Appendix 4: Biology 401 and 402

The Ohio State University
Colleges of the Arts and Sciences New Course Request

College of Biological Sciences
Academic Unit
Biology

Book 3 Listing (e.g., Portuguese)
401 Integrated Biology I
Number Title

IntegratdBiologyI U 5
18-Character Title Abbreviation Level Credit Hours

Summer Autumn Winter x Spring Year 2008
Proposed effective date, choose one quarter and put an "X" after it; and fill in the year. See the OAA curriculum manual for deadlines.

A. Course Offerings Bulletin Information

Follow the instructions in the OAA curriculum manual. If this is a course with decimal subdivisions, then use one New Course Request form for the generic information that will apply to all subdivisions; and use separate forms for each new decimal subdivision, including on each form the information that is unique to that subdivision. If the course offered is less than a quarter or a term, please complete the Flexibly Scheduled/Off Campus/Workshop Request form.

Description (*not to exceed 25 words*): A case studies approach is used to to gain a better understanding of biological

concepts and principles. This course is designed for biology majors.

Quarter offered: Wi, Au Distribution of class time/contact hours: 2 1.5 hr cl, 1 1hr rec
Quarter and contact/class time hours information should be omitted from Book 3 publication (yes or no): yes

Prerequisite(s): Biology 113 and 114 or HS AP Biology; and Chem 123 and Math 150; or permission of instructor

Exclusion or limiting clause:

Repeatable to a maximum of _____ credit hours.

Cross-listed with:

Grade Option (Please check): Letter ☐x S/U ☐ Progress ☐ What course is last in the series? _402__

Honors Statement: Yes ☐ No x GEC: Yes ☐ No x Admission Condition
Off-Campus: Yes ☐ No x EM: Yes ☐ No x Course: Yes ☐ No x
Embedded Honors Statement: Yes ☐ No x

Other General Course Information:
(e.g. "Taught in English." "Credit does not count toward BSBA degree.")

B. General Information

Subject Code 260101 Subsidy Level (V, G, T, B, M, D, or P) B

If you have questions, please email Jed Dickhaut at dickhaut.1@osu.edu.

1. Provide the rationale for proposing this course:
Revisions to the biology major

2. Please list Majors/Minors affected by the creation of this new course. Attach revisions of all affected programs. This course is (check one): x Required on major(s)/minor(s) ☐ A choice on major(s)/minors(s)
☐ An elective within major(s)/minor(s) ☐ A general elective:

3. Indicate the nature of the program adjustments, new funding, and/or withdrawals that make possible the implementation of this new course.

4. Is the approval of this request contingent upon the approval of other course requests or curricular requests?

Yes x No ☐ List: Biology 402

5. If this course is part of a sequence, list the number of the other course(s) in the sequence: 402

6. Expected section size: 250 (lecture), 25 (rec) Proposed number of sections per year: 2

7. Do you want prerequisites enforced electronically (see OAA manual for what can be enforced)? Yes x No ☐

8. This course has been discussed with and has the concurrence of the following academic units needing this course or with academic units having directly related interests (*List units and attach letters and/or forms*):
Not Applicable ☐
Departments in the College of Biological Sciences: Biochemistry, Entomology, EEO Biology, Microbiology,
Molecular Genetics, Plant Cellular and Molecular Biology

9. **Attach a course syllabus that includes a topical outline of the course, student learning outcomes and/or course objectives, off-campus field experience, methods of evaluation, and other items as stated in the OAA curriculum manual and e-mail to asccurrofc@osu.edu.**

Approval Process The signatures on the lines in ALL CAPS (e.g. ACADEMIC UNIT) are required.

1. Academic Unit Undergraduate Studies Committee Chair	Printed Name	Date
2. Academic Unit Graduate Studies Committee Chair	Printed Name	Date
3. ACADEMIC UNIT CHAIR/DIRECTOR	Caroline Breitenberger **Printed Name**	**Date**

After the Academic Unit Chair/Director signs the request, forward the form to the ASC Curriculum Office, 105 Brown Hall, 190 West 17th Ave. or fax it to 688-5678. Attach the syllabus and any supporting documentation in an e-mail to asccurrofc@osu.edu. The ASC Curriculum Office will forward the request to the appropriate committee.

		David Horn	
5.	**COLLEGE CURRICULUM COMMITTEE**	**Printed Name**	**Date**
		Edward Adelson	10-29-07
6.	**ARTS AND SCIENCES EXECUTIVE DEAN**	**Printed Name**	**Date**
7.	Graduate School (if appropriate)	Printed Name	Date
8.	University Honors Center (if appropriate)	Printed Name	Date
9.	Office of International Education (if appropriate)	Printed Name	Date
10.	**ACADEMIC AFFAIRS**	**Printed Name**	**Date**

Colleges of the Arts and Sciences Curriculum Office. 10/02/06

Biology 401: Integrated Biology I U 5 credit hours

Winter quarter, 2008

Course description: Biology 401 is the first course of a two-quarter sequence that uses case studies to illustrate and explore fundamental concepts of the biological sciences. The two-course sequence provides a solid foundation and preparation for any major in the biological sciences. *This syllabus is one possible adaptation of the first course in the series; in future iterations, modules may be exchanged, but the goals and objectives of substituted modules should align with the goals and objectives of the modules they replace.*

Prerequisites: Biology 113 and 114, or AP Biology in high school; and Chem 123; and Math 150; or permission of instructor

Lecture time: 2 x 1.5 hours

The first year clientèle for this course will consist of current biology majors who are opting into the redesigned major – very few Au07 freshmen will be ready for this course. We plan to cap the initial enrollment at 100 students. In 2008-09, we plan to limit course enrollment to appr. 250 students per offering. At that class size, offering this course twice a year should be adequate to accommodate all new biology majors.

Faculty instructors:
Contact information:
Office hours:

Recitations: 1 x 1 hour

The recitations incorporate learning activities that are designed to be applicable to any module substituted in the course and will be capped at 20 students per recitation. One GTA should be able to handle 4 recitation sections.

GTAs:
Contact information:
Office hours:

Course Coordinator:

Staff member, coordinates lecturing assignments, lecturer training workshops, recitation activities and GTA training, and coordinates student assessment activities.

Contact information:
Office hours:

Course objectives: Students will apply and explore in greater depth facts and concepts introduced in introductory biology courses. They will begin to develop the ability to integrate biological information and ideas, to apply foundational unifying theories to new problems or situations and to demonstrate quantitative skills that are central to study and research in the biological sciences.

Learning goals:

1. Students will apply facts and concepts related to the following overarching themes to analyze biological phenomena:
    - The cell
    - Heredity
    - Emergent properties
    - Regulation
    - Interaction with the environment
    - Diversity
    - Evolution
    - Structure and function
    - Scientific inquiry
    - Science/technology and society
    - Fundamental interconnectedness of chemistry, physics, mathematics
    - Metabolic unity
2. Students will use quantitative skills, concepts from the physical sciences, and overarching biological themes (listed under #1 above) to analyze biological phenomena.
3. Students will integrate at least two overarching themes (listed under #1) to explain a complex biological system.
4. Students will increase their scientific literacy as they demonstrate critical thinking and scientific logic in the analysis of natural phenomena and the ethics behind the human involvement in these phenomena.

Readings: A course packet will be available at CopEZ and additional materials will be available on the course web site. In addition, every student will be expected to have available a rigorous introductory biology textbook targeted to science majors to use as a reference book. Campbell's *Biology*, 7th edition, is an appropriate reference work.

Grading:

Recitation activities and on-line assignments 30 points

A series of graded activities with varying deadlines will be placed on the course web site. You will be expected to check this web site on a daily basis and to complete those assignments by the indicated deadlines. Many of these assignments will involve answering questions that will be similar to questions on the midterm and final examinations.

Midterm or in-class quizzes 20 points

Paper 10 points

Write a 2-page summary article, as if for the science pages of the New York Times, describing the topic presented by the guest lecturer (lecture 17 in the syllabus). Your paper should summarize the experimental methods and results, including an analysis of variables that were considered (or not) and limits in interpretation of the data presented.

Attendance and participation 10 points

Attendance will be taken during recitation, and in lecture. Participation will be evaluated based on participation in the recitation activities. Every

absence must be excused by the Course Coordinator. Absences due to official university-sanctioned events or (documented) illness of the student generally will be automatically excused; other excuses will be reviewed on a case-by-case basis.

Final exam 30 points

>90% A
81-90% B
71-80% C
61-70% D
<61% E

Academic Misconduct:
It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the Committee on Academic Misconduct (Faculty Rule 335-5-487). For additional information, see the University's Code of Student Conduct (http://studentaffairs.osu.edu/resource_csc.asp).

Disability Services:
Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the Course Coordinator as soon as possible of their needs. The Office for Disability Services is located in room 150 Pomerene Hall, 1760 Neil Avenue; telephone 614-292-3307, TDD 292-0901; http://www.ods.ohio-state.edu/.

Weekly schedule of lectures and assignments:

Lecture 1 Introduction to Biology 401/402

- General description of case studies approach
- Review all of introductory biology
- Use of the reference book and other course materials
- Progression across the two courses (increasing depth, complexity, emphasis on integration)

Student milestones in achieving fluency in the language of biology

- Research lecture in Biology 401; research seminar of student's choice in Biology 402
- Read literature for general scientific audience in Biology 401; read research literature in the discipline in Biology 402

Expectations in these courses:

The student:

- Will participate in classroom and recitation discussions and activities
- Will visit the course web site on a regular basis to find out the background material that must be reviewed before class and to complete the on-line activities
- Will review material in reference textbook as needed before class
- Will attend lecture
- Will be an active learner
- Will progress from (a) simply understanding background material to (b) understanding how many different biological disciplines are integrated by researchers in the field to (c) being able to succinctly explain to others how several different areas of the biological sciences are relevant to contemporary issues in the biological sciences

Faculty:

- Will engage students in active learning
- Will model the integration of biological principles across different disciplines with their underlying physical and mathematical concepts

GTAs:

- Will engage students in active learning
- Will model the integration of biological principles across different disciplines with their underlying physical and mathematical concepts

Use of the reference book and other course materials

Module 1: The nature and origin(s) of life

This module is designed to reinforce the importance of the study of physics, chemistry and mathematics in the expansion of the student's knowledge of the biological sciences. Mathematical concepts are reinforced with examples of time, size and probability. The physical sciences are integrated throughout the descriptions of living organisms and their environments.

Lecture 2

What is science; scientific inquiry
- Alternative hypotheses
- How do we define life?

The fundamental interconnectedness among mathematics, physical sciences, and biology
- Earth science and what we know or surmise about early life
- Early evolution
  - Fossil evidence
  - The RNA world hypothesis

Recitation 1

Define "environment" in a biological context
- How do living organisms obtain energy from the environment?

On-line activity: energy flows and/or the thermodynamics of life

Lecture 3

Continue to examine interconnectedness among mathematics, physics, chemistry and biology
- Time:
  - Age of the earth
  - Age of *Homo sapiens*
    - How many generations?
- Size and number of organisms:
  - Significance

Module 2: Life in extreme environments

This module is designed to reinforce fundamental biological themes having to do with the cell and its contents by introducing students to organisms growing in novel environments.

Lecture 4

Single-celled organisms
- Classification

Extreme environments
- Example: deep-sea thermal vents
- What are the environments that support life
- Cell structure and how it is maintained in extreme environments

Recitation 2 Metabolism – general review of universal aspects

On-line activity: simulation of a living organism (build a cell)

Lecture 5
Universality of metabolism
Anaerobic pathways

Lecture 6
Genomes and evolution
Central dogma (DNA to RNA to protein)
Genomic information

Recitation 3
Molecular evolution
Definition
Methods for study
On-line activity: simulation of evolution

Lecture 7
Adaptation
Adaptation at the organismal level
How do organisms change in response to their environment
How do organisms change their environment
Adaptation at the genomic level
Evolutionary clues in genes
Effect of mutation and gene flow on evolution
Humans as another example of an extreme environment

Lecture 8
The evolution of organismal classification systems
Systematics
Woese

Recitation 4 Review for midterm
On-line activity: develop a map of the topics and concepts integrated in Module 2

Lecture 9 **Midterm exam**

Module 3: Malaria

Malaria is chosen as the system to be studied in this module because understanding host-vector-parasite interactions and disease control can integrate fundamental biological concepts from molecules to ecosystems. The material in this module is presented at a higher level of complexity than the previous modules.

Lecture 10
Epidemiology of a human disease: malaria as a model

Recitation 5

Dynamics of host-pathogen interactions
Co-evolution
    On-line activity: Mortality vs morbidity

Lecture 11
The pathogen and its vector

Lecture 12
The human immune system
Control of disease: Vaccine development

Recitation 6
The immune system
    On-line activity: Recombination of IgG genes – how many different molecules?

Lecture 13
Molecular aspects of the disease
    How does the parasite evade its host?
        Erythrocyte structure
        Hemoglobin structure and function

Lecture 14
Selection based on disease resistance
Sickle cell anemia and other thalassemias
Human ecology: selection and human evolution

Recitation 7
Other examples of human disease as evolutionary selective pressure
    On-line activity: Think like a pathogen

Lecture 15
Mosquito control
Vector ecology
Ecological approaches to disease control
Ecological implications of disease control

Lecture 16
Treatments for malaria
    Most existing treatments come from plant sources
    Why do plants make these compounds?
The search for drugs – chemistry, mathematics
Types of drugs, their mechanism of action
Drug testing and approval
Ethics

Recitation 8

Background materials for guest lecture
Discuss scientific paper(s) that represent topic to be covered by guest lecturer

Lecture 17 Guest lecturer will present his or her research on a topic relevant to modules 1-3, at a level appropriate for students in this course.

Module 4: Sex and death

This module introduces topics that encourage the student to understand the complexity of living organisms, and to think of them as more than assemblages of single cells.

Lecture 18
Evolution relies on genomic diversity
- How is genetic diversity created and maintained?
- Why engage in sex?
- Consequences of in-breeding

Recitation 9
Meiosis
- Exchange of genetic material
- Why is it important?

On-line activity: access and report on data about life-span studies

Lecture 19
Death
- Evolutionary benefits of death
- What life-span means; what determines life-span
- Extension of life span: role of diet, oxidative stress
- Apoptosis

Lecture 20
- Selection and domestication
- Genetic engineering
- Ethics and social issues

Recitation 10 Review for final exam

Final exam: Students will be provided, at least one week in advance of the final exam, with a set of essay questions which require an integrated approach to biology. Students will be directed toward resources to develop complete answers to the essay questions, and then will have to answer 1-2 of these questions in class for the final exam.