ann | 08/23/2012 01:41 PM | Submitted for Approval |
| Approved | Misicka,Matthew Alan | 08/23/2012 02:36 PM | Unit Approval |
| Revision Requested | Hadad,Christopher Martin | 08/23/2012 05:45 PM | College Approval |
| Submitted | Stetson,David Leete | 09/04/2012 10:19 AM | Submitted for Approval |
| Approved | Misicka,Matthew Alan | 09/04/2012 10:25 AM | Unit Approval |
| Approved | Hadad,Christopher Martin | 09/04/2012 12:03 PM | College Approval |
| Revision Requested | Vankeerbergen,Bernadette Chantal | 09/05/2012 12:43 PM | ASCCAO Approval |
| Submitted | Eakins,Barbara Ann | 11/21/2012 01:27 PM | Submitted for Approval |
| Approved | Breitenberger,Caroline Anna | 11/21/2012 01:31 PM | Unit Approval |
| Approved | Hadad,Christopher Martin | 11/23/2012 01:34 PM | College Approval |
| Pending Approval | Nolen,Dawn<br>Jenkins,Mary Ellen Bigler<br>Vankeerbergen,Bernadette Chantal<br>Hogle,Danielle Nicole<br>Hanlin,Deborah Kay | 11/23/2012 01:34 PM | ASCCAO Approval |

**BIOLOGY 4194—GROUP STUDIES BIOLOGICAL ANALYSIS**
**Syllabus for Autumn Semester 2012**

**Lectures: Tu,Th 2:20PM – 3:40PM, Caldwell Lab 0119**
**Lab: F, 1:30PM - 4:30PM, Jennings Hall 0330**


**INSTRUCTORS** **Dr. David Stetson** (stetson.1@osu.edu), 292-5307, 240D Jennings
OFFICE HOURS: MTRF 9:00-11:00AM

**Dr. Richard Lease** (lease.22@osu.edu), 210 Koffolt, 140 W. 19th
OFFICE HOURS: by appointment

**Dr. Rebecca Tien** (tien.22@osu.edu), 325 Jennings
OFFICE HOURS: TTH 11:00AM-12:00PM

**COURSE COORDINATOR** **Megan Clawson** (clawson.31@osu.edu), 688-5495, 255E Jennings
OFFICE HOURS: walk-in or by appointment


**Description:**
Biological Analysis is an introductory course in biology for students interested in a quantitative, analytical approach to the discipline. It presents biology as an integrated body of knowledge with a focus on systems, control of those systems, and transfer of materials and energy through those systems. Students who complete this course will

- appreciate that life on Earth is a single, coordinated, and interacting system
- understand the processes of evolution as variation and natural selection acting upon that variation
- understand the physical and biological properties of biomolecules
- know the life of a cell
- understand the relationships of cells to organs, organs to organisms, organisms to communities, and communities to ecosystems

**Prerequisites:**
Level 2 standing required; Chem 1220 (or 1250) and Math 1152 strongly recommended; does not substitute for Biology 1113(H)/1114(H) for majors in the biological sciences.

**Lecture Textbook**
Campbell, N.A., Simon, E.J., Dickey, J.L., Reece, J.B. (2013) Essential Biology with Physiology, 4th ed. (New York, New York: The Pearson/Benjamin Cummings Publishing Company). (ISBN 978-0-321-77260-2) with mastering biology, or you may purchase a code to access mastering biology.

Alon, U., (2007) An Introduction to Systems Biology, Design Principles of Biological Circuits. (Boca Raton, FL: Taylor and Francis Group, LLC). (ISBN 1-58488-642-0)
Although a textbook is required, the coursework will include reading of assigned articles and any other material that may be made available to the students, including web-based materials.

**Lab Notebook:** Student Lab Notebook with spiral binding (Hayden McNeil, ISBN 978-1-930882-35-5)

**Handouts:** Many handouts will be provided in the course, all of which will be posted in digital format in the Content section of Carmen. Carmen can be accessed online at www.carmen.osu.edu.
**Extra Readings** Some extra readings will be required for some lectures. These will be specified in the relevant lectures and posted on Carmen.

**GEC Natural Science Learning Objectives**
Courses in natural sciences foster an understanding of the principles, theories and methods of modern science, the relationship between science and technology, and the effects of science and technology on the environment.

1. Students understand the basic facts, principles, theories and methods of modern science.
2. Students learn key events in the history of science.
3. Students provide examples of the inter-dependence of scientific and technological developments.
4. Students discuss social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

This course is designed to fulfill the requirements of the Natural Science component of a General Education Curriculum. Throughout the course, in laboratory exercises, problem sets, and readings, students will use mathematics, statistics, and data analysis and interpretation.

**Learning Outcomes**

Successful students will be able to:

1. Apply quantitative approaches to analyze biological processes
    a. Acquire and analyze quantitative data
    b. Evaluate balance-based models to describe biological processes
    c. Apply balance-based models to analyze biological processes
    d. Identify temporal and spatial scales associated with specific biological processes

2. Illustrate life on Earth as a single, coordinated, and interacting system
    a. Characterize and describe the major features of the biological domains and kingdoms
    b. Use concepts of emergent properties and scale to explain the relationships between molecules and cells, cells and organs, organs and organisms, organisms and communities, and communities and ecosystems
    c. Explain the forms of energy utilized in biological systems and the laws of thermodynamics that govern them
    d. Describe the cellular response to its environment
    e. Explain ecological phenomena related to populations and communities in terms of basic mathematical models
    f. Track flow of matter and energy through an ecosystem
    g. Describe how form and function support and limit an organism's survival and reproduction
    h. Explain human and global impacts of perturbations in an ecosystem
    i. Describe the interrelationship between biodiversity and community interactions, such as predation, competition, and symbiosis

3. Describe the processes of evolution as variation and selection acting upon that variation
    a. Explain how evolution accounts for the unity and diversity of life
    b. Use the geologic time scale to identify when major biological evolutionary events occurred
    c. Explain the mechanisms of evolution
        i. Explain the transfer and modification of heritable traits from parents to offspring
        ii. Describe the nature and expression of heritable information at the molecular level, including DNA replication, DNA repair, transcription, protein synthesis.
        iii. Apply Mendelian genetics to solve monohybrid and dihybrid crosses
        iv. Identify examples of non-Mendelian patterns of inheritance
    d. Use concepts associated with evolution to explain patterns of speciation and extinction
        i. Describe methods used to infer evolutionary relationships
        ii. Use concepts associated with evolution to explain artificial selection
        iii. Explain mechanisms of sexual selection and the evolution of social behavior

4. Apply the physical and biological properties of biomolecules to characterize and alter chemical and biological processes in the cell.
    a. Identify examples, and list characteristics and general functions of the major classes of biological macromolecules (carbohydrates, lipids, proteins, nucleic acids)
    b. Explain the energy transformations involved in fermentation, cellular respiration, and photosynthesis (including orderly chemical transformations, the relevance of redox reactions, and electron/proton transport)
    c. Describe the nature and function of enzymes and describe major mechanisms used to control their activity
    d. Describe the experimental basis and select applications of recombinant DNA technology.

5. Describe the major processes in the life of a cell
    a. Explain the activities in the cell by relating cellular structure and cellular function
    b. Explain the mechanisms and structures involved in mitotic and meiotic cell division, and explain the different roles for and consequences of each
    c. Describe how the loss/failure of cellular control mechanisms can cause disease

d. Explain how genetic expression is controlled in prokaryotes and eukaryotes
e. Explain cellular reproduction, growth, differentiation, and apoptosis in the context of organismal development
f. Describe characteristics of viruses (e.g., reproduction, genome type and content, exchange of genetic material).

6. Apply biological concepts in the evaluation of contemporary issues
    a. Describe the development and evaluation of scientific explanations of natural phenomena
    b. Use quantitative reasoning to support a position

***Grading and Evaluation***

**Lecture (600 points):** Lecture grades will consist of assigned classwork and homework. Instructions will be provided on Carmen on how to register for Mastering Biology. Mastering Biology is required for the course. Assignments are to be completed as out-of-class homework requiring 30-50mins of time. These assignments are intended to provide necessary background information for the week's lecture topics, as well as to help you keep up with the course material. Assignment due dates are indicated by an asterisk (*) on the lecture schedule. Assignments must be accessed and completed during the specified amount of time. ***Plan in advance, loss of power or internet access will not be an excuse for a make-up assignment.*** There will be three lecture midterms, and a lecture final exam. Exam material will be drawn from the lectures, laboratories, and the assigned readings. The exam format is up to the discretion of the instructor.

**Lab (430 points):** The laboratory will have a series of laboratory exercises and quizzes that test laboratory material. There will also be a formal lab report, as well as a lab final consisting of multiple choice and short answer questions.

| | |
|---|---|
| Class/Homework Assignments | 100 pts |
| Lab Summaries (13 @ 2-15 pts each) | 130 pts |
| Formal Lab Report | 50 pts |
| Lab Quizzes (5 @20 pts each) | 100 pts |
| Lab Final | 150 pts |
| Midterm Exams (3 @100 pts each) | 300 pts |
| Final Exam | 200 pts |
| Total | 1030 pts |

**Grade scheme:** Your final grade will be based on the percentage of the 1030 points that you earn during the course of the semester, as indicated below. Please note that we do not grade the course on a curve and Carmen does not round averages up to the next nearest percentage point, so 92.11% and 92.97% both earn the grade of A-.

| % Grade | % Grade | % Grade | % Grade | % Grade | % Grade |
|---|---|---|---|---|---|
| 93-100 A | 87-89 B+ | 80-82 B- | 73-76 C | 67-69 D+ | 59 and below E |
| 90-92 A- | 83-86 B | 77-79 C+ | 70-72 C- | 60-66 D | |

Biology 4194 will use a case-study approach to present and integrate our understanding of biology at all relevant levels. Each case will extend through three weeks of the course and for each case, students will solve analytical problems, complete a laboratory exercise, which may include any technique from enzymology to computer programming, and write an examination at the case's termination. The course will culminate with a final examination.

| | |
|---|---|
| Week 1 | Orientation, Introduction |
| Module 1 | Molecular and Cellular Processes |
| Module 2 | Biology of Tissues and Organs |
| Module 3 | Origin of Life and Evolutionary Processes |
| Module 4 | Ecosystemic Processes and Sustainability |
| Week 14 | Review and Debriefing |

## Lecture Schedule

**EB= Essential Biology; ISB= An Introduction to Systems Biology**

Be sure to read the relevant pages in the assigned text **BEFORE** coming to lecture.

| Date | Topic | Readings |
|---|---|---|
| Aug 23 | Stetson: Introduction to the Course | EB: Chap. 1 |
| | | |
| Aug 28* | Stetson: Evolution is the Foundation | ISB: Ch 1 |
| Aug 30 | Lease: Molecules and Cells; Central aspects of Molecular Genetics | EB: Ch 2-3,10; ISB 2 |
| | | |
| Sept 4 | Lease: Protein Structure/Function | EB: Ch 2-3; SUPPL. READINGS |
| Sept 6 | Lease: Michaelis-Menten Enzyme Kinetics | SUPPL. READINGS; ISB: Appx A1, A2, A7 |
| | | |
| Sept 11 | Lease: Core Metabolism | EB Ch 5-7; SUPPL. READINGS |
| Sept 13 | Lease: Prokaryotes and eukaryotes | EB: Ch 4, 8; ISB 3 |
| | | |
| Sept 18 | Lease: Gene regulation | EB Ch 9,11; ISB: 4-5 |
| Sept 20 | Lease: Signal transduction | ISB: 6.1-6.5; SUPPL. READINGS |
| | | |
| Sept 25 | Lease (Breitenberger): Cancer cell case study | EB Ch 8; SUPPL. READINGS |
| Sept 27 | Lease (Wood): Biotechnology applications | EB Ch 12 |
| | | |
| Oct 2 | Lease et al.; Exam | |
| Oct 4* | Stetson: Tissues and Organs | EB: Chaps. 21-29 |
| | | |
| Oct 9* | Stetson | |
| Oct 11 | Stetson | |
| | | |
| Oct 16* | Stetson: Evolution | EB: Chaps. 13.17 |
| Oct 18 | Stetson | |
| | | |
| Oct 23* | Stetson | |
| Oct 25 | Stetson | |
| | | |
| Oct 30* | Stetson | |
| Nov 1 | Stetson; Exam | |
| | | |
| Nov 6 | Tien et al.: Ecology | EB: Chaps 18-20 |
| Nov 8 | Tien et al. | |
| | | |
| Nov 13 | Tien et al. | |
| Nov 15 | Tien et al. | |
| | | |
| Nov 20 | Tien et al. | |
| Nov 22 | **THANKSGIVING HOLIDAY** | |
| | | |
| Nov 27 | Tien et al. | |
| Nov 29 | Tien et al. | |
| | | |
| Dec 4 | Tien et al.; Exam | |
| | | |
| **Dec 10** | **FINAL EXAM: 2:00PM-3:45PM** | |

**NOTE: The final exam begins 20 min EARLIER than the usual lecture time.**

*Course Policies*

**Lecture Exam Make-ups:** A student who misses a lecture exam, and who has a written medical excuse from the Student Health Center or a physician, or other valid excuse is permitted to make up the missed exam. You must contact Megan Clawson within 24 hours of the exam. Medical excuses will be accepted only if the student is seen and treated by a qualified medical professional during the period of illness. Other valid excuses are limited to problems that are "beyond the student's control," such as military duty, intercollegiate athletic or academic activities, funerals, etc. Written documentation of these activities must also be provided. It is your responsibility to schedule the makeup WITHIN ONE WEEK OF THE EXAM, and present your valid excuse. Makeup labs and lab assignments will be handled by your TA.

If you anticipate having to miss an exam due to attendance at a university sanctioned event or other qualifying conflict, you must contact Megan Clawson at least one week in advance of the exam and supply written documentation signed by an appropriate official.

Persons arriving late for exams after the first person has completed the exam may be allowed to take the exam in the remaining time with an imposed penalty of 25% of the total exam points. Lack of transportation, loss of electricity, travel plans, etc. will not be considered valid excuses. If suitable documentation is presented for the reason of tardiness, then a make-up exam will be given. **The format of the make-up exam is at the discretion of your instructors.**

**Grade Disputes:** It is the student's responsibility to follow his/her progress in the course throughout the semester. Questions about grading mistakes or grades that are missing should be directed to the TA within 10 class days of the posting of graded class material to Carmen. Please contact Megan Clawson (clawson.31@osu.edu) for questions regarding lecture exam grades. **Grade disputes brought to the attention of your TA or the Course Coordinator after ten class days will not be considered.**

**Laboratory and Recitation Policy:** Laboratory and recitation are an integral part of the course. They are designed to complement as well as supplement the lecture. You may first encounter something in lab before you have it in lecture or vice versa. Students are expected to come prepared to lab having completed the assigned reading.

Lab assignments consist of notes to be turned in at the end of the lab, and specific questions from the lab handouts, to be done by each individual. Lab work is to be completed in cooperative groups of 2 students. Each group member is expected to contribute EQUALLY, and participation in each exercise will be evaluated by the TA each period. Groups are required to turn in one Formal Lab Report on which all group members sign their name. All lab group members will receive the same score for each graded lab assignment IF all members participated equally in the work each day.

**Laboratory Safety:** Eating, drinking, smoking and chewing tobacco is prohibited in lab. Open-toe shoes and flip-flops cannot be worn in the lab room. Treat all chemicals with respect and care. Please be cautious when using them, and use any safety equipment provided. If you are pregnant, suspect you may be pregnant at that time, or are particularly sensitive to chemicals, please notify your TA.

**Lab Final:** The lab final exam is comprehensive, and consists of multiple choice and short answer questions.

**Late Lab Assignments:** The lab assignments are due at the designated time in the lab schedule. Any lab assignment turned in late must be placed in your lab TA's mailbox in room 247 Jennings between the hours of 8:00 A.M. and 5:00 P.M. weekdays. You are required to record your assignment in the assignment log notebook and time-stamp your assignment with the time stamp machine, both located just inside the doorway. Recording and stamping your assignment is for your benefit to make sure your paper is received and gets proper credit. Assignments not recorded and time stamped will be assumed to have been received on the day of TA pick up. Late assignments will lose 25% of the available points each day for up to three (3) days after the due date. Assignments will NOT be accepted after more than three days.

**Missed Labs:** Labs cannot be made up unless the absence is excused and proper documentation is provided (e.g., doctor, coach, etc.). Downloaded forms from the OSU Health Center are not accepted. You have 48 hours to contact your TA about making up a missed laboratory assignment for a valid reason. After 48 hours, your grade will be a 0. Make-up lab assignments must be completed within one week of receipt. Reduction will occur as stated on the late lab assignment policy if turned in after one week. ***Missing 3 labs (excused or unexcused) will automatically result in a failing grade for the course***.

**Academic Misconduct:** OSU has a strict code of academic misconduct that requires us to report any and all cases of suspected misconduct (e.g. cheating on an examination, plagiarism in written assignments, using an examination proxy, failure to follow course policies, etc.) to the OSU Committee on Academic Misconduct for adjudication. We will strictly adhere to this policy.

**Accessibility:** Any student registered with the Office of Disability Services, and needing accommodation should make an appointment with the Course Coordinator, Megan Clawson, to discuss those needs. Please do this within the first two weeks of the semester. Only the Course Coordinator is authorized to sign ODS forms. Please fill out parts of the proctor sheet forms that are to be completed by the student before bringing the form for signature. This will help us ensure that your individual needs will be met appropriately and equitably.

**Sexual Harassment:** OSU considers sexual harassment to be unacceptable behavior that destroys opportunities for learning. While all members of the staff involved in this course have been trained in the OSU sexual harassment policies and procedures, this is not true for all students. Students are expected to follow the university code of conduct at all times and report any concerns about questionable or unwanted behavior to the Course Coordinator.

**University Escort Service:** To promote safety on campus, transportation across campus is offered by the OSU Department of Public Safety. Service is available between 7:30 P.M. and 3:00 A.M. during Au and Sp semesters. Call 292-3322 to schedule a pick-up. You must provide at least one hour notice (http://www.ps.ohio-state.edu/sss/escort_info/).

**Issue Resolution:** The CLSE believes that student concerns are usually most effectively addressed by the staff closest to the situation. Therefore, students are ordinarily expected to address issues or concerns with their TAs first. If the issue cannot be resolved by your TA, or for some reason you feel that you absolutely cannot address your concern with your TA, please feel free to contact your Course Coordinator, Megan Clawson, or Assistant Director, Matt Misicka.

# Biology 4194 Lab/Recitation Schedule

| Designation on Carmen | DATE | EXERCISE/CARMEN DOWNLOAD | ASSIGNMENTS |
|---|---|---|---|
| **Lab Safety** | 24 Aug. | Introduction to General Laboratory Protocol and Safety Review;<br>Intro to Spectrophotometers | **Read** - Welcome to Biology Lab, Safety Review (Handout on Carmen)<br>**Due @ end**– Safety Review (5 pt; individual) |
| **DNA Analysis** | 31 Aug. | DNA Analysis of Bacterial Plasmid Sequences | **Read Before Lab** – Lab Handout on Carmen<br>**Due @ end**– Lab Notes (2 pt) |
| **Mendelian & Human Genetics** | 7 Sept. | Mendelian Genetics with Statistical Analysis;<br>Human Genetics | **Read Before Lab** – Lab Handout on Carmen |
| **Miniprep** | 14 Sept. | Miniprep and Restriction Map of a Plasmid DNA From Bacteria;<br>Bacterial Transformation | **Quiz 1**<br>**Due-** Mendelian Genetics & Human Genetics (15 pt each)<br>**Read Before Lab** – Handout on Carmen<br>**Due @ end**– Lab Notes (2 pt) |
| **Induction & Purification** | 21 Sept. | Induction and Purification of Protein Expressed in E. coli | **Read Before Lab** – Handout on Carmen<br>**Due @ end**– Lab Notes (2 pt) |
| **Recovery & Purification** | 28 Sept. | Recovery and Purification of Expressed Proteins via Engineered Tag Systems | **Quiz 2**<br>**Read Before Lab** – Handout on Carmen<br>**Due @ end**– Lab Notes (2 pt) |
| **Enzymes** | 5 Oct. | Enzyme Assays and Enzyme Kinetics | **Read Before Lab** – Handout on Carmen<br>**Due @ end**– Lab Notes (2 pt) |
| **Histology** | 12 Oct. | Histology | **Due** – Formal Lab Report (50 pt)<br>**Read Before Lab** – Handout on Carmen |
| **Evo & Pop Gen** | 19 Oct. | Evolution and Population Genetics | **Quiz 3**<br>**Due** – Histology (10 pt)<br>**Read Before Lab** – Handout on Carmen |
| **Systematics** | 26 Oct. | Phylogeny and Systematics | **Due** – Evolution and Population Genetics (15 pt)<br>**Read Before Lab** – Handout on Carmen |
| **Animal Diversity** | 2 Nov. | Animal Diversity | **Quiz 4**<br>**Due** – Phylogeny and Systematics (15 pt)<br>**Read Before Lab** – Handout on Carmen |
| **Photosynthesis** | 9 Nov. | Photosynthesis | **Due** – Animal Diversity (15 pt)<br>**Read Before Lab** – Handout on Carmen |
| **Island Biogeography** | 16 Nov. | Island Biogeography and Conservation | **Quiz 5**<br>**Due** - Photosynthesis (15 pt)<br>**Read Before Lab** – Handout on Carmen<br>**Due @ end**– Island Biogeography (15 pt) |
| | 23 Nov. | **Thanksgiving Holiday**<br>Mon. & Tues. Open Lab Review | **Prepare for lab final** |
| **Lab Final** | 30 Nov. | **Lab Final**<br>**Lecture Final Review** | |
| | 7 Dec. | No labs this week | **LECTURE FINAL EXAM 10 Dec.** |

*This syllabus is a working document and may change with ample notification*

Biology 2100 GE rationale

Biology 2100 is a response to a request from the College of Engineering for a one-semester course in biology that would replace Biology 1113 and Biology 1114 in their curriculum and that would emphasize an analytical and quantitative approach to biology. This course is expected to be populated primarily by students in biomedical engineering, chemical and biomolecular engineering, and food, agricultural, and environmental engineering. Because this course will present biology as an integrated whole, and because it will cover the full breadth of the discipline (to the extent possible), it will be a biology course with laboratory that will fulfill the General Education requirements in a manner similar to Biology 1113 and 1114, packaged as a single course rather than a two-semester sequence. The course will be supervised by a faculty member from the biological sciences departments in the College of Arts and Sciences, on behalf of the Center for Life Sciences Education. Additional faculty from the Colleges of Arts and Sciences and Engineering will share the teaching of the integrated modules. Before each offering, the team of instructors will spend a week developing each offering, choosing the modules, developing the assessments, and choosing the laboratory exercises and other projects.

The course aligns well with GE Natural Science learning objectives; a few examples follow:

1. *Students understand the basic facts, principles, theories and methods of modern science.*
    a. Evolution: students will be able to explain how evolution accounts for the unity and diversity of life, use the geologic time scale to identify when major biological evolutionary events occurred, explain the mechanisms of evolution, and describe methods used to infer evolutionary relationships.
    b. The Chemistry of Life: students will be able to identify examples, and list characteristics and general functions of the major classes of biological macromolecules (carbohydrates, lipids, proteins, nucleic acids), explain the energy transformations involved in fermentation, cellular respiration, and photosynthesis (including orderly chemical transformations, the relevance of redox reactions, and electron/proton transport), and describe the experimental basis and select applications of recombinant DNA technology.
    c. The Cell: students will be able to explain the activities in the cell by relating cellular structure and cellular function, explain the mechanisms and structures involved in mitotic and meiotic cell division, and explain the different roles for and consequences of each, and describe how the loss/failure of cellular control mechanisms can cause disease.
    d. Genetics: students will be able to describe the nature and modification of heritable traits from parents to offspring, describe the nature and expression of heritable information at the molecular level, including DNA replication, DNA repair, transcription, protein synthesis, apply Mendelian genetics to solve monohybrid and dihybrid crosses, identify examples of non-Mendelian patterns of inheritance, and explain how genetic expression is controlled in prokaryotes and eukaryotes.
    e. Diversity of life: students will be able to characterize and describe the major features of the biological domains and kingdoms.
    f. Ecology: students will be able to use concepts of emergent properties and scale to explain the relationships between organisms and communities and communities and

ecosystems, explain ecological phenomena related to populations and communities in terms of basic mathematical models, and describe human and global impacts of perturbations in an ecosystem.

2. *Students understand key events in the development of science and recognize that science is an evolving body of knowledge.* In this course, students will study the development of our understanding of geological history, the development of evolutionary thought, the development of Mendelian genetics, and how cellular structure and function was analyzed.

3. *Students describe the inter-dependence of scientific and technological developments.* Throughout the course, applications of biological principles and techniques will be related to the subject at hand and the consequences of such applications will be discussed. Students will learn about technological breakthroughs that have led to major changes in our understanding of biological topics, for instance current genomic and proteomic studies were facilitated by advances in DNA sequencing and protein analysis, respectively, and have led to fundamental changes in the treatment of diseases such as cancer.

4. *Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.* Students in this course will describe the development and evaluation of scientific explanations of natural phenomena, and use quantitative reasoning to support a position.

Biology 2100 Assessment plan

| GEC Learning Objective | Indirect Methods | Direct Methods |
|---|---|---|
| 1. Students understand the basic facts, principles, theories and methods of modern science. | SALG | Embedded questions on exams<br>Grading rubric for lab report will include a subscore addressing this learning outcome |
| 2. Students learn key events in the history of science and recognize that science is an evolving body of knowledge. | SALG | Embedded questions on exams |
| 3. Students provide examples of the inter-dependence of scientific and technological developments. | SALG | Embedded questions on exams |
| 4. Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world. | SALG | Embedded questions on exams<br>Homework assignment with grading rubric that addresses this outcome |

A few questions on each exam will be mapped to the GE learning outcomes listed above and student performance on these specific questions will be analyzed separately from the rest of the exam. The lab report grading rubric will contain a subscore that corresponds to learning outcome #1. At least one homework assignment will target learning outcome #4, and will be graded using a rubric with a subscore corresponding to LO #4.

In addition, we will use the Student Assessment of Learning Gains (SALG), an instrument that has been extensively used in other Biology courses at Ohio State (including Biology 1113 and 1114) to evaluate students' perceptions of the course as well as their self-assessment of whether they have met the GE learning objectives for this course. The SALG is described at the following website:
http://www.wcer.wisc.edu/salgains/ftp/SALGPaperPresentationAtACS.pdf
Examples of SALG questions asked in previous classes:

As a result of your work in this class, what GAINS DID YOU MAKE in your UNDERSTANDING of each of the following? (1 = no gains, 2 = a little gain, 3 = moderate gain, 4 = good gain, 5 = great gain)

- How ideas from this class relate to those encountered in other disciplines
- How this class helps people address real world issues
- Articles in the media that discuss scientific findings
- How to think about a research question
- Historical aspects of biology
- Understanding the main concepts (basic facts, principles, theories and methods of modern biology)
- Understanding the interdependence between scientific and technological developments
- Understanding the potential of science and technology to address problems of the contemporary world
- Current and future significance of biology on society
- Scientific ethics and practices

Please comment on how this class has CHANGED YOUR ATTITUDES toward this subject.

What will you CARRY WITH YOU into other classes or other aspects of your life?

The indirect and direct measures of the GE learning outcomes will be compiled by the instructor and Center for Life Sciences Education staff and reviewed with the course instructor, the course coordinator, and other relevant CLSE staff. The expected level of achievement is:

- at least 75% of the students will perform satisfactorily (C work or better) on the embedded exam questions reflecting learning objectives 1-4
- 75% of the students will perform satisfactorily (C work or better) on the laboratory report and homework subscores having to do with learning objectives 1, 4
- a class average of 3.0 (moderate gain) or higher on the SALG questions in which students self-evaluate how their understanding of GE learning outcomes has increased during the course

These scores would indicate that most students perceived at least "moderately" increased understanding of the objectives of the GEC and could demonstrate their learning on an exam and/or in a written document. Other questions on the SALG address additional course learning outcomes, course mechanics, *etc.*, and will be considered in making modifications to the course, if necessary. If the course assessments indicate that students do not meet the expected level of achievement of GE learning outcomes, the instructor will modify the course in ways that will more fully address these learning outcomes. Depending on the outcomes of assessment in the first few years, homework and/or lab assignments that link directly with outcomes 2 and 3 may be added (or substituted) to the list of direct measures above.

**From:** "Seeger, Mark" <seeger.9@osu.edu>
**Subject:** RE: Biology 2100
**Date:** February 29, 2012 11:57:54 AM EST
**To:** David Stetson <dlstetson@me.com>

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Dave -

My apologies - I thought I had replied to the earlier request.

Molecular Genetics has no concerns with this proposed course. We feel that it will adequately prepare students for Molecular Genetics 4500 General Genetics and will add it to the list of acceptable Introductory Biology prerequisites for MolGen 4500 once final approval for Biology 2100 has been granted.

Let me know if you need any additional input from Molecular Genetics.

Sincerely,
Mark

Mark A. Seeger, PhD
Associate Professor
Associate Chair
Department of Molecular Genetics
965 Biological Science Building
484 W 12th Ave
Columbus, OH 43210
614-292-5106 (office)
614-292-4466 (fax)

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**From:** David Stetson [dlstetson@me.com]
**Sent:** Monday, February 27, 2012 4:27 PM
**To:** Seeger, Mark
**Subject:** Fwd: Biology 2100

Mark, here is the original request.

Dave

Begin forwarded message:

> **From:** David Stetson <stetson.1@osu.edu>
> **Subject: Biology 2100**
> **Date:** January 20, 2012 11:02:25 AM EST
> **To:** Seeger Mark <seeger.9@osu.edu>
>
> Mark, I think you are still chair of MolGen's curriculum committee, but if you are not, could you pass this request to the appropriate person? As you may be aware, we at CLSE were asked by the College of Engineering to build an intro bio course to replace 113 and 114 and that would be more quantitative and analytical than either 113 or 114. I've come up with this Bio 2100, syllabus attached. I seek your concurrence with the course and I ask whether MolGen will accept this new course as a prereq for MolGen 4500.
>
> David L. Stetson, Ph.D.
> Center for Life Sciences Education
> 240D Jennings Hall

1735 Neil Avenue
614 292-5307

**From:** "Daniels, Charles" <daniels.7@osu.edu>
**Subject:** Re: Biology 2100
**Date:** January 20, 2012 11:06:23 AM EST
**To:** "Stetson, David" <Stetson.1@osu.edu>

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Hi Dave

The course looks great and Microbiology would accept this as a prereq for both M4000 (509) and M4100 (520/521).

Let me know if you need a formal response from us.

Cheers
Chuck

On 1/20/12 10:59 AM, "David Stetson" <stetson.1@osu.edu> wrote:

> Chuck, as you may be aware, we at CLSE were asked by the College of Engineering to build an intro bio course to replace 113 and 114 and that would be more quantitative and analytical than either 113 or 114. I've come up with this Bio 2100, syllabus attached. I seek your concurrence with the course and I ask whether Micro will accept this new course a a prereq for Micro 4000?
>
> Dave
>
> David L. Stetson, Ph.D.
> Center for Life Sciences Education
> 240D Jennings Hall
> 1735 Neil Avenue
> 614 292-5307
>
> --
> BEGIN-ANTISPAM-VOTING-LINKS
> ---
>
> Teach CanIt if this mail (ID 1324655132) is spam:
> Spam:
> https://antispam.osu.edu/b.php?i=1324655132&m=228f6f835bc2&c=s
> Not spam:
> https://antispam.osu.edu/b.php?i=1324655132&m=228f6f835bc2&c=n
> Forget vote:
> https://antispam.osu.edu/b.php?i=1324655132&m=228f6f835bc2&c=f
> ---
> END-ANTISPAM-VOTING-LINKS

**From:** "Lanno, Roman" <lanno.1@osu.edu>
**Subject:** BIO 2100
**Date:** February 20, 2012 2:37:37 PM EST
**To:** "Stetson, David" <Stetson.1@osu.edu>
**Cc:** "Wolfe, Andrea" <wolfe.205@osu.edu>, "Curtis, Peter" <Curtis.7@osu.edu>

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Hi Dave,
Just to follow up on BIOL 2100, the Curriculum Committee discussed this as a pre-requisite for non-biology majors that woud like to take EEOB 3510, Cellular and Developmental Biology and found that it would be adequate as a required pre-requisite for EEOB 3510. The course catalogue description will be updated to reflect this in the next course change form I submit. Let me know if you have any questions.
Roman

THE OHIO STATE UNIVERSITY

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Subject: Support for Biology 2100, Biological Analysis

27 January 2012

The College of Engineering fully supports the creation of Biology 2100, Biological Analysis. Biology 2100 will become the Biology course of choice for our students.

Edward B. McCaul, Jr., PhD, PE
Assistant Dean for Curriculum and Assessment
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117 Hitchcock Hall
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