Course Approval Form

For approval of new courses and deletions or modifications to an existing course.

More information is located on page 2.

Action Requested:
[X] Create new course [ ] Delete existing course
[ ] Modify existing course (check all that apply)
[ ] Title [ ] Prereq/coreq [ ] Credits [ ] Schedule Type [ ] Repeat Status [ ] Restrictions [ ] Grade Type

Course Level:
[X] Undergraduate
[ ] Graduate

College/School:	College of Science
Department:	Biology Program
Submitted by:	Andrea Weeks
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Subject Code: BIOL **Number:** 310
(Do not list multiple codes or numbers. Each course proposal must have a separate form.)

Effective Term: [X] Fall [ ] Spring [ ] Summer *Year* 2011

Title: Current: Biodiversity
Banner (30 characters max including spaces):
New:

Credits: (check one) [X] Fixed ____ or ____ [ ] Variable ____ to ____

Repeat Status: (check one) [X] Not Repeatable (NR) [ ] Repeatable within degree (RD) [ ] Repeatable within term (RT)
Total repeatable credits allowed:

Grade Mode: (check one) [ ] Regular (A, B, C, etc.) [ ] Satisfactory/No Credit [ ] Special (A, B C, etc. +IP)

Schedule Type Code(s): (check all that apply)
[X] Lecture (LEC) [X] Lab (LAB) [X] Recitation (RCT) [ ] Internship (INT) [ ] Independent Study (IND) [ ] Seminar (SEM) [ ] Studio (STU)

Prerequisite(s):	**Corequisite(s):**
BIOL213, 214 and 311, or permission of instructor	

Special Instructions: (restrictions for major, college, or degree; cross-listed courses; hard-coding; etc.)

Catalog Copy for NEW Courses Only (Consult University Catalog for models)

Description (No more than 60 words, use verb phrases and present tense)	**Notes** (List additional information for the course)
Explores the fundamental principles governing organismal biology while introducing the three domains of life: the Archaea, the Bacteria, the Eukaryotes, plus viruses. Two Saturday or Sunday field trips are required.	

Indicate number of contact hours: Hours of Lecture or Seminar per week: 3 Hours of Lab or Studio: 3 Hours of recitation = 1

When Offered: (check all that apply) [X] Fall [X] Summer [X] Spring

Approval Signatures

Department Approval ____ Date ____   College/School Approval ____ Date ____

If this course includes subject matter currently dealt with by any other units, the originating department must circulate this proposal for review by those units and obtain the necessary signatures prior to submission. Failure to do so will delay action on this proposal.

Unit Name	Unit Approval Name	Unit Approver's Signature	Date

For Graduate Courses Only

Graduate Council Member ____   Provost Office ____   Graduate Council Approval Date ____

Course Proposal Submitted to the Graduate Council
by
The College of Science

1. COURSE NUMBER AND TITLE: BIOL 310: Biodiversity

Course Prerequisites: BIOL 213, BIOL 214, and BIOL 311, or permission of instructor

Catalog Description: Explores the fundamental principles governing organismal biology while introducing the three domains of life: the Archaea, the Bacteria, the Eukaryotes, plus viruses. Two Saturday field trips are required.

2. COURSE JUSTIFICATION:

Course Objectives: By the end of the course, students will be able to illustrate the following fundamental principles of organismal biology with examples from all domains of life: 1) Organismal structure is a functional response to a set of external constraints that is canalized by common ancestry; 2) Biodiversity has been generated or radically altered as a consequence of abiotic pressures and biotic interactions, including all forms of genetic exchange (conjugation to introgression), organismal symbioses (organellar endosymbioses to plant/pollinator interactions) and the indirect actions of other organisms on the abiotic environment (the oxygen revolution to the Industrial Revolution); 3) Increasing complexity in organisms overall is neither inevitable nor necessarily the optimal outcome, which make terms such as "advanced" and "primitive" value-free (e.g., the persistence of "primitive" bacteria in all ecosystems, the liability of our appendix in our "advanced" digestive tract). Topics are presented roughly in order of their chronological appearance in the geological history of life.

Course Necessity: This course will become part of the new core curriculum in Biology and will replace BIOL 303 Animal Biology and BIOL 304 Plant Biology.

Course Relationship to Existing Programs: This course will replace BIOL 303 and BIOL 304 in all programs, including Biology B.S. and B.A. degrees.

Course Relationship to Existing Courses: None.

3. APPROVAL HISTORY:

4. SCHEDULING AND PROPOSED INSTRUCTORS:

Semester of Initial Offering: Fall 2011

Proposed Instructors: Drs. Andrea Weeks, Dr. Geoffrey Birchard, Dr. James Lawrey and Dr. Al Torzilli

5. TENTATIVE SYLLABUS: See attached.

BIOL 310 – Biodiversity

Credits: 5

Lecture: MWF 10:30-11:20 am
Laboratory: 2hr 45 min/wk (multiple sections of 24)
Recitation: 50 min/wk (multiple sections of 24).
Prerequisites: BIOL 213, BIOL 214, BIOL 311
Required texts:

Lecture: Life 9th Edition. Sadava, D., D.M. Hillis, H.C. Heller, and M.R. Berenbaum. Sinauer Associates, Inc. [Recommended The history of life (2009), Benton, M. Oxford University Press]
Lab: Custom Lab Manual from GMU
Recitation: Custom Reading Packet from GMU, Sustaining Life. Chivian, E. and A. Bernstein (eds.). Oxford University Press.

Course Goal/Objectives: Biodiversity educates students about the fundamental principles governing organismal biology while introducing them to the three domains of life: the Archaea, the Bacteria, the Eukarya, plus viruses. Three main principals are emphasized throughout the course. Firstly, organismal structure is a functional response to a set of external constraints but is canalized by common ancestry. Secondly, biodiversity has been generated or radically altered as a consequence of abiotic pressures and biotic interactions, including all forms of genetic exchange (conjugation to introgression), organismal symbioses (organellar endosymbioses to plant/pollinator interactions), and the indirect actions of other organisms on the abiotic environment (the oxygen revolution to the Industrial Revolution). Lastly, increasing complexity in organisms overall is neither inevitable nor necessarily the optimal outcome, which make terms such as "advanced" and "primitive" value-free (e.g., the persistence of "primitive" bacteria in all ecosystems, the liability of our appendix in our "advanced" digestive tract). Topics are presented roughly in order of their chronological appearance in the geological history of life.

Grading:

I-Clicker questions (every lecture)	5%
Lecture exams (3)	45%
Cumulative final exam	15%
Pre-lab write-ups (12)	10%
Lab write-ups (14)	15%
Pre-recitation write-ups	8%
Recitation participation	2%
	100%

Final letter grades are assigned using the standard percentage divisions (e.g. A ≥90%; rounded to the first decimal place). Plus/minus distinctions (e.g. A+ ≥ 97%, A- ≤93%) are made except for C- and D grades.

Lecture: Lecture is divided into thirds reflecting an overview of the chemical and physical constraints to life and early organismal diversity (Wks 1-4), the implications of shifts to multicellularity in the major eukaryotic lineages (Wks 5-8) and the diversification of terrestrial plants, fungi and animals, including humans (Wks 9-14) (Table 1).

Table 1. Lecture schedule

Theme	week	reading	topic
Terraforming	1	1, 25;	Physical and chemical limitations to life on Earth. The geological timeline and definition of life
	2	17.2; 26; 51.1; 58.1	The first 2.5 billion years of (prokaryotic) life: genomic and geochemical revolution
	3		The last billion years of prokaryotic life, including extant lineages. Where are they now?
	4	27; 17.3	Transition to eukaryotic condition; rooting the Tree of Life and the protists
Living Together	5	32.1; 43	Sex and specialization: problems and opportunities associated with the transition to multicellularity
	6	28.1; 30.1; 39.3-39.4	The transition in plants, fungi.
	7	32.1-32.2; 33.1-33.2; 40.1; 41.1; 49.1-49.2;	The transition in animals.
	8	33.3; 48.3	Cambrian explosion; skeletons and accelerated biotic interactions; fish.
Local Optima	9	28.2-28.4; 29;	Terrestrial revolution was led by plants.
	10	30.2-30.4; 39.1-39.2; 56.1-56.3	Plant evolution was facilitated by fungi and animals interactions, which persist today.
	11	31.3-31.5; 40;	Terrestrial evolution of animals was driven by the same abiotic constraints encountered by plants.
	12	50.1-50.2; 51.3; 56.1-56.3	Drive to optimize water-balance, nutrition and reproduction leads to animal radiations, symbioses.
	13	17.4; 43.3; 44.5	Origin and evolution of the human animal and its associated biota.
	14	59; 18.6	Future of biodiversity

Laboratory: The goal of lab is two-fold: to engage students in active investigation of the pleisiomorphic and synapomorphic characteristics of major clades (Table 2) and to train students to conduct experiments. To this end, most labs will have an 1) experimental component whereby a model organism from the focus clade is manipulated to explore some a) universal biological structure or function, b) essential skill or technique, and/or c) the suite of synapomorphies for that particular clade and 2) organismal "survey" type activities.

Table 2. Laboratory session schedule.

week	Survey	Activity
1	Archaea	*Halobacterium* experiment set up
2	Bacteria	Lab 1 data collection; Phage-finding using *Mycobacterium smegmatis* set up
3	Protists	Lab 2 data collection; *Dictyostelium* Chemotaxis Experiment
4	Non-vascular plants	Algal photosynthetic performance experiment; C-Fern Set up
5	Vascular Plants I	C-Fern data collection; Plant water relations and gas exchange lab
6	Vascular Plants II	C-Fern data collection; Plant taxis and hormonal response lab
7	Vascular Plants III	Photosynthetic anatomy/physiology lab
8	Plants	US Botanical Garden/NMNH Pollinator exhibit
9	Fungi	*Pilobolus* development experiment set up
10	Protostomes I	Lab 9 data collection; Sea urchin reproduction laboratory
11	Protostomes II	Metabolic scaling lab. *Tribolium* growth experiment set up
12	Animals	National Zoological Park
13	Deuterostomes I	Collect data from Lab 11; Fish dissection
14	Deuterostomes II	Urine output lab

Recitation: The goal of recitation is two-fold: to review and build on knowledge gained in lecture and to support skill-building activities directly related to on-going laboratory projects, such as statistical testing and graphing.

week	Topic
1	Sustaining Life Ch. 1 What is Biodiversity
2	Scientific data reporting and presentation
3	How to read a scientific paper
4	Determining statistical significance of results
5	*Bangiomorpha pubescens* n. gen., n. sp.: implications for the evolution of sex, multicellularity, and the Mesoproterozoic/Neoproterozoic radiation of eukaryotes *Paleobiology* (2000) 26(3): 386-404
6	Molecular Evidence for the Early Colonization of Land by Fungi and Plants Science (2001) 293 (5532): 1129-1133
7	The last common bilaterian ancestor Development (2002) 129: 3021-3032.
8	Molecular Clocks Do Not Support the Cambrian Explosion Molecular Biology and Evolution (2005) 22 (3): 387-390.
9	Sustaining Life Ch. 3 Ecosystem Services
10	Sustaining Life Ch. 4 Medicines from nature

11	Sustaining Life Ch. 8 & 9 Biodiversity, food production and farming
12	Sustaining Life Ch. 5 Biodiversity and medical research
13	Sustaining Life Ch. 6 Organisms valuable to medicine
14	Sustaining Life Ch. 7 Ecosystem disturbance, biodiversity, infectious diseases